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Disaster preparedness and community helping behaviour in the wake of the 2020 Oregon wildfires

Muhammad Usman Amin Siddiqi, Leanne Giordono, Chad Zanocco, Greg Stelmach, June Flora, and Hilary Boudet[1]

Extreme weather events are increasing in frequency and severity owing to climate change. Individual-level behavioural responses—notably, disaster preparedness and community helping actions (such as donating and volunteering)—supplement government efforts to respond to such phenomena, but rarely have they been explored together. Using data from a survey administered soon after the 2020 Oregon wildfires, this paper compares a range of socio-demographic, experiential, attitudinal, and communication-related factors associated with these two individual-level behavioural responses. Findings indicate that respondents who reported experiencing a higher degree of harm and heightened concern about climate change after the wildfires were more likely to report disaster preparedness and community helping actions. Those who reported more frequent informal discussions about the wildfires, consulting more sources to seek information on them, and higher percentages of friends, neighbours, and community members taking actions to prepare for future wildfires also reported more disaster preparedness and community helping actions. Disaster preparedness actions were also positively associated with seeking information from formal/official sources.

Keywords: climate change, communication, community helping behaviour, descriptive norms, disaster preparedness, natural hazards, personal experience, risk mitigation, wildfires

Introduction

Given projected patterns of climate change, wildfires and other extreme events are likely to become more frequent and severe even in areas that were previously considered low risk (UNEP, 2022). Akin to global trends, the United States, especially the western region of the country, has witnessed a recent surge in wildfire activity (USGCRP, 2018; Burke et al., 2021; First Street Foundation, 2022). Between 1984 and 2020, the Pacific northwestern state of Oregon experienced 892 incidents of wildfire larger than 1,000 acres, resulting in more than 12 million cumulative acres burned. Approximately one million properties have been identified as being within 20 miles of these historic wildfire boundaries in Oregon (First Street Foundation, 2022). However, Oregon's wildfires in September 2020 were unprecedented in geographic scope and number of communities affected (Schmidt, Knowles, and Berman, 2020): nine deaths, in excess of 1.2 million acres of land burned, substantial property damage (including the destruction of more than 4,000

houses), widespread evacuation orders, and prolonged poor air quality in the most populous areas of the state. Oregon estimated a total cost of USD 1.15 billion for wildfire/wind damage, the response, and debris removal (Garrett and Le Chevallier, 2021).

A comprehensive multi-level approach, involving governments, communities, and individuals, is required to build resilience to extreme weather-related disasters (UNISDR, 2005; Council of Australian Governments, 2011; FEMA, 2011). However, 'individual-level behavioural responses to wildfire risk are central to adaptation outcomes' (Hamilton et al., 2018, p. 2), as individuals not only directly experience harm to daily activities, property, finances, and physical and mental health because of wildfire and smoke, but also their exposure to wildfire is shaped by disaster preparedness actions. Moreover, local populations are usually the first on the scene in the wake of a disaster and remain there long after more regional services have ceased.

Citizen participation is considered to be a key principle of resilience building and disaster risk reduction (FEMA, 2011). Citizens are not only instrumental in reducing risks through disaster preparedness, but they can also volunteer invaluable assistance to trained emergency personnel in order to help those affected to recover post disaster. Thus, both disaster preparedness and community helping actions like donations and volunteering are critical in enhancing local capacities to cope with future disasters (UNISDR, 2005).

We focus on individual-level behavioural responses, in terms of disaster preparedness and community helping actions, to the 2020 Oregon wildfires. While both types have been studied before (McCaffrey et al., 2020; Sparrow et al., 2021; Gordon, 2022; Wallis, Fischer, and Abrahamse, 2022), they have not been combined and compared in the same study. Using data obtained from our survey of 1,308 Oregonians administered within six months of the 2020 Oregon wildfires, we aim to understand factors associated with the adoption of disaster preparedness and community helping behaviour after this disaster, with special emphasis on wildfire-related harm, information-seeking, and social norms.

To provide a comprehensive approach, our study includes both research questions and hypotheses (see Table 1). Research questions were formulated in areas with conflicting empirical evidence or limited theoretical expectations, whereas hypotheses were developed based on evidence of the expected relationship between variables in existing research. Our research questions aim to explore similarities and differences among the factors that influence disaster preparedness and community helping behaviour following wildfire-related disasters, as well as to investigate the associations between demographic characteristics and these actions. In addition, we propose that harm experienced during wildfires, heightened climate change concern after experiencing wildfires, seeking wildfire-related information from official sources, consulting multiple sources, engaging in informal discussions about wildfires, and descriptive norms about disaster preparedness are positively associated with disaster preparedness and community helping behaviour. By including both types of inquiries, we aim to ensure thorough analysis of the research topic. Based on our findings, we also discuss policy implications.

