Living with bushfire risk: social and environmental influences on preparedness

Paton, Bürgelt and Prior discuss the process of developing a model capable of informing the development of community outreach strategies to facilitate the sustained adoption of bushfire preparedness measures.

Abstract

This paper discusses the process of developing a model capable of informing the development of community outreach strategies to facilitate the sustained adoption of bushfire preparedness measures. Following the identification of anomalies in defining the predictors of preparedness, a qualitative study of the reasoning processes that influence whether or not people decided to prepare for bushfire hazards is presented. The findings of the qualitative study are used to revise the preparedness model. Finally, using data from 482 residents in high bushfire risk areas in Hobart, the ability of the revised model to account for differences in levels of household preparedness is discussed.

Introduction

Encouraging people to prepare for bushfires (e.g., creating a defensible space around the home, cleaning leaves from guttering, placing metal flyscreens on windows, screening eaves, ensuring access to resources for extinguishing spot fires, and determining householders 'stay or go' positions) is a significant public policy issue in Australia (McLeod, 2003). Preparing reduces the risk of loss and injury, facilitates coping with bushfire consequences, and minimises damage and insurance costs. However, despite the attention directed to this task, the goal of ensuring sustained levels of bushfire preparedness has proved elusive (McLeod, 2003). Consequently, developing more effective public outreach education programs is an important risk management goal.

Public outreach programs typically assume that advising people of their risk and what they should do to manage that risk (e.g., prepare) will motivate people to act (Smith, 1993). However, following a study that compared levels of risk perception and preparedness before and after a comprehensive outreach program, Paton et al. (2000) demonstrated that this assumption could not be supported. The receipt of information per se did not affect whether people would prepare. In a subsequent study of earthquake preparedness, Paton et al (2005) demonstrated that whether or not people prepared was a function of how people interpreted their relationship with the hazardous aspects of their environment. Two basic processes were implicated. The first concerned people's perception of the relative importance of hazard issues (compared with other demands on the community). The second involved people's interpretation of their ability to take action to increase their safety. Furthermore, these factors did not make equal contributions to preparedness. Rather they described a sequence of decisions that people made before preparing.

Paton et al. (2005) also observed that while these interpretive processes could facilitate preparedness, they could also result in some people actually deciding not to prepare. This distinction between "preparing" and "not preparing" outcomes was also found in a subsequent study of bushfire preparedness (Paton et al., 2006). This finding meant that, if they are to function to increase preparedness, outreach programs must be designed to a) encourage those disinclined to prepare to appreciate the importance and benefits of preparing, and b) motivate preparedness (Paton et al., 2005; Paton & Wright, 2008).

The core objective of the studies introduced in the previous paragraphs was to develop a model that could provide emergency management and fire agencies with an evidence-based means for managing these issues. A valid and reliable model would provide them with a framework for assessing community outreach needs and guiding the development of effective outreach programs. To pursue this objective, it is first necessary to identify the predictors of each outcome.

However, when testing the ability of the model to predict earthquake (Paton et al., 2005) and bushfire (Paton et al., 2006; Paton et al., 2007) preparedness,

analysis revealed that one predictor, critical awareness (the degree to which people think about and discuss hazard issues (Dalton et al., 2001; Paton et al., 2005), predicted both "preparing" and "not preparing" outcomes. Furthermore, this same variable was the strongest predictor of both outcomes. When linked to opposing outcomes in this way the variable itself ceases to have any value as a guide to planning outreach programs. Consequently, if a robust model capable of informing intervention development was to be developed, a more searching analysis of the predictors of preparedness was required.

To achieve this goal, it was first necessary to gain a better understanding of how one variable (critical awareness) could account for such disparate outcomes. This issue was examined using a qualitative analysis of the reasoning processes behind decisions to prepare versus deciding not to do so. Because the development of outreach programs can be more effectively pursued if fire agencies have a valid and reliable model to guide their outreach planning and intervention development, the findings of the qualitative study were subsequently used to develop a revised model. In the next section, the findings of the qualitative analysis and its implications for revising the model are discussed.

Qualitative study

Method

In-depth, semi-structured telephone interviews were conducted with residents in Hobart at the commencement of the 2004/05 bushfire season. The interviews were thus conducted at a time when people had received outreach material from fire agencies and should have been in the process of preparing for the forthcoming bushfire season (but before any bushfire had occurred). The timing of the research was selected to provide insights into people's preparedness decision making as it happened.

