

# Increasing Preparedness for Wildfires by Informing Residents of Their Community's Social Norms

Piers D. L. Howe, Ph.D.<sup>1</sup>; Jennifer Boldero, Ph.D.<sup>2</sup>; Ilona M. McNeill, Ph.D.<sup>3</sup>; Adriana Vargas-Sáenz<sup>4</sup>; and John Handmer, Ph.D.<sup>5</sup>

**Abstract:** Despite being informed about the risks of wildfires and what can be done to reduce these risks, many Australian residents in areas prone to wildfires still do not adequately prepare for them. A more effective strategy is needed to encourage residents to become better prepared for wildfires. Studies have shown that communicating social norms, such as what others typically do (i.e., the descriptive norm) and think should be done (i.e., the injunctive norm), is an effective way of modifying behavior. Two pilot studies were run in which participants played a game where they simulated preparing for a wildfire. A social norm message was found to significantly increase wildfire preparedness in this hypothetical game. When the equivalent message was trialed in an actual field study by surveying residents twice 19 days apart on average, the number of preparedness actions performed by residents increased by 11%. These results indicate that social norm messages can play a useful role as part of a larger information campaign to encourage people to become better prepared for wildfires. **DOI: 10.1061/(ASCE)NH.1527-6996.0000279.** © 2017 American Society of Civil Engineers.

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## Introduction

Wildfires, referred to in Australia as bushfires, are a major threat in all parts of Australia. In terms of number of fatalities, they are the fourth most hazardous natural disaster after heatwaves, tropical cyclones, and floods (Coates 1999). Between 1901 and 2008, 552 civilians (i.e., nonfirefighters) died in wildfires. In the 2009 Black Saturday wildfires, a further 173 people died (Teague et al. 2010). The economic cost of wildfires is also substantial. From 1967 to 1999, wildfires cost Australia \$77.2 million per year in 1998 Australian dollars, corresponding to 7% of the total cost of natural disasters for that period (Bureau of Transport Economics 2001).

The predominant strategy used in Australia to enhance community preparedness for wildfires is to inform residents about the risks associated with them and how they should prepare so that these risks are minimized. This strategy is currently embodied in the national Prepare. Act. Survive. campaign (e.g., Department of Fire and Emergency Services 2014; Queensland Fire and Emergency Service 2016). Commenced in 2009, this campaign has produced mixed results, with many residents remaining inadequately prepared (Rhodes et al. 2011; McLennan et al. 2015), despite most claiming that they know the risks and know what they should do

to minimize them (Rhodes and Gilbert 2010; Rhodes et al. 2011; McNeill et al. 2013). For example, a survey conducted in 2009–2010 by the Country Fire Authority found that only 24% of residents in areas that were at a high risk for wildfires in the Australian state of Victoria had a comprehensive plan for what they would do if one occurred (Rhodes and Gilbert 2010). This was despite 92% of respondents reporting having received bushfire safety information within the previous six months, with three-quarters reporting that they read the information (Rhodes and Gilbert 2010). Similarly, a later survey, also conducted by the Country Fire Authority, found that although all respondents reported that they generally felt well informed, with 89% requesting either no or only a little more information, most did not have what the authority regarded as a comprehensive plan and only 10% had any written plan at all (Rhodes et al. 2011). Dunlop et al. (2014) found that only 38% of their respondents had listed the important things to do and remember in case of fire. Likewise, McNeill et al. (2017) found that in Victoria only 51% of residents had considered how atypical situations (e.g., certain family members not being home even though they normally are) would affect their bushfire plan.

It is clear that most residents in high-risk bushfire areas do understand that they are at risk and what they should do to minimize risk, and yet most are inadequately prepared (Rhodes and Gilbert 2010; Rhodes et al. 2011). A more effective strategy is therefore needed to encourage residents to become better prepared for wildfires. The communication of social norms—in particular, what other people do (i.e., the descriptive norm) and believe should be done (i.e., the injunctive norm)—has been found to be an effective behavior modification strategy in a range of domains. These domains include decreasing alcohol consumption (Neighbors et al. 2004), decreasing drug use (Donaldson et al. 1994), decreasing energy consumption (Schultz et al. 2007; Nolan et al. 2008), decreasing gambling (Larimer and Neighbors 2003), increasing use of appropriate sun protection (Reid and Aiken 2013), increasing recycling (Schultz 1999), and increasing conservation behaviors (Schultz et al. 2008). However, none of these studies addressed the central focus of the present study—increasing preparedness for wildfires. Accordingly, although it is reasonable that a strategy

<sup>1</sup>Associate Professor, School of Psychological Sciences, Univ. of Melbourne, Parkville, VIC 3010, Australia (corresponding author). E-mail: pdhowe@unimelb.edu.au

<sup>2</sup>Associate Professor, School of Psychological Sciences, Univ. of Melbourne, Parkville, VIC 3010, Australia.

<sup>3</sup>School of Psychological Sciences, Univ. of Melbourne, Parkville, VIC 3010, Australia.

<sup>4</sup>School of Psychological Sciences, Univ. of Melbourne, Parkville, VIC 3010, Australia.

<sup>5</sup>Professor, School of Science, Royal Melbourne Institute of Technology Univ., Melbourne, VIC 3001, Australia.

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based on communicating social norms may be effective at increasing resident preparedness in bushfire-prone areas, this has yet to be demonstrated.