Literature review

The existing literatures on disaster preparedness and community helping behaviour come from two different yet related scholarly traditions. Work on individual disaster preparedness tends to be concentrated in disaster- and health-related publications and can be specific to disaster type (Lindell, 1997; Reser and Swim, 2011; Kohn et al., 2012; Hamilton et al., 2018; Ryan et al., 2020), whereas the literature on community helping behaviour like donations and volunteering has its own set of theories largely based in studies of altruistic behaviours outside of disaster situations (Piliavin and Charng, 1990; Wilson and Musick, 1997; Jones, 2006; Haski-Leventhal, 2009; Bekkers and Wiepking, 2011; Wiepking and Bekkers, 2012). A subset of literature on altruistic behaviours, though, focuses on donations to (Kaniasty and Norris, 1995a; Simon, 1997; Bennett and Kottasz, 2000; Cheung and Chan, 2000; Perrine and Heather, 2000; Oosterhof, Heuvelman, and Peters, 2009; Zagefka et al., 2011, 2012; Zagefka, Noor, and Brown, 2013; Zagefka and James, 2015) and volunteering for (Barton, 1969; Schuster et al., 2001; Wayment, 2004; Michel, 2007; Whittaker, McLennan, and Handmer, 2015) disaster relief activities. However, we are unaware of any study that combines an examination of disaster preparedness and community helping behaviour in a disaster-related context, which is the impetus behind our first research question:

> ***RQ1:*** *What are the similarities and differences among factors associated with disaster preparedness and community helping behaviour in the wake of wildfire-related disasters?*

Although disaster preparedness and community helping behaviour have been studied separately in different research traditions, both literatures are based strongly in social psychology and share a common set of predictors. For instance, demographic characteristics, social norms, harm or negative experiences, personal efficacy and responsibility, and event-related information seeking or communications have been found to predict both disaster preparedness and community helping behaviour. In addition to these common predictors, earlier studies have also explored factors that are specifically associated with disaster preparedness or community helping behaviour. For example, risk perceptions have been found to be particularly associated with disaster preparedness (Fischer and Charnley, 2012; Brenkert-Smith et al., 2013; Champ and Brenkert-Smith, 2016), whereas religion (Bekkers and Wiepking, 2011) and history of donations to charities in general (Bennett and Kottasz, 2000) have been found to be associated with community helping behaviour.

Demographic characteristics

Earlier research has found some evidence of an association between the adoption of disaster preparedness and demographic characteristics (Turner, Nigg, and Paz, 1986; Russell, Goltz, and Bourque, 1995; Mileti and Darlington, 1995, 1997; Bronfman et al., 2019; Lindell and Perry, 2000; Lindell and Whitney, 2000), although the effect size has traditionally been very small (Lindell and Perry, 2000). However, research on wildfire-related disaster

preparedness behaviour has produced mixed findings concerning the impact of demographic characteristics. Age, for instance, has been found to have a positive (Brenkert-Smith, Champ, and Flores, 2012; McNeill et al., 2013; Dickinson et al., 2015), a negative (Fischer, 2011; Champ, Donovan, and Barth, 2013; Fischer et al., 2014; Olsen et al., 2017; Wolters et al., 2017), and no effect at all (Martin, Martin, and Kent, 2009) on the adoption of disaster preparedness behaviours. Community helping behaviour, by contrast, has generally been found to be positively associated with age (Auten and Rudney, 1990; Farmer and Fedor, 2001; Frey and Meier, 2004; List, 2004; Eckel, Grossman, and Johnston, 2005; Rooney et al., 2005; Mesch et al., 2006). However, Rooney, Steinberg, and Schervish (2001) found that age becomes insignificant when other factors correlated with age (such as income, marital status, and religion) are included in the model (see also Bekkers and Wiepking, 2011). Michel (2007) found that age was negatively associated with total hours spent volunteering after Hurricane Katrina (2005).

