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Creating a sustainable future: the challenges and opportunities

Community perceptions of bushfire maps across Australia and where to next

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COMMUNITY PERCEPTIONS OF BUSHFIRE MAPS ACROSS AUSTRALIA AND WHERE TO NEXT

BACKGROUND

Research in Australia has been conducted on the public's response to risk and warning communication (Dootson et al. 2019; 2021), however, less research effort has focused exclusively on the efficacy of bushfire maps in the public information and warnings milieu (e.g., Cao et al., 2016;2017; Whittaker et al., 2020). This research addresses that gap with a nation-wide survey of N= 3,007 community members in Australia funded by Natural Hazards Research Australia (see Begg et al., 2022). The survey examines community comprehension of, and intended actions prompted by, 14 bushfire maps, supplied by emergency services agencies. Drawing on the Protective Action and Decision-Making Model (PADM; Lindell and Perry 2012), this research specifically examines the extent to which the community are exposed to bushfire maps, how well they grab attention, the extent to which the community comprehend what the map is communicating about the hazard and the associated risk. Further, the research seeks to understand the extent to which a map can signal threat and inform protective action perceptions. These perceptions then form the basis for decisions about how to respond to an imminent or long-term bushfire threat. The outcome of the PADM process, together with situational facilitators and impediments, produces a behavioural response from the community comprising further information searching, emotion-focused coping, and or protective action (Lindell & Perry, 2012).

RESEARCH APPROACH

To assess the extent to which community members use, comprehend, perceive, and act upon bushfire maps and associated warning messages, including bushfire spread prediction maps, two types of maps and associated warning messages were tested across each jurisdiction, with one predictive map formally tested in the New South Wales/Australian Capital Territory survey. The research was designed in close collaboration with agencies across Australia, including: Queensland Fire and Emergency Services (QFES), New South Wales Rural Fire Service (NSW RFS), Australian Capital Territory Emergency Services Agency (ACT ESA), Country Fire Authority Victoria (CFA VIC), Emergency Management Victoria (EMV), Tasmania Fire Service (TFS), South Australia Country Fire Service (SA CFS), Western Australia Department of Fire and Emergency Services (DFES), and Northern Territory Fire and Rescue Service (NTFRS).

A total of seven surveys were run on a sample of Australians (*N* = 3,007) recruited by the Qualtrics market research panel. The sample comprised 52% female respondents, with over 51% aged 18 to 44 years. The sociodemographic characteristics of the sample are available on request. Approximately 11% of the respondents indicated that someone in their household was a member of a state emergency service agency. Just over 42% indicated that they had previously experienced a bushfire, with 34% indicating experience within the past five years. Over 42% reported they had used a bushfire map to inform their decision making during a previous bushfire event. Respondents self-reported a low-moderate level of perceived knowledge about bushfire hazards and risk (*M* = 4.0; scale of 0–10).

A scenario-based questionnaire was designed to understand the extent to which community members use, comprehend, perceive, and act upon bushfire maps and associated warning messages, including bushfire spread prediction maps. Respondents were assigned to one of seven surveys based on the Australian

jurisdiction in which they lived. Each survey comprised three sections. Section 1 captured bushfire experience, exposure to and use of maps, general risk and coping assessment, source and source credibility questions, and self-reported preparatory protective actions. In Section 2, respondents were exposed to one map and associated warning message from their home state/territory, followed by a series of comprehension, emotion, risk perception, map effectiveness, coping appraisal, and protective action intentions questions. This was repeated for a second map with an associated warning message from their home state/territory. Section 3 of the survey covered demographic information. The survey used pre-existing validated items to measure the constructs in this study. The QUT ethics approval number for this research project is LR 2022-5724-11822.

RESULTS

This extended abstract reports the results for the national sample while forthcoming academic publications report jurisdiction specific insights.

Preferred, trusted sources and platforms for bushfire information

Descriptive analysis was performed to better understand respondents' preferences for information sources and platforms during a bushfire. Respondents indicated that they typically received information about bushfires from the formal fire agency (e.g., QFES, NSW RFS, ACT ESA, CFA VIC, TFS, SA CFS, WA DFES, NTFRS), Local Government, State Government, Bureau of Meteorology, and media. However, when asked about who a trusted source of bushfire information was, media was usually replaced with police services or family and friends. Specific platforms that were commonly used to find information included agency websites, an app (agency-owned or third-party), Google searches, online news, television, radio, and some social media platforms.