Previous investigations into the effectiveness of communicating social norms to modify behavior typically used very simple messages. Often these messages were designed to change just a single behavior, such as decreasing alcohol consumption (Neighbors et al. 2004) or increasing recycling (Schultz 1999). Conversely, the present task was substantially different in that it was necessary to modify several behaviors simultaneously. Whereas in these previous studies it was relatively easy for participants to remember what they were supposed to do, in the current study this was not the case. Obviously, if residents cannot remember what actions they are meant to perform, they are unlikely to perform them. So, although the current study was theoretically motivated by the desire to determine to what extent communication of social norms could be used to enhance preparedness for wildfires, for methodological reasons it was also necessary to develop ways of enhancing people's ability to remember what actions needed to be performed.

One obvious way to make it more likely that residents will remember which actions they are meant to perform is to make the message itself as engaging as possible. The more a person attends to a message, the more likely he or she is to remember its contents (Norman 1976). One way to increase the engagement between reader and message is to accompany the message with a photograph (Finn 1988), as evidenced by the widespread use of photographs in advertising. It was for this reason that, in the field studies a photograph was displayed when the normative message was presented.

Another way to make it more likely that participants will remember which actions they should perform is to use acronyms (Kibler and Blick 1972; Nelson and Archer 1972; Stalder 2005). Acronyms are widely used in some education settings (Norman 1976). Whereas photographs can increase the desire of a participant to remember a message, acronyms can help the participant to in fact do so. Consequently, an acronym was constructed to represent the preparatory actions that participants needed to perform. It was expected that this acronym would make it more likely that these actions would be remembered.

In summary, although the primary aim of the current study was to determine whether communicating social norms is an effective way of increasing preparedness for wildfires, for purely practical reasons the messages sometimes included photographs and acronyms. This choice reflected the desire to create a practical solution that would work in the field. A secondary aim was to determine the degree to which the intervention affected the intent to perform these preparatory actions in addition to the extent to which it actually caused the preparatory actions to be performed. Both the theory of planned behavior (Ajzen 1985) and the theory of reasoned action (Fishbein and Ajzen 1975) propose that the necessary precursor to voluntary actions is the intention to act. Consequently, the field study measured the intent to perform the preparatory actions immediately after the intervention to determine to what degree the intent to prepare was modified by the intervention.

### Preparatory Actions

When conditions are extreme, for example when it is especially hot, dry, and windy, designated code red in Victoria or catastrophic in New South Wales, evacuation is the only safe option in the event of a bushfire because houses are not designed to be defensible under such conditions (Country Fire Authority 2014; Rural Fire Service 2017). Thus, all residents in Australia who live in an area at risk of wildfires must have a workable evacuation plan. This study focused on the minimum preparatory actions necessary to create such a

plan. The Country Fire Authority in Victoria advised the authors that a workable evacuation plan would require residents to have performed the following four actions:

- Identify the specific trigger(s) for leaving/relocating (e.g., the fire danger rating);
- Ensure that all members of the household are comfortable with the evacuation plan;
- Ensure that household members have planned exactly how to leave/relocate under different circumstances, including when different householders are at different locations (e.g., one is at home, one is at work) and so may not have direct access to a vehicle; and
- Ensure that household members have discussed or considered how road closures and fire directions might impact evacuation/relocation plans, and have identified alternative evacuation routes.

In the following studies, the preparedness of residents was operationalized as the number of these actions that participants reported had been performed. All four items were included as part of a previous survey in which residents in Victoria and New South Wales on average reported having completed 48% of these actions (McNeill et al. 2017). The purpose of the current investigation was to determine which message would increase the level of preparedness beyond this level.

### Pilot Study 1

Because there were too many potential interventions to test in the field, they were first piloted in a series of online experiments that attempted to simulate the decision making that occurs in the real world. Although it cannot be claimed that these simulations were completely realistic, comparing all interventions in the same simulated environment allowed determination of their relative effectiveness and determination of the intervention most likely to be effective in a real-world context. In total, two pilot studies were run. The first was designed to find the optimal norm-based message to encourage people to better prepare for wildfires. The aim of the second pilot study was to find the optimal photograph to pair with this message. Based on these studies, the intervention that was most likely to be effective was selected. The effectiveness of this intervention was then tested by surveying actual residents in bushfire-prone areas in Victoria and New South Wales.

### Method

The experiments were conducted online, via Qualtrics, an online survey platform (Qualtrics.com). The participants were recruited via Amazon's Mechanical Turk (2017). Mechanical Turk uses a nonrandom recruitment process. Advertisements for specific tasks, such as the current study, are placed on an electronic bulletin board accessible to people who have registered with the website. Because participants choose which tasks they wish to perform, they are self-selected. Also, because the participants were Americans in North America, the term *forest fires* was used instead of *bushfires*. Participants were invited to play a game in which they imagined that they owned a home in an area that was prone to forest fires. The objective was to evacuate all members of their household from the area safely in the event of a forest fire. To increase the likelihood of evacuating safely, they could pay to ensure that each of the four preparatory actions listed previously had occurred. They were told that a forest fire season would then be simulated and, based on which actions they paid to have occur, it would be determined if their evacuation plan was successful for the simulated fire season. If it was, they would be paid a \$2 bonus less the cost of the actions

that they paid for. If their household did not successfully evacuate, they would not be paid the bonus.