While most of the studies have not found wildfire-related disaster preparedness behaviours to be associated with gender (Martin, Martin, and Kent, 2009; Fischer, 2011; Champ, Donovan, and Barth, 2013), some have found female respondents to be more likely than men to take disaster preparedness actions (Brenkert-Smith, Champ, and Flores, 2012; Dickinson et al., 2015), and others have found otherwise (McNeill et al., 2013). Studies on charitable giving suggest that female respondents are more likely to donate than male respondents, although males are more likely than females to donate higher amounts (Bekkers, 2006; Lyons and Nivison-Smith, 2006; Wiepking and Bekkers, 2012). Moreover, males are more likely to donate to religious causes, while females are more likely to donate to secular organisations (Brown and Ferris, 2007). However, males are more likely than females to volunteer during an emergency period (Quarantelli, 1996).

Wildfire-related disaster preparedness behaviour has also been found to be positively associated with education (Wolters et al., 2017) and income (Collins, 2008a; Champ, Donovan, and Barth 2013) in some studies, whereas others have not found any such relationship (Martin, Martin, and Kent, 2009; Fischer, 2011). Donations and volunteering are also generally positively associated with education (Penner, 2002; Lyons and Nivison-Smith, 2006; Mesch et al., 2006; Okun and Michel, 2006; Brown and Ferris, 2007; Michel, 2007; Wiepking and Maas, 2009).

There is also overwhelming support for a positive relationship between income and altruistic donations (Wiepking and Bekkers, 2012) and volunteering (Quarantelli, 1996; Penner, 2002). Wiepking and Bekkers (2012) cite more than 70 studies that have found both the likelihood and amount of donations to be positively associated with income, wealth, and perception of wealth. Bennett and Kottasz (2000) found that the perception of being financially better off is positively related to donations for disasters triggered by natural hazards.

Natural hazard research has also looked at household vulnerabilities (presence of individuals belonging to vulnerable groups, such as pregnant women and individuals with chronic conditions) as a correlate of risk mitigation or disaster preparedness behaviour, generating mixed findings (Turner, Nigg, and Paz, 1986; Dooley et al., 1992; Collins, 2008b). While having children is generally negatively associated with donations, Bennett

and Kottasz (2000) found a positive association between having children and donations for disasters triggered by natural hazards. Efforts to examine the association between ideology and disaster preparedness also present mixed findings (Bronfman et al., 2019; Javeline, Kijewski-Correa, and Chesler, 2019).

Overall, findings of existing research on the relationship between demographic characteristics and disaster preparedness behaviour are mixed, with age having positive, negative, or no effect, and gender having varying associations with disaster preparedness actions, donations, and volunteering. Education and income are generally positively associated with disaster preparedness behaviour, donations, and volunteering, with income showing overwhelming support for a positive relationship. The relationship between household vulnerabilities and disaster preparedness is also mixed, and having children has been found to have both positive and negative associations with donations. The association between ideology and disaster preparedness is unclear. Given these mixed findings related to demographic characteristics, we offer the following research question:

RQ2: *How are demographic characteristics associated with disaster preparedness and community helping behaviour?*

Event experience/harm

Past experiences tend to shape individuals' beliefs (Lindell and Perry, 2000), risk perceptions, and behaviours (Bickerstaff, 2004). Studies based on the Theory of Planned Behavior (Ajzen, 1991) and Protection Motivation Theory (Rogers and Prentice-Dunn, 1997) have incorporated past experiences as an independent variable to improve the ability to predict behavioural intent (Hale, Householder, and Greene, 2003) as a precursor to actual behaviour. However, wildfire research, and hazard research in general, presents mixed findings on the relationship between hazard experience and disaster preparedness behaviour (Tierney, Lindell, and Perry, 2001; Hall and Slothower, 2009; Brenkert-Smith, Champ, and Flores, 2012; Hamilton et al., 2018).

Several studies contain evidence of a relationship between personal experience of wildfires and both disaster preparedness behaviour and behavioural intentions (Beebe and Omi, 1993; Jacobson, Monroe, and Marynowski, 2001; McCaffrey et al., 2011). Individuals who have personal experience of/exposure to wildfires have been found to be more likely to perceive a greater probability and negative consequences of future wildfires (Champ and Brenkert-Smith, 2016), more likely to rate fire as an extreme threat (Abt, Kuypers, and Whitson, 1990), and have greater concern about future wildfires (Fischer, 2011). However, several other studies have failed to find a statistically significant relationship between wildfire experience and disaster preparedness behaviour (Martin, Martin, and Kent, 2009; Schulte and Miller, 2010). Still other studies have reported a negative relationship between wildfire experience and disaster preparedness actions and intentions (Jacobson, Monroe, and Marynowski, 2001; Hall and Slothower, 2009) as negative wildfire experiences can also lead to lower risk perceptions (Hall and Slothower, 2009) or to feelings of let-down or resignation (Winter and Fried, 2000; Arvai et al., 2006).