Interview participants were theoretically sampled from survey respondents whose perspectives could shed light on why critical awareness predicted both "preparing" and "not preparing" outcomes. In both the earthquake and bushfire studies, the type of intention people formed was found to be a reliable indicator of whether they would fall into the "prepare" or "not prepare" groups (Paton et al., 2005). Consequently, interview participants were selected from those scoring high on "intention to prepare" (i.e., those more likely to prepare: n = 13) and those with high "intention to seek information" (i.e., those disinclined to prepare: n = 4) scores in the Paton et al. (2006) survey that demonstrated that critical awareness predicted both "preparing" and "not preparing" outcomes. This case sampling approach was adopted to increase the opportunity to compare the underlying conditions, patterns of interaction, responses, and consequences associated with decisions to prepare versus not prepare (Flick, 2002).

Interviews were fully transcribed and systematically analysed using grounded theory analysis techniques (i.e. open, axial, and selective coding, paradigm model, constant comparison between individual cases, asking questions of the data, creating networks among the emerging concepts) (Strauss & Corbin, 1998). To manage the technical aspects of the analysis more effectively, the qualitative data analysis programme ATLAS.ti was used. The analysis identified important meanings, contexts, interactions and consequences of "preparing" versus "not preparing". The outcome was the best fit between the data and their interpretation and the systematic integration of data into a coherent account of people's beliefs and social relationships influenced "preparing" and "not preparing" outcomes (Flick, 2002). The interview data revealed that those deciding to prepare and those disinclined to do so interpret and think differently about bushfire risk and preparedness.

Results

The categories and sub-categories that describe peoples' choices are summarised in Tables 1 and 2. With regard to those who decided to prepare, respondents reported how stories about bushfires circulating within their community enhanced their knowledge of the local history of bushfires, increased their acceptance of both bushfire risk and the importance of preparing for bushfires, and provided a supportive context in which they were able to acquire information about what to do to prepare. Responsibility for self and others, being connected to the natural environment, having a positive outlook, being action oriented and organised, having sufficient time and resources, and being knowledgeable about fires, weather and environment also influenced people deciding to prepare. However, believing that preparing would not make a difference, conflicting views about the need for preparing within the family, conflict with and/or a lack of willingness to collaborate with neighbours to manage vegetation, and perceiving bushfires as having a lower priority in life than other demands were cited as reasons for deciding not to prepare. Before discussing these findings in details, it is worth noting that a belief in preparing did not guarantee a uniformly high level of preparedness. Several contingencies influenced people's beliefs regarding what to do and when they should do it.

One factor concerned beliefs about what constituted adequate preparation. These beliefs ranged from mowing the lawn regularly to adopting all the measures recommended by fire agencies. Even if it falls short of what is, objectively, an adequate level of preparedness, if people believe they are already sufficiently prepared,

they are unlikely to attend to risk information or change their behaviour. People's decisions were also qualified by their beliefs regarding when to act.

While some people routinely prepared at the start of the fire season, others stated that they would not prepare until the threat was imminent. That is, only when dangerous weather (e.g., receipt of fire warning, awareness of hot, dry, windy conditions) and bush conditions prevailed, or when fire was perceived as a direct threat to their property (e.g., smoke visible and coming their way). While people may know what to do, the short time frame afforded by this approach, and the high levels of stress likely to prevail as the fire front approaches, will reduce the effectiveness of any decision making and action at this time. A final contingent influence concerned how environmental beliefs influenced support for some mitigation measures but not others.

Respondents whose environmental beliefs were salient aspects of their lifestyle were happy to support measures with low environmental impact (e.g., clearing leaves, mowing the lawn). However, they were reluctant to support activities that would adversely affect their natural living environment (e.g. controlled burning, felling eucalyptus trees, clearing a defensible space around their house). Their perception that such actions would damage the flora and fauna in their living environment, and thus the environmental qualities they value, created dissonance between their love of nature and preparing, reducing their support for the latter. Such dissonance was not, however, inevitable.