By trial and error, it was determined that, when the costs of the four actions were set to 55, 20, 120, and 70 cents, respectively, the completion rates were similar and the average completion rate was 44%. This is similar to the completion rates for the same actions in the field: residents in both Victoria and New South Wales on average report having performed 48% (McNeill et al. 2017). The cost structure was kept constant for both pilot studies. Immediately after reading the instructions, participants received one of five possible interventions (baseline, acronym only, descriptive norm, injunctive norm, and combined descriptive and injunctive norm), discussed in more detail later. Because the pilot study was exploratory, the conditions were presented in a sequential fashion. Two of them (the baseline and descriptive norm conditions) were repeated after all conditions had been completed to demonstrate that the findings were consistent and stable. For each of these two conditions, no difference could be detected between the two runs; therefore, for each condition the data for the two runs were combined, which is why these two conditions have approximately double the number of participants who participated in the other conditions.

### Baseline Condition

In the baseline condition, there was no intervention. After being presented with the instructions and the prices for each of the four actions, the participants chose which actions they wanted to pay for. The simulation then ended.

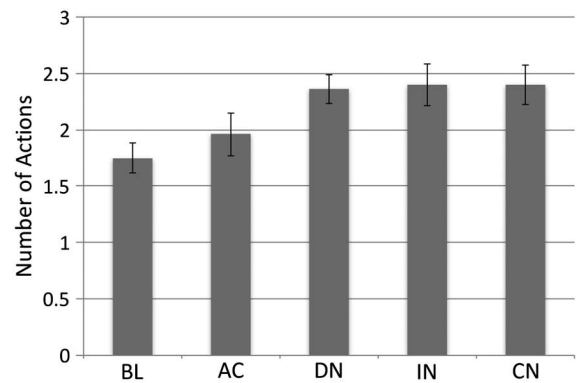
### Acronym Condition

In the acronym condition, participants were first presented with the instructions described previously and then presented with the acronym LIVE. The initial intention was to create and compare several acronyms and choose the most effective. However, the researchers were unable to create any other acronyms that could reasonably represent the four actions. Therefore, this condition used LIVE only. It was explained that each letter of the acronym related to one planning actions (1) Leave when? (2) In agreement? (3) Vehicles/transport sorted? and (4) Evacuation routes determined? The purpose of this acronym was to reinforce the importance of the four actions participants needed to perform to evacuate safely. After presentation of the acronym, participants viewed four words (PLAN, LIVE, FIRE, and BUSH) and were asked to indicate which was the acronym. If they got this question wrong, they were reminded of the acronym and what preparatory action each letter represented and retested. This process was repeated up to four times, so the participants had five attempts. If they failed all five, they were excluded from the survey.

Participants who identified the acronym correctly were then asked to identify what phrase each letter stood for. The letters were presented one at a time and were followed by four phrases. For example, the letter *L* was followed by the four phrases: Leave when? Leave, do you have a plan? Leave, do you have transport? and Leave with whom? Participants were given five attempts (i.e., including any attempts needed to identify the acronym). Any failure required them to start over. They were only allowed to continue with the simulation and decide which actions they would pay to have performed once they had successfully demonstrated that they knew the acronym and what preparedness action each letter represented.

### Descriptive Norm Condition

The descriptive norm condition started identically to the acronym condition. After the participants demonstrated that they had learned the LIVE acronym, they were then told, "For the following actions, many people pay to have at least three of the actions performed."



**Fig. 1.** Number of preparatory actions participants paid to have performed in each of the five conditions of the first pilot study; error bars = standard error of mean; BL = baseline condition; AC = acronym condition; DN = descriptive norm condition; IN = injunctive norm condition; CN = combined norm condition

### Injunctive Norm Condition

The injunction norm intervention was identical to the descriptive norm intervention except that participants were told, "For the following actions, most people think that others should pay to have at least three of the actions performed."

### Combined Descriptive and Injunctive Norm Intervention

The combined intervention condition was identical to the previous two conditions except that participants were told, "For the following actions, it is recommended that you pay to have at least three of the actions performed. Many people do this."

The number of participants in each condition was 56 (baseline condition), 27 (acronym condition), 59 (descriptive norm condition), 28, (injunctive norm condition), and 30 (combined descriptive and injunctive norm condition).

### Results

A one-way ANOVA revealed that there was a significant difference in uptake (i.e., the number of preparatory actions paid for) between the five conditions,  $F(4,195) = 3.46$ ,  $p = 0.009$ ,  $\eta^2 = 0.07$  (Fig. 1). Post hoc Tukey HSD tests were conducted on all possible pairwise comparisons. The only pairs of conditions that were found to be statistically different ( $p < 0.05$ ) were the baseline condition versus the descriptive norm condition and the baseline condition versus the combined descriptive and injunctive norm condition.