Comprehension of the map and associated warning message

Respondents, for the most part, comprehended the purpose of the maps and associated warning messages as well as the intended prompted action. There were some points of confusion, including when the map contained multiple polygons and warning levels, when the respondent was placed outside the polygon, and when it was hard to locate oneself on the map due to the design of the map such as too many roads and no road names or the map was too bare, with limited geographical information.

Overall, there was moderate-high self-reported perceived map effectiveness ($M \sim 5.0$; scale of 0–10)., such that the maps and associated warning messages were worth remembering, grabbed respondents' attention, and were powerful, informative, or meaningful (Davis et al., 2017; Dillard et al., 2007).

Risk perceptions and emotions elicited with the map and associated warning message

Overall, both risk perceptions and negative emotions tended to increase when the map and associated warning message were visualising and describing a higher level of threat escalation. For example, Map 1 may have been a 'Watch and Act' level of bushfire escalation whereas Map 2 may have then been an 'Emergency Warning' level of bushfire escalation, a higher level of warning in the national Australian Warning System. Map 2 would thus be associated with stronger self-reported risk perceptions and negative emotions, congruent with the higher level of warning escalation.

Protective action intentions associated with the map and warning message

When evaluating the top five actions that respondents indicated they would take in response to viewing a map and associated warning message, the national sample was largely compliant with the agency-issued instructions (which were usually stated in the associated warning message). Worth noting were the additional actions respondents indicated they may take beyond what was explicitly instructed by the fire agency, which fell into one of three possible categories: (1) a general instruction, e.g., stay informed by emergency services agencies, which was not explicitly mentioned but largely implied by the map and associated warning message; (2) a specific action that was not explicitly mentioned but would still help protect the lives and property of the affected individual; or (3) a specific action that was not explicitly mentioned in the map and or associated warning message and where following that action could potentially put the individual (or their property) at risk (e.g., waiting for a firefighter to tell them to evacuate, waiting for police to knock on the door).

Coping appraisal associated with the map and warning message

Coping appraisal refers to whether respondents felt generally confident in their ability to protect themselves and their property from a bushfire and the extent to which the respondent perceived that they had the ability to perform the protective actions required (i.e., self-efficacy), that their actions would in fact protect themselves (i.e., response efficacy) and that performing the actions would not come at a high cost (i.e., response cost) (Grothmann & Reusswig, 2006). The maps and associated warning messages had two impacts on coping appraisal, either: (1) the map and associated warning message saw an increased coping appraisal from the initial self-reported general perceived coping appraisal of responding to bushfires; or (2) the more complex, higher escalation of warning saw a higher coping appraisal assessment by the respondent from the initial self-reported general perceived coping appraisal of responding to bushfires. Pairing a high coping appraisal with high-risk perceptions is helpful to incite protective action over maladaptive decision-making (e.g., wishful thinking, denial, inaction) as per protective motivation theory (Rogers, 1975).

Community suggestions for improvement to map design

Common feedback on how to improve map design across the whole sample of respondents on maps tested across Australia included calls for:

1. **Directionality of hazard**: use arrows showing directionality of the bushfire spread.
2. **Legend**: use a legend or key to help interpret the information presented on the map.
3. **Timing**: indicate when the map was developed and for how long it is valid; time estimates on how fast it is tracking.
4. **Landmarks**: show on the map key landmarks, including evacuation centres, to help people locate themselves on the map.
5. **Routes:** show clear routes out to help people navigate their evacuation.
6. **Interactive capabilities:** provide the ability to engage with the map directly i.e., zoom functionality.
7. **Sizing and legibility:** increase the prominence of hazard markers alongside placenames, roadways, and other landmarks.
8. **Colours:** increase contrast of colours to clearly delineate multiple warning areas.

NEXT STEPS

The purpose of this study was to assess the extent to which community members use, comprehend, perceive, and act upon maps, including bushfire spread prediction maps, in the context of bushfires. Combining the insights from this work with other work packages under the Predictions in Public research project funded by Natural Hazards Research Australia (see Begg et al., 2022), offers a practical contribution to the field of emergency management. First, the research offers an empirical foundation to sense-check the theoretical principles for map design and dissemination (Work Package 2). Second, the results offer jurisdiction-specific feedback to adjust each jurisdiction's respective communication strategies and map design. Third, the predictive map tested in the New South Wales/Australian Capital Territory survey received positive feedback, which offers community insights to triangulate with agency insights (Work Package 3) on the use of predictive maps in the public domain. Fourth, combining these results with the forthcoming qualitative interviews with communities (Work Package 4) will provide a foundation for the development, design, and further testing of specific map concepts, including predictive maps, for national testing in Phase Two of this research program in 2023-2024.

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