One lifestyler adopted an approach labelled as *positive preparation*. Positive preparation included factors like house design that offers maximum fire resistance through position, building material, and building features and maintaining a lush and green garden of native vegetation with water features. In combination, these factors contributed to sustaining environmental quality and provided better fire resistance.

This discussion illustrates how people's interpretation of their circumstances affects the level of preparing. Others, however, take this further and are disinclined to prepare in the first place. One goal of the qualitative study was to identify variables that could be included in a model capable of guiding the development of fire agency outreach planning and intervention. In the next section, the paper discusses how the qualitative findings were used to achieve this goal. It also examines the degree to which the revised model can account for differences in levels of bushfire preparedness. If this relationship can be demonstrated, fire agencies will have a valid and reliable model available to inform their outreach planning.

Table 1. The categories and sub-categories derived from interviews with those in the "preparing" group (N=14).

Category	Sub-categories
Preparing is Effective	• Preparing will make a difference in a bushfire • High levels of knowledge and wisdom about fire, weather and bush conditions • High personal responsibility for safety • Being independent • Being action oriented • Having the necessary resources • Preparing increases safety • Preparing reduces anxiety
High Attachment to Place	• Strong attachment to home and property • Strong environmental beliefs
Community Participation	• Regular participation in community groups and activities • Discuss bushfire issues with others in the community • Discussion helps understanding risk and identifying what to do to prepare effectively • Desire to give back to the community and help others
Staying in Case of Bushfire	• Staying will save lives and property
Habit	• Preparation has become a habit
Insurance	• No insurance

Preparing versus not Preparing

This section focuses primarily on those aspects of the qualitative data that inform understanding of how Critical Awareness (CA) could predict both the "preparing" and "not preparing" outcomes observed in the earlier work (Paton et al., 2005; Paton et al., 2006). CA describes the frequency with which people think about and discuss bushfire issues, but not the content of their deliberations or discourse (e.g., whether they think and talk about preparing in positive or negative ways). The interview data shows that *what* people think about influences the nature of their decisions.

Both the "prepare" and "not prepare" group members raised issues regarding their beliefs about the efficacy of preparedness measures (Tables 1 & 2). Members of the "prepare" group believed that preparing is an effective strategy. In contrast, the "not prepare" group were equally adamant that preparing would not make a difference to their safety. The critical awareness variable would not have distinguished between these diverse beliefs (i.e., because it asked about the frequency with which people thought and talked about bushfire issues rather than their content). By articulating these diverse

beliefs, these data thus illustrate how the same variable, Critical Awareness, could predict both "preparing" and "not preparing" outcomes. This finding suggests that the critical awareness variable be abandoned in favour of one capable of differentiating between these control beliefs. One such variable is Outcome Expectancy (McClure, Allen, & Walkey, 2001; McClure, Walkey, & Allen, 1999; Paton et al., 2008). Outcome expectancy comprises two components. Positive outcome expectancy taps into beliefs that personal preparation can make a difference and add value to one's life. Negative outcomes expectancy taps into beliefs that hazards are too destructive for personal action to make a difference.

Table 2. The categories and sub-categories derived from interviews with those in the "not preparing" group (N=4).

Category	Sub-categories
Preparing is Ineffective	• Preparing will not make a difference • Poor knowledge of fire behaviour • Willing to take the risk • Bushfire are a source of anxiety • Can't do more
Low Attachment to Place	• Low attachment to where I live • Intention to leave if fire occurs
Social Pressure and Conflict	• Disagreement about effectiveness of preparing amongst family members • Social disapproval from neighbours if I prepare • Conflict with neighbours about taking action • Other activities more important
Stay and Defend	• Staying will not improve chances of survival • Staying increases danger
Insurance	• Well insured

Insights into the factors that lead some people to prepare but others to decide not to act were also evident in people's accounts of the relationship between their social context and their risk management choices. Both the "preparing" and "not preparing" groups identified the quality of their attachment to where they lived and the people in their community as having a bearing on their bushfire preparedness behaviour (Tables 1 & 2). However, each described the relationship between bushfire mitigation and their social contexts in very different ways.

Preparing was associated with a sense of attachment to where they lived and engaging in community life. For example, they cited how day-to-day activities and participation in community life (e.g., neighbours discussing previous bushfires when they meet on the street or when involved in community activities) afforded opportunities to gain insights into the bushfire history of the area and to work out why and how to prepare. This identifies how sense of attachment to place and to others within their community can influence preparedness. It indicates that social interaction also serves a problem solving function.