### Pilot Study 2

#### Method

Given that the authors could not detect any difference in the efficacy of the three norm intervention conditions, the combined descriptive and injunctive norm condition was chosen for the next pilot study because it was more likely to be robust in an actual field trial (Schultz et al. 2007). This pilot study investigated the effect of juxtaposing the combined descriptive and injunctive norm intervention with one of the photographs shown in Fig. 2. These photographs were chosen because it was thought that they would capture participants' interest and consequently encourage people to be better prepared for forest fires. There were five conditions: the combined descriptive and injunctive norm on its own, the combined norm with the picture of the forest fire, the combined norm





**Fig. 2.** Three photographs trialed in the pilot studies (from left to right, images by Peter Wilson, Dmitry Kalinovsky, and Steve Lovegrove, Shutterstock.com)

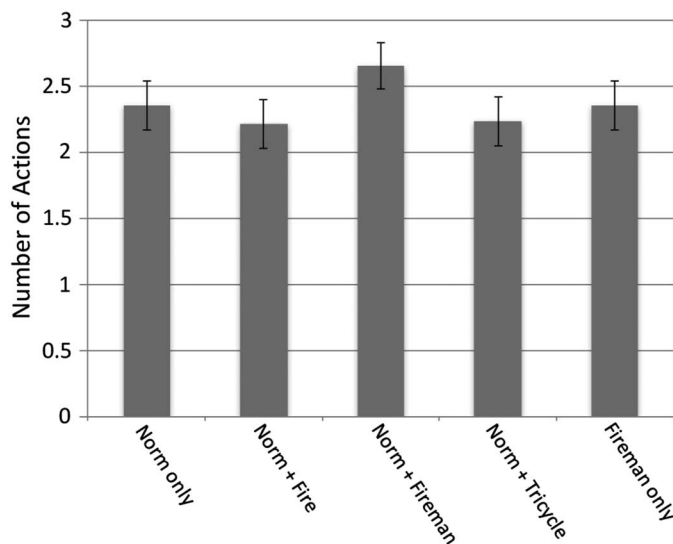
with the picture of the firefighter, the combined norm with the picture of the tricycle, and the photograph of the firefighter on its own. In keeping with the first pilot study, the minimum number of participants in each condition was 28. The first and last conditions ran slightly more, each running 29.

### Results

A one-way ANOVA revealed that there was no significant difference between the five conditions,  $F(4,137) = 0.842$ ,  $p = 0.50$ ,  $\eta^2 = 0.02$  (Fig. 3). However, it was necessary to choose just one condition for the field study, so it was decided to use the combined norm with the photograph of the fireman given that it showed a trend to lead to the highest preparedness levels. Therefore, this was the most likely combination to lead to higher preparedness among residents in bushfire-prone areas in the field survey.

### Field Study

Having used the pilot study to identify the intervention that was likely to be the most effective, a field study was then conducted to test the intervention in a realistic setting. This work was part of a larger study examining increasing bushfire preparedness, and only the parts of that study relevant to the current study are discussed here.



**Fig. 3.** Average number of preparatory actions participants paid to have performed in each of the five conditions in the second pilot study

In the field study, participants were surveyed twice, with an interval of approximately 19 days between surveys. At the end of the first survey, participants were split into three groups. For Group 1, there was no intervention. Group 2 was shown the acronym described previously but not the photograph or the combined norm message. Group 3 was shown the acronym, the combined norm message, and the photograph.

### Hypotheses

The expectation was that the interventions would affect both self-reported preparedness and the intent to prepare for wildfires. It was further assumed that the Group-3 intervention (i.e., the combined norm condition) would be more effective than the Group-2 intervention (i.e., the acronym only condition) which, in turn, would be more effective than the Group-1 intervention (i.e., the baseline condition). In addition, it was expected that actual self-reported preparedness would generally increase over time, even for the control group (no intervention) (McNeill et al. 2017). Based on this and the pilot study results, the following seven hypotheses were proposed: Because it was assumed that the combined norm intervention would be the most effective, it was expected that intentions to prepare would be greater for Group 3 than for either Group 1 (H1) or Group 2 (H2). Because it was assumed that acronym-only intervention would be effective, it was expected that intentions to prepare would be greater for Group 2 than for Group 1 (H3). Because it was expected that for all three groups actual preparedness would generally increase over time (McNeill et al. 2017), it was expected that for all three groups, self-reported preparedness would be greater at Time 2 than at Time 1 (H4). Because it was assumed that the combined norm intervention would be the most effective, it was expected that the increase in preparedness would be greater for Group 3 than for Group 1 (H5) and Group 2 (H6). Because it was assumed that acronym-only intervention would be effective, it was expected that the increase in preparedness would be greater for Group 2 than for Group 1 (H7).

In summary, the first three hypotheses were concerned with residents' intentions to prepare. These intentions were measured at the end of the first survey (i.e., at Time 1). The remaining four hypotheses were concerned with the degree to which the interventions led to an increase in self-reported preparedness and so were concerned with the increase in preparedness from Time 1 to Time 2 and how this varied between conditions.

### Recruitment and Eligibility

A third party was used to recruit residents in Victoria and New South Wales who lived in areas at risk of forest fires. These recruits were randomly selected from a group that had previously agreed to

participate in surveys administered by this third party. The selection procedure was specifically chosen so that the distribution of gender and age matched the distribution of the population in general, to ensure that the sample was as representative as possible. Participants were randomly allocated to one of the survey conditions. Because the initial recruitment was done by a third party, the researchers do not have data on the response rate. Each participant was surveyed twice, with a minimum period of 2 weeks between surveys. The average time between a response to the first and second surveys was 19.4 days. These surveys started near the beginning of the bushfire season. For Victoria, the first wave started on October 27, 2015, and finished on November 27, 2015. The second wave started on November 4, 2015, and finished on December 14, 2015. For New South Wales, the first wave started on December 2, 2015, and finished on January 1, 2016. The second wave started on December 18, 2015, and ended on January 14, 2016.