Harm experience may also enhance the motivation to help others. Psychologists working with victims of violence have observed cases of negative experiences giving rise to prosocial behaviour (Staub and Vollhardt, 2008; Vollhardt, 2009). 'Altruism born of suffering', the term coined by Staub (2003, 2005), denotes that individuals who have experienced suffering or harm may become particularly motivated to help others. Earlier studies have used several concepts from social psychology, such as required helpfulness, empathy, negative state relief, and common fate, as well as from clinical psychology, such as rebuilding meanings for post-traumatic growth and coping mechanisms like a distraction from own trouble, perceptions of self-efficacy and competence, and social integration, to explain community helping behaviour in the wake of adverse life events (Staub and Vollhardt, 2008; Vollhardt, 2009). Numerous studies provide empirical evidence of increased community helping behaviour during or after terrorist attacks (Schuster et al., 2001; Thomas, 2003; Yum and Schenck-Hamlin, 2005; Penner et al., 2005; Piferi, Jobe, and Jones, 2006), wars (Raboteg-šaric, Žužul, and Keresteš, 1994; Macksoud and Aber, 1996; Kishon-Barash, Midlarsky, and Johnson, 1999), the Holocaust (Kahana, Harel, and Kahana, 1988; Kay, 1998; Suedfeld et al., 2005), political violence (Hernández, 2002), and social marginality (Unger, 2000). Individuals who report experiencing physical or mental harm during disasters are more likely to donate (Kaniasty and Norris, 1995b) as well as volunteer (Schuster et al., 2001; Wayment, 2004) during or after such events. Concerning disasters triggered by natural hazards, Kaniasty and Norris (1995a) found that victims of Hurricane Hugo (1989) reported more community helping behaviour than non-victims. Vollhardt and Staub (2011) found that respondents with past traumatic experiences were more likely to volunteer and report more feelings of empathy and personal responsibility to help victims of the 2004 tsunami in Southeast Asia.

Overall, there is substantial evidence to hypothesise a positive association between harm experience and community helping behaviour. However, the relationship between harm experience and disaster preparedness behaviour is less clear. We suggest that these inconsistencies may be due to differences in how experience has been measured in previous studies. Most have focused on event experience rather than harm incurred, and some have only considered harm to property, without accounting for harm to daily activities, finances, and physical and mental health. We hypothesise a positive association between harm experience and disaster preparedness behaviour using a more comprehensive measure of harm experience that takes into account various types of harm:

H1$_A$: *Wildfire-related harm will be positively associated with disaster preparedness behaviour.*

H1$_B$: *Wildfire-related harm will be positively associated with community helping behaviour.*

The relationship between behavioural intentions or actions and past experiences can be moderated by attitudes (Vogt, Winter, and Fried, 2005) or concern about future events (Fischer, 2011), which provides support for our next hypothesis. We propose that

respondents who experienced the 2020 Oregon wildfires and subsequently became more concerned about climate change will be more likely to engage in disaster preparedness and community helping behaviour. This is based on the assumption that heightened concern will motivate individuals to take proactive steps to protect themselves and their communities against future wildfire-related harm. The hypotheses are as follows:

$H2_A$: *Respondents who were more concerned about climate change after experiencing the 2020 Oregon wildfires will be more likely to take a higher number of disaster preparedness actions.*

$H2_B$: *Respondents who were more concerned about climate change after experiencing the 2020 Oregon wildfires will be more likely to take community helping actions.*

Information sources

A considerable amount of research on natural hazards focuses on the role of information sources in shaping risk mitigation behaviour (Lindell, 1997; Lion, Meertens, and Bot, 2002; Brenkert-Smith, Champ, and Flores, 2012). However, earlier work on the role of information sources in the adoption of wildfire-related risk mitigation behaviour has mostly centred on trust in information from forest management and other natural resource agencies (Shindler, Brunson, and Stankey, 2002; Winter, Vogt, and McCaffrey, 2004; Vogt, Winter, and Fried, 2005).