The link between preparedness and feeling a sense of attachment to the community in which one lives mirrors the finding that place attachment (the degree to which people feel that they are embedded within their social-ecological environment) increases people's emotional investment in their community (Hummon, 1992; Low & Altman, 1992), making it more likely that people will be motivated to act to enhance their safety within this environment. The second finding, that engaging with others provided valuable information and assists one's ability to work out what is required (i.e., problem–solving), is consistent with findings in the risk perception literature that points out that interaction with those with similar interests and circumstances plays an important role in helping people work out how to deal with uncertain, challenging events (Eng & Parker, 1994; Hardin & Higgins, 1996; Lion et al., 2002). The qualitative analysis thus identifies three potential variables that could be included in a revised model; attachment to place, involvement with other community members, and problem solving.

In contrast to those participants who were predisposed to prepare, the decisions of members of the "not preparing" group were made in very different social contexts. Disagreement amongst family members regarding the need for or benefit of preparing was cited by the "not prepare" group as a reason for not preparing. They also described how a lack of resources, a low sense of belonging to where they lived, and unwillingness to collaborate with neighbours on clearing vegetation as reasons for not preparing.

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A sense of attachment to place and to others within community can influence preparedness.

These accounts help provide additional insights into why some people decide not to prepare. The latter issues suggest a need to include a measure capable of encapsulating social conflicts and disagreements in a revised model. While additional work will be required to investigate these issues systematically, a measure of response efficacy that encapsulates these social conflict and resource constraints (Abraham et al., 1998; Lindell & Whitney, 2000) is available for use until a more comprehensive measure becomes available.

The qualitative analysis captured some of the variety and depth of experiences that inform people's risk management decision making. These data informed understanding of how people's interpretation of their relationship with bushfire hazards (e.g., outcome expectancy) and social context factors influenced preparedness decisions. If the findings of this work are to be pressed into service to support outreach development, it is necessary to convert them into a set of variables that fire agencies can use to assess communities and guide intervention development. Furthermore, the value of these data is a function of the degree to which the emergent variables can account for differences in levels of bushfire preparedness. The next step was to model the role of these variables in the revised model. The development and testing of this revised model is dealt with in the next section.

Modelling preparedness

Drawing upon the findings of the qualitative analyses, the variables included in the model were revised. Critical awareness was deleted in favour of the outcome expectancy construct. The responses of the 'preparing' group (Table 1) mirror the components of the positive outcome expectancy construct, and those in the 'not preparing' group (Table 2) reflect its negative outcome expectancy counterpart.

The Sense of Community (SoC) measure (Bishop et al., 2000) was retained. However, in light of the finding that people's accounts of their preparedness decisions differentiated between a sense of belonging to place and to people (Tables 1 and 2), a principal components analysis (PCA) was conducted to determine whether it could reflect this distinction. Before proceeding, the suitability of the data for factors analysis was first determined. The ratio of cases to variables exceeded 10, and the correlation matrix revealed several correlations over r=.3. The Kaiser-Meyer-Olkin value was .791, exceeding the recommended value of .6. All sampling adequacy values exceeded .5, and Bartletts test of sphericity was statistically significant. These tests indicated that the SoC data was appropriate for factor analysis. The PCA confirmed the existence of two factors, one (SoC Place) describing a sense of belonging to place (e.g., I would not move from this community) and the other (SoC People), identifying a sense of belonging to people in one's community (e.g., I often have friends from the community visiting). The qualitative analysis revealed that decisions to prepare involved more than being part of a community. It also revealed how interaction with others helped people work out what they had to do and why. That is, social interaction also fulfilled a collective problem solving function.

Eng and Parker (1994) discussed how dealing with uncertain and challenging circumstances required both access to information from others with similar views and interests and an ability to engage with others to work out how to adapt information and advice to fit individual needs. Because this aspect of preparing was not captured by the SoC measure, Eng and Parker's measure of 'articulating problems' was included as a variable in the revised model. To accommodate the potential for social conflict to constrain preparing, a measure labelled 'preparation inhibitors,' derived from studies showing that social conflict and resource constraints (e.g., not prepared to work with others, time, financial) reduced the likelihood of people preparing (Abraham et al., 1998; Lindell & Whitney, 2000) was included.