All participants were screened before completing the survey at Time 1. To be eligible, they had to be 18 years or older and live in a property within 100 m of an area of bushland (e.g., park, reserve, undeveloped public or private land) that was at least 1 ha in size. Participants in Victoria had to be in an area that Country Fire Authority had designated as being at either high risk or extreme risk of wildfires and/or grassfires (participants were given a web link to verify that they satisfied this requirement). Because the whole of New South Wales is, in principle, considered at a high risk of wildfires, respondents were required to indicate that they lived in an area that they believed was at high risk of wildfires or grassfires. To ensure that they would need to discuss their bushfire plans with someone else, those who lived alone were not eligible to participate. In addition, individuals had to confirm that they were either the main person making bushfire-related decisions or shared the responsibility equally with a partner/spouse. During the survey, there were two catch questions requiring participants to tick a particular response (e.g., neither agree nor disagree) to verify that they were paying attention. Participants were excluded if they answered both catch questions incorrectly.

### Time-1 Survey

Participants first answered a series of demographic questions about themselves and their household. Following, they were asked to indicate, for each of the four preparatory actions, whether they had performed that action. Participants were then randomly split into three groups (Fig. 4). Group 1 received no intervention and continued without pause to the final section, in which they were asked a series of questions regarding their perceptions of others' views of planning to evacuate from wildfires, and their intentions to evacuate

from wildfires (see Supplemental Data). It was important to assess their intentions because both the theory of planned behavior (Ajzen 1985) and the theory of reasoned action (Fishbein and Ajzen 1975), from which the social norm intervention was derived, state that the necessary precursor to voluntary action is the intention to act. Group 2 was presented with the LIVE acronym and tested on it in the same manner as in the pilot study. This ensured that these participants had memorized the acronym and understood which action each letter represented. The participants then completed the final section of the survey as described earlier. Group 3 was also presented with the acronym and tested on it. Group members were additionally presented with a normative message that was displayed simultaneously with the picture of the firefighter used in the second pilot study. In keeping with the pilot study, the message contained both a descriptive norm and an injunctive norm, as it has been shown that this type of message is the most robust (Schultz et al. 2007). The Country Fire Authority (Victoria) had informed the researchers that the message used in the pilot studies was too abrupt and would be more effective lengthened and rephrased. Based on this advice, the message was edited as follows:

To safely evacuate your home in the event of a bushfire you need plan your evacuation ahead of time, and be able to fully address the four questions summarised by the acronym L.I.V.E. (Leave when? In agreement? Vehicles/ Transport sorted? Evacuation routes planned?). When it comes to people living in areas similar to yours, namely areas that are at risk of bushfires or grassfires, many are able to fully address all four questions. If you cannot yet do this, please rectify the situation as soon as possible. Your safe evacuation may depend on it.

After being presented with this message, participants in Group 3 completed the final section of the survey, as described earlier.

### Time-2 Survey

As the aim of the current study was to determine whether or not the invention caused residents in bushfire-prone areas to increase their preparedness for wildfires, it was necessary to allow them a few weeks to perform the actions and then to administer a second survey to determine if they had, in fact, performed these actions. In this second survey, participants were presented with the same four preparatory actions, one at a time, and asked to indicate whether they had performed them. All questions were phrased in an identical manner to how they had been presented in the Time 1 survey. For any preparatory actions that they had not completed, they were asked to select a reason, from a list of possible reasons, for not performing the action. Following this, participants were asked specific questions that varied according to their Time-1 group

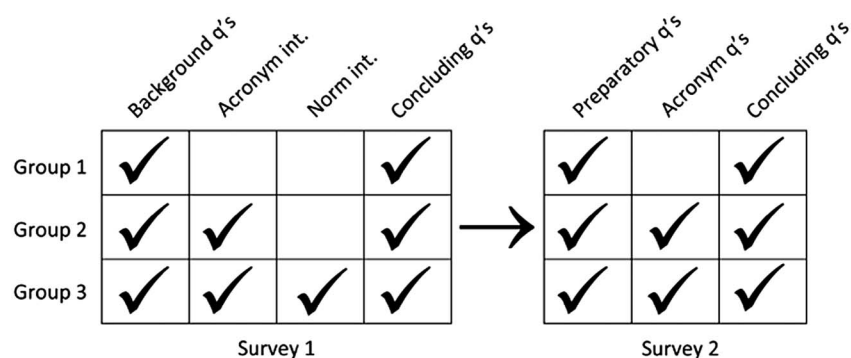


Fig. 4. Summary of the structure of the two surveys for each of the three groups; q's = questions; int. = intervention

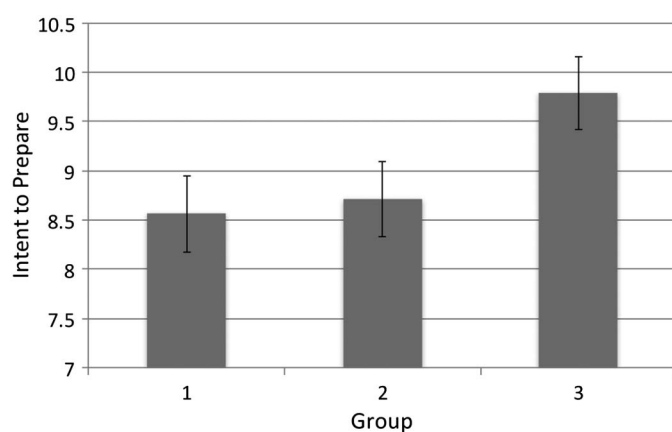
assignment. Those in Group 1 completed the final section of the survey, whereas those in Groups 2 and 3 were first tested on their knowledge of the acronym. During the final section of the survey, all participants were asked to provide their opinion on how people could be better encouraged to prepare for wildfires.