More recent studies have compared the role of formal and informal sources of information. Brenkert-Smith, Champ, and Flores (2012) found that using formal sources of wildfire information like the local fire department or county specialist has a positive effect, whereas using informal sources like neighbours and friends has a negative effect on disaster preparedness behaviour. However, Brenkert–Smith, Champ, and Flores (2006) observed that informal social interactions, even simple neighbour-to-neighbour discussions, were important in helping individual homeowners explore the types of mitigation options available to implement. Dickinson et al. (2015) found that fire-specific interactions with friends and neighbours and with experts resulted in a higher probability of risk mitigation actions, although more generic social interactions did not have a significant effect on risk mitigation actions.

Moreover, altruism literature in the field of economics, mostly rooted in theories about public goods, suggests that frequent communication can enhance the likelihood of community helping behaviour, as it helps to solve social dilemmas (Piliavin and Charng, 1990). More information about a disaster increases the likelihood of donating or volunteering for disaster relief activities. Oliner and Oliner (1988) found that Christians who rescued Jews in Nazi Europe in the 1930s and 1940s had more information about them.

Extensive media coverage of a disaster is likely to boost the response to emergency relief donation appeals (Chapman et al., 2023). Bennett and Kottasz (2000) found that respondents who spent more time watching television were more likely to donate to disaster relief fundraising appeals.

Building on previous studies, we have developed two hypotheses in this regard. H3 proposes that seeking information from formal sources, such as city, county, or state websites, is positively associated with disaster preparedness and community helping behaviour, whereas H4 suggests that wildfire-related discussions with friends, family, and neighbours are also positively associated with these two actions:

$H3_A$: *Respondents who sought wildfire-related information from formal sources (city, county, or state websites) will be more likely to take a higher number of disaster preparedness actions.*

$H3_B$: *Respondents who sought wildfire-related information from formal sources (city, county, or state websites) will be more likely to take community helping actions.*

$H4_A$: *Informal discussions with friends, family, and neighbours about wildfires will be positively associated with disaster preparedness actions.*

$H4_B$: *Informal discussions with friends, family, and neighbours about wildfires will be positively associated with community helping actions.*

Risk communication research has improved our understanding of risk information seeking and processing and the development of preventive behaviours (Griffin, Dunwoody, and Neuwirth, 1999), especially the risks related to the environment and climate change (Kahlor, 2007; Yang and Kahlor, 2013). Kahlor and Rosenthal (2009) found that the number of sources one relies on for information about climate change is positively correlated with one's climate change knowledge. Better climate change knowledge is likely to heighten risk perceptions, hence improving the likelihood of disaster preparedness behaviour, which motivates our fifth hypothesis:

$H5_A$: *The number of information sources consulted to seek out information about wildfires will be positively associated with disaster preparedness behaviour.*

$H5_B$: *The number of information sources consulted to seek out information about wildfires will be positively associated with community helping behaviour.*

Descriptive norms

Individuals tend to adopt behaviour exhibited by the people with whom they often interact (Fowler and Christakis, 2010). The effect of this peer influence is likely to be amplified by the similarity that breeds social connections (Hamilton et al., 2018)—individuals tend to interact with individuals with similar values, beliefs, and experiences (McPherson, Smith-Lovin, and Cook, 2001). The idea that norms influence behaviour has been studied by researchers using several terms such as subjective norms (Ajzen and Fishbein, 1980; Griffin et al., 2008), normative influences (Deutsch and Gerard, 1957; Cialdini, Reno, and Kallgren, 1990), and social norms (Perkins et al., 1999). These terms, when used, usually refer to one of two distinct, but often mutually confused, ideas articulated by

Cialdini, Reno, and Kallgren (1990): descriptive and injunctive norms. Descriptive norms refer to 'individuals' beliefs about the prevalence of a behavior', whereas injunctive norms refer to 'the extent to which individuals perceive that influential others expect them to behave in a certain way, and by implication, social sanctions will be incurred if they do not' (Rimal and Real, 2005, p. 390).