As with its earlier counterpart, the revised model proposes that people's decisions to prepare reflect the outcome of a sequence of evaluative activities. The process commences with people's beliefs regarding whether or not personal action can influence one's safety. If people believe that bushfires are too catastrophic or uncontrollable for personal actions to make any difference (i.e., negative outcome expectancy beliefs), it was hypothesised that people will not prepare. Because respondents described social and resource constraints as factors leading to their deciding not to prepare, it was hypothesised that "preparation inhibitors" would mediate the relationship between negative outcome expectancy beliefs and bushfire preparedness.

If, however, people believe that preparing can be effective (i.e., hold positive outcome expectancy beliefs), they will be motivated to prepare. However, whether they form intentions will be a function of the degree to which they feel a sense of belonging to where they live and by the degree to which they can access information and guidance about managing their bushfire risk from others within their community. It was hypothesised that sense of community and articulating problems would mediate the relationship between positive outcome expectancy, intentions to act and preparing.

Consistent with the social-cognitive theoretical foundation upon which it is based (Paton et al., 2005), the model describes preparing as the outcome of a sequence of decisions. As such, with the exception of the outcome expectancy variables that indicate the

starting point of the process, the contribution of each of the remaining variables in the model is dependent on those preceding them (as indicated by the arrows linking the variables in Figure 1). Consequently, structural equation modelling was selected for the analysis. Because it can estimate multiple and inter-related dependence relationships simultaneously, structural equation modelling allows statistics to be calculated to test the model as a whole and to show how well the data fit the hypothesised model (Goodness-of-Fit).

The variables outlined in the above discussion were compiled into a questionnaire. The questionnaire was distributed to 1000 households in suburbs in Hobart. The areas selected were identified by fire agencies as having comparable levels of bushfire risk. Survey data were obtained from 482 residents in Hobart during November 2006, giving a rate of return of 48%.

Results

Data were analysed using structural equation modelling (Amos 6.0). The results are summarised in Figure 1. The model presented here accommodates the hypothesised relationships and those identified by the modification indices furnished by the analysis. The fit indices ($x2$ = 8.30, df = 5, p=0.138; RMSEA = 0.037 (90% 0.0 -> 0.080), P-Value for Test of Close Fit (RMSEA < 0.05) = 0.628; NFI = 0.983, GFI =0.995, AGFI = 0.972) indicate that the revised model is a good fit for the data. The model accounted for 39% of the variance in preparation. Based on his meta-analysis of similar social cognitive models, Sheeran (2002) would define this as a very good effect size.