## Results

### Background Information

In total, 1,084 people met the screening requirements, participated at both time points, and answered at least one catch question at Time 1 correctly. Sixty percent of the participants lived in Victoria; the remainder, in New South Wales. Fifty-eight percent were female. A one-way ANOVA revealed no difference in the number of males and females in the three groups,  $F(2,1,081) = 0.025$ ,  $p = 0.975$ ,  $\eta^2 < 0.001$ . Participants ranged in age from 18 to 82 years (mean = 48.2, SD = 14.2). A one-way ANOVA revealed no difference in the mean age between the three groups,  $F(2,1,077) = 2.33$ ,  $p = 0.098$ ,  $\eta^2 = 0.004$ . Detailed demographics are described in the Supplemental Data.

At Time 1, there was no significant difference between the groups on the percentage of preparedness actions they had completed,  $F(2,1,081) = 2.29$ ,  $p = 0.102$ ,  $\eta^2 = 0.04$ . On average, participants had completed 54% (SD = 39%) of the actions, which was similar to what McNeill et al. (2017) reported. In general, participants agreed that people personally significant to them would want them to plan to safely evacuate from a bushfire. The degree to which they agreed with this statement varied as a function of the group to which they were assigned,  $F(2,1,081) = 5.49$ ,  $p = 0.004$ ,  $\eta^2 = 0.03$ ; Group-1 mean = 2.16, Group-2 mean = 2.26, Group-3 mean = 2.57; scale: -4 = strongly disagree, +4 = strongly agree. However, the degree of agreement was significantly greater than zero even for Group 1, which had not received any intervention,  $t(258) = 78.4$ ,  $p < 0.001$ ,  $R^2 = 0.94$ . Similarly, participants generally agreed that other people in a situation similar to theirs would probably plan to safely evacuate from a bushfire. There was a nonsignificant trend for this belief to differ between groups,  $F(2,1,081) = 2.97$ ,  $p = 0.052$ ,  $\eta^2 = 0.01$ ; Group-1 mean = 1.82, Group-2 mean = 2.05, Group-3 mean = 2.10; scale: -4 = strongly disagree, +4 = strongly agree; moreover, the degree of agreement was significantly greater than zero even for Group 1,  $t(258) = 76.0$ ,  $p < 0.001$ ,  $R^2 = 0.94$ .



**Fig. 5.** Intentions to prepare for the three groups, measured at Time 1; error bars = standard error of mean

### Intentions to Prepare (H1, H2, H3)

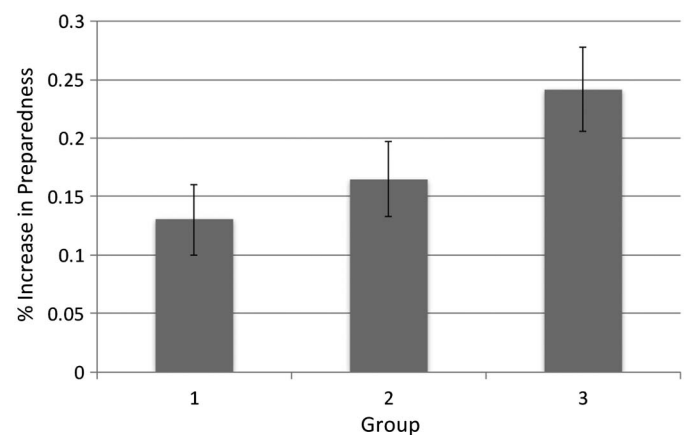
Intentions to prepare for wildfires for the three groups are shown in Fig. 5. The intent to prepare was 14% greater in Group 3 than in Group 1,  $t(728) = 2.28$ ,  $p = 0.011$ ,  $R^2 = 0.007$ , 1-tailed, consistent with H1. It was 12% stronger for Group 3 than for Group 2,  $t(728) = 2.02$ ,  $p = 0.022$ ,  $R^2 = 0.006$ , 1-tailed, consistent with H2. However, there was no difference in the intentions of Groups 1 and 2,  $t(728) = 0.280$ ,  $p = 0.390$ ,  $R^2 < 0.001$ , 1-tailed, inconsistent with H3. Thus, the first and second hypotheses were supported whereas the third hypothesis was not. Intentions to prepare were positively correlated with preparedness both at Time 1,  $r(1,082) = 0.309$ ,  $p < 0.01$ , and at Time 2,  $r(1,082) = 0.217$ ,  $p < 0.01$ . However, when preparedness at Time 1 was controlled for, intentions to prepare were not correlated with the increase in preparedness from Time 1 to Time 2,  $r(1,079) = 0.042$ ,  $p = 0.165$ .