Communication researchers have found these 'felt pressures from the relevant others to keep on top of risk information' to be positively related to more active risk information seeking (Griffin et al., 2008, p. 290; see also Kahlor et al., 2006). Earlier research on wildfire risk mitigation identifies actions by community groups and neighbours as a source of motivation for homeowners to engage in disaster preparedness activities (Berrens et al., 2007). Monroe and Nelson (2004) observed in their qualitative study of forested areas of Florida and Minnesota a strong sense of 'appropriate' behaviour among their respondents maintained by the social norms of the community. McCaffrey et al. (2011) reported that at least one-third of their respondents mentioned peer influence as a reason for their disaster preparedness actions. Bright and Burtz (2006) found a strong influence of subjective norms on the intentions of full-time residents of north-central Minnesota to conduct Firewise landscaping activities. Schulte and Miller (2010) also discovered that the risk mitigation efforts of Colorado residents were primarily associated with their perception of the mitigation of neighbouring lands. Concerning community helping behaviour, studies show that descriptive norms are effective in promoting prosocial behaviours—as compared to standard altruistic appeals, descriptive norms are more likely to increase charitable giving and other pro-social behaviours (Goldstein, Cialdini, and Griskevicius, 2008; Agerström et al., 2016).

Consulting different sources of information and talking to friends and family members about disasters can influence one's perception of how many of their community members are taking actions to prepare for such events or what actions they are taking. However, it is important to recognise that these two factors are separate and can have different effects. Depending on the information and discussions, people may believe that others are taking more or fewer actions. Furthermore, exposure to information can either reinforce or challenge existing norms. Consequently, we have included descriptive norms as an independent variable in our analyses in addition to information seeking measures. Based on earlier research, we propose that those who believe that others in their community engage in wildfire-related disaster preparedness will be more likely to engage in such behaviour themselves and extend help to their fellow community members:

H6$_A$: *Descriptive norms about wildfire-related disaster preparedness will be positively associated with disaster preparedness behaviour.*

H6$_B$: *Descriptive norms about wildfire-related disaster preparedness will be positively associated with community helping behaviour.*

Table 1 presents in full the study's research questions and hypotheses.

Table 1. Research questions and hypotheses

Research questions	
RQ1	What are the similarities and differences among factors associated with disaster preparedness and community helping behaviour in the wake of wildfire-related disasters?
RQ2	How are demographic characteristics associated with disaster preparedness and community helping behaviour?
Hypotheses	
Disaster preparedness behaviour	
$\mathbf{H1_A}$	Wildfire-related harm will be positively associated with disaster preparedness behaviour.
$\mathbf{H2_A}$	Respondents who were more concerned about climate change after experiencing the 2020 Oregon wildfires will be more likely to take a higher number of disaster preparedness actions.
$\mathbf{H3_A}$	Respondents who sought wildfire-related information from formal sources (city, county, or state websites) will be more likely to take a higher number of disaster preparedness actions.
$\mathbf{H4_A}$	Informal discussions with friends, family, and neighbours about wildfires will be positively associated with disaster preparedness actions.
$\mathbf{H5_A}$	The number of information sources consulted to seek out information about wildfires will be positively associated with disaster preparedness behaviour.
$\mathbf{H6_A}$	Descriptive norms about wildfire-related disaster preparedness will be positively associated with disaster preparedness behaviour.
Community helping behaviour	
$\mathbf{H1_B}$	Wildfire-related harm will be positively associated with community helping behaviour.
$\mathbf{H2_B}$	Respondents who were more concerned about climate change after experiencing the 2020 Oregon wildfires will be more likely to take community helping actions.
$\mathbf{H3_B}$	Respondents who sought wildfire-related information from formal sources (city, county, or state websites) will be more likely to take community helping actions.
$\mathbf{H4_B}$	Informal discussions with friends, family, and neighbours about wildfires will be positively associated with community helping actions.
$\mathbf{H5_B}$	The number of information sources consulted to seek out information about wildfires will be positively associated with community helping behaviour.
$\mathbf{H6_B}$	Descriptive norms about wildfire-related disaster preparedness will be positively associated with community helping behaviour.

Source: authors.

Methods

Data

Data for this study were obtained from a survey of 1,308 Oregonians administered between 28 December 2020 and 23 February 2021 by Qualtrics XM. The sampling company recruited respondents from various sources and validated their details via third-party verification measures prior to their joining the sample. Respondents included only those individuals who reported living in a valid Oregon zip code at the time of the September 2020 Oregon wildfires. We used quota sampling to yield a final analytic sample

of 1,308 adult Oregonians (age: 18+) with shares of the sample similar to the Oregon adult population with respect to sex, age, highest educational attainment, and rural/urban residence. To ensure a sufficient number of respondents from rural areas, we oversampled the rural population using geographic designations developed by the Oregon Office of Rural Health (n.d.). Our sample is representative of the Oregon population (+/- two percentage points) but contains a slightly higher proportion of individuals with higher education degrees than the state as a whole (see Appendix A).[2] For the survey questionnaire, we conducted a thorough review