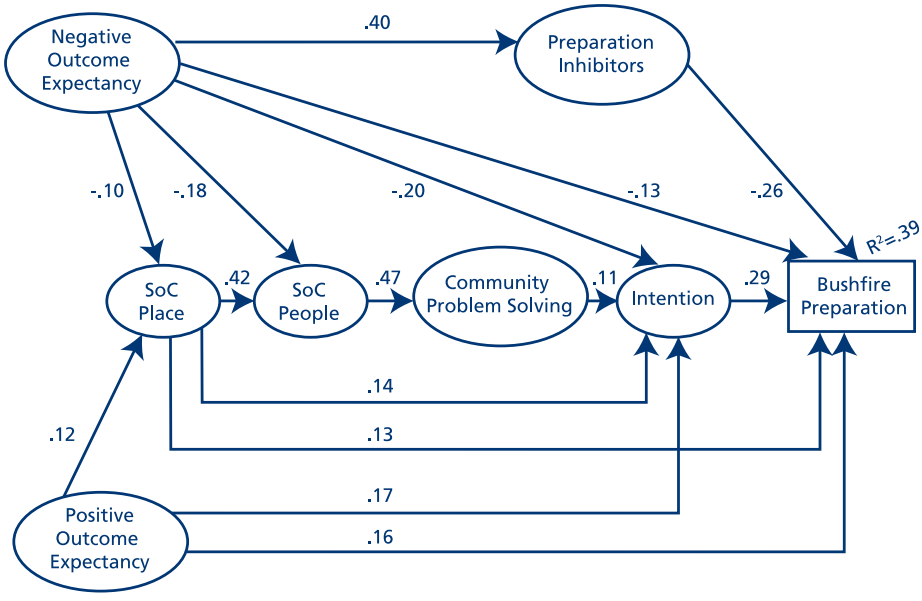
Discussion

The model confirms that "preparing" and "not preparing" are separate processes. With regard to "not preparing," negative outcome expectancy (NOE) was the principal driver. It had a direct negative influence on both intentions and actual preparedness (Figure 1). An indirect influence, with "preparation inhibitors" mediating its relationship with preparing, was also evident. Finding a negative relationship between NOE and the SoC variables suggests that holding NOE beliefs reduces the likelihood that one will engage with others to identify and manage sources of environmental risk.

Positive outcome expectancy (POE) had a direct influence on both intentions and preparing (Figure 1). This direct relationship suggests that at least some people know what to do and act accordingly. Others, however, appear to rely on others for guidance, with their sense of belonging to place and people, and their ability to access social resources to assist their working out what to do playing an important role in their risk management.

While it did not predict preparedness directly, 'SoC Place' mediated the relationship between POE and both intentions and preparing (Figure 1). This confirmed the qualitative finding that a combination of POE beliefs and a desire to safeguard one's living environment (assuming a degree of parity between 'SoC Place' and the place attachment construct – see above discussion) motivates preparing. However, for some respondents, an additional input was required.

Figure 1: Summary of the structural equation model of bushfire preparedness (SoC= Sense of Community)



The model (Figure 1) confirmed the qualitative finding that information from people with similar interests and values (SoC People) in routine social contexts increases understanding of one's circumstances and helps one decide what to do. The analysis also confirmed that access to collective problem solving capabilities makes an additional contribution to people's preparedness decisions.

The analysis also identified the fact that while positive outcome expectancy beliefs were sufficient to motivate action directly in some respondents, others first form intentions (Figure 1). This draws attention to the fact that several factors influence whether intentions are converted into action. Because attitudinal ambivalence moderates the likelihood of people acting on intentions (Conner et al., 2003), the dissonance reported by some respondents between preparing and protecting their environment (see discussion of the qualitative data above) can reduce the likelihood of their acting on their intentions, at least with regard to those preparedness measures perceived as having a detrimental environmental impact. Another factor is peoples' beliefs regarding when the next bushfire will occur. For those who believe it could occur within 12 months, the likelihood of converting intentions into actions is high, but this drops substantially as the expected timing of a future bushfire is pushed further into the future (Paton et al., 2005). While not systematically investigated here, investigation of factors that influence the conversion of intentions into actions should be included in future research agenda.

Conclusion

Living in high bushfire risk areas, or just receiving information about risk and how it might be managed is not sufficient to motivate people to prepare. Rather, several individual and community factors interact to influence how people interpret the hazardous circumstances that could prevail in their community. The nature of the interpretive process they invoke in this context determines whether or not people decide to prepare. Because preparing and not preparing are relatively discrete processes, outreach programs must accommodate both possibilities and to design intervention accordingly (see Paton & Wright, 2008 for a discussion of strategies that cater for each process).

By capturing people's views and how they make choices about preparing, the model provides a robust framework for outreach planning and intervention design. The model illustrates the complexity inherent in people's preparedness decision making process and the existence of several routes to the same end-point. For some a belief in the efficacy of preparing (and presumably the knowledge and resources required) is sufficient to motivate some people to act. For others, the decision is more a function of interaction between personal beliefs and social context influences. Outreach programs must be designed to accommodate this diversity in the routes that people can follow on the road to preparedness. However, before unambiguous conclusions can be reached about the latter, it will be necessary to accommodate the constraint of the cross-sectional nature of the present analysis and conduct longitudinal, prospective analysis of preparedness. While the pursuit of this objective is often constrained by the fact that people have engaged in some level of preparedness in the past, the identification of a group that are predisposed to "not prepare" could provide a way of circumventing this constraint. By working with members of the latter group, it could be possible to conduct a prospective analysis of their preparing decisions following the point where their "not preparing" predisposition is undermined and they commence the process of thinking about preparing. Additional work is also required to fully understand the mechanisms that influence levels of preparedness and the reliance of some people on preparing only when directly threatened by bushfire and to examine the relationship between intentions and actions.

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