### Preparedness over Time (H4, H5, H6, H7)

Fig. 6 shows the difference in preparedness between time points. This level of preparedness was significantly greater at Time 2 for all three groups than that at Time 1 [Group 1,  $t(358) = 4.09$ ,  $p < 0.001$ ,  $R^2 < 0.045$ , 1-tailed; Group 2,  $t(353) = 5.19$ ,  $p < 0.001$ ,  $R^2 = 0.071$ , 1-tailed; Group 3,  $t(370) = 6.74$ ,  $p < 0.001$ ,  $R^2 = 0.109$ , 1-tailed], consistent with H4. The increase in the preparedness between time points was 11% greater for Group 3 than for Group 1,  $t(728) = 1.89$ ,  $p = 0.030$ ,  $R^2 = 0.005$ , 1-tailed, consistent with H5. However, there was no difference in the increase in preparedness for Groups 3 and 2,  $t(723) = 1.30$ ,  $p = 0.097$ ,  $R^2 = 0.002$ , 1-tailed, inconsistent with H6, or between Groups 2 and 1,  $t(711) = 0.63$ ,  $p = 0.265$ ,  $R^2 < 0.001$ , 1-tailed, inconsistent with H7. Thus, Hypotheses 4 and 5 were supported but Hypotheses 6 and 7 were not. This indicates that the social norm intervention was effective but the acronym-only intervention was not.

### Reasons for Inaction

At Time 2, participants who indicated that they had not performed a particular action were subsequently asked to provide a reason for not doing so. Across all four actions, 40% of respondents indicated that they did not think it was important to do it, 37% indicated that they did not get around to doing it, 13% indicated that they forgot to do it, 6% indicated that the action was too difficult, and 4% indicated some other reason.



**Fig. 6.** Percentage increase in the number of preparedness actions performed at Time 2 relative to Time 1 for the three field study conditions: baseline, acronym-only, and norm intervention; error bars = standard error of mean



For the two groups of participants who were asked to memorize the acronym at Time 1 (i.e., Groups 2 and 3), 62% could still correctly identify the acronym from the list of words PLAN, LIVE, FIRE, and BUSH at Time 2. However, only 15% could correctly identify all four phrases corresponding to each letter of the acronym. This shows that there is substantial room for improvement in creating strategies to aid the memorization of preparedness behaviors.

When asked to indicate how residents could better plan to evacuate, participants indicated that people need to be made more aware that they live in an area at high risk of wildfires (27%), that planning their evacuation can help protect them (21%), that the reason that their evacuation needs to be planned should be better explained (16%), that they are reminded more often to plan their evacuation (11%), that they are provided with online support for planning their evacuation (8%), that they are made more aware that fire officials want people to plan their evacuation (7%), that they do nothing further (5%), that they be made more aware that many people already plan their evacuation (3%), and that people require some other intervention not on the list that they were given (2%).

## Discussion

In the pilot studies, participants paid to have preparatory actions performed in the online game. However, in the field study the aim was to determine the extent to which residents actually performed the preparatory actions. Thus, although the online game was specifically designed to be similar to the field study, asking about the same preparatory actions, expressed in the same terms, it was not expected that the completion rate of the actions would be the same given this fundamental difference between the pilot studies and the field study. Consistent with this expectation, in the pilot studies the intervention containing the combined norm and firefighter photograph resulted in a 52% increase in the number of preparatory actions participants paid to have performed when compared to the baseline (i.e., the no-intervention condition). The equivalent intervention applied in the field study resulted in a statistically significant but smaller increase of 11% in the number of preparatory actions performed compared with the baseline condition. This finding cannot be attributed to the Hawthorne effect (Adair 1984) because participants were equally aware that they were under observation in the two conditions.

Both the theory of planned behavior (Ajzen 1985) and the theory of reasoned action (Fishbein and Ajzen 1975), from which the social norm intervention was derived, state that the necessary precursor to voluntary action is the intention to prepare. In keeping with these theories, a participant's intention to perform the preparatory actions was correlated with his or her preparedness at both Time 1 and Time 2. However, there was no evidence that intention to act actually increased the number of actions performed in the field study. Specifically, when the effect of preparedness at Time 1 was controlled for, no correlation between the intention to perform the preparatory actions and the increase in the number of preparatory actions performed from Time 1 to Time 2 was found. It is probable that the reason for this is that a person's intention to prepare was mostly unaffected by participating in the current study. In particular, it could be that a person's intent to prepare remained essentially constant over time and so had already increased preparedness to the maximum extent it was going to by Time 1. Thus, there was no scope for it to increase preparedness further by Time 2. Consistent with this hypothesis, it was found that even the social norm intervention had relative little effect on the intent to prepare, increasing it relative to the baseline condition by only 14%.

Trying to increase preparedness for four actions simultaneously is difficult. Previous studies have typically focused on changing a single behavior, such as reusing towels (Schultz et al. 2008), decreasing electricity consumption (Nolan et al. 2008), or paying taxes promptly (Bell 2013). In comparison, the intervention in the current study was designed to simultaneously improve compliance in four related but distinct behaviors. This was done because the Country Fire Authority (Victoria) had advised that it was necessary for residents to complete all four actions to be adequately prepared to evacuate in the event of a bushfire. A consequence of trying to simultaneously improve compliance in four areas meant that the message was less targeted on each individual behavior than it otherwise could have been, and this might in part explain why the intervention was not more effective in the field study. Weighing against this argument is the fact that a very similar intervention in the pilot study showed a much larger effect, despite also targeting four actions. Simultaneously targeting multiple preparatory actions may well have decreased the effectiveness of the intervention but, in light of the results of the pilot study, it is unlikely that this was the sole reason that the intervention was not more effective in the field study.

The intervention used in the field study was phrased slightly differently from the equivalent intervention used in the second pilot study. Could the difference in the phrasing have contributed to the reduction in the effect observed in the field study? This is unlikely for at least two reasons. First, the first pilot study showed that even major differences in the type of message—for example, using a descriptive versus an injunctive norm—had little effect on the number of preparatory actions that participants paid to have performed. Second, the phrasing of the message was specifically altered to increase the completion rate based on the insights of end users, and there was nothing in the new phrasing that could account for a decrease in the completion rate. Therefore, there seems to be no reason why the phrasing of the message in the field study would decrease the completion rate relative to the pilot study.

There are other potential reasons that the intervention was more effective in the pilot study than in the field study. For example, social norm interventions are typically at their most effective when they correct a misperception (Borsari and Carey 2003). As the survey results of Group 1 revealed, most residents in bushfire-prone areas believed that people in a situation similar to theirs would have performed these preparatory actions and most also believed that people who were personally significant to them would want them to complete these preparatory actions. Thus, both the descriptive element and the injunctive element of the norm intervention essentially told residents something that most of them already believed to be true, so it is unlikely to have changed their viewpoint. Conversely, the participants in the online pilot study were selected at random and so were unlikely to live in areas prone to wildfires. As such, the norm intervention would have given most of them information that they did not already have, which could explain why the intervention was more effective for these participants (Borsari and Carey 2003).

It is also possible that practical difficulties may have hindered the participants in the field study from performing the actions. For the field study, the participants needed to actually perform the preparatory actions themselves, which introduced difficulties not present in the pilot study. For example, when the field study participants were asked why they had not performed an action, a little over half of them reported that they had not gotten around to it, had forgotten to do it, or had found it too difficult to do. This implies that they would have performed the action but for practical reasons had not done so. Another potential reason is that it seems that the intervention failed to convince approximately 40% of participants

that the preparatory actions were important enough to perform. Whereas the hypothetical pilot studies were designed to make it clear that the actions were important, in the real world participants had to make this decision themselves. A final reason is that in the second survey only 15% of respondents could remember all four of the preparatory actions that they were meant to perform. This would have reduced the effectiveness of the intervention.

## Practical Implications

The norm intervention successfully increased the degree to which residents were prepared to evacuate safely from wildfires. Compared with the baseline (i.e., no-intervention condition) the norm intervention led to residents in bushfire-prone areas performing 11% more preparatory actions. The size of this effect was similar to the effect sizes reported in other studies (Nolan et al. 2008). Although an 11% increase in the number of preparatory actions performed is useful, on its own it does not ensure that all residents are adequately prepared for wildfires. From a practical point of view, a major issue seems to be that relatively few study participants could recall what the LIVE acronym stood for. Whereas 62% could recall the acronym itself, only 15% could identify the preparatory action each letter stood for. It is therefore unsurprising that this acronym had relatively little impact in increasing residents' preparedness. Future work will need to develop better methods of promoting message retention. Unless people can remember what the acronym stands for, they will have problems remembering what preparatory actions they should perform. A more effective way to promote message retention would be to repeatedly show the acronym to individuals. In the current study, this could not be done because of financial limitations. However, if this acronym were to be used as part of a wider norm-based information campaign, residents would be repeatedly exposed to it, presumably increasing compliance rates. As such, these results are very promising given that they were achieved with only one exposure of the acronym to residents.

## Limitations and Future Work

There are at least four avenues of interest for future work. First, the intervention in the current study combined three factors: a descriptive norm, an injunctive norm, and a description of the personal benefits that could result from being better prepared. Future work should aim to unpack the individual contributions of these factors. Although there is evidence that perceptions of likely personal impact are a key factor in whether or not individuals perform preparatory or protective actions (Huang et al. 2016), it has also been reported that the degree to which this holds true depends on whether the appeal is made at the collective level or at the individual level (White and Simpson 2013). Unpacking this interaction in the context of wildfires would be theoretically interesting and would have practical relevance.

Second, it would be interesting to investigate whether the order in which information is presented affects compliance. In the current study, the photograph and norm intervention combination was presented only after participants had learned the acronym. Perhaps, if the order had been reversed, participants would have learned the acronym more thoroughly, which may have resulted in them performing more preparatory actions.

Third, it would be helpful to track compliance at a range of durations. The current study employed only two waves, and the average time between the first and second surveys was 19.4 days. It would be interesting to see if the effect size increased or decreased

at longer intervals. As the interval increased, residents would have more time to perform the preparatory actions but also more time to forget what those actions were.

Finally, future work should determine which characteristics predict preparedness levels. The data analyzed in the current study were taken from a larger study. One of the aims of the larger study was to address this question.

## Conclusion

In this study, it has been shown that a message based on the communication of social norms can increase the number of preparedness actions performed by residents in areas at risk of wildfires by 11%. Although this increase is useful and in keeping with effect sizes found in similar studies, a bigger effect is needed if residents are to be adequately prepared. A major issue seems to have been that residents forgot what preparatory actions they needed to perform. This difficulty was more acute in the current study than in most previous studies that also attempted to engender behavior change by communicating social norms. The reason is that the aim of the current study was to simultaneously encourage people to perform four actions whereas previous studies typically focused on encouraging only one. In the current study, the social norm message was presented only once, but in a real-world information campaign it would be presented multiple times, presumably resulting in a larger effect size. In this way, the findings of the current study are promising and encouraging. They indicate that messages designed to communicate social norms are likely to be effective as part of a wider information campaign.

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## Supplemental Data

Additional demographics information and the intent-to-prepare items are available online in the ASCE Library ([www.ascelibrary.org](http://www.ascelibrary.org)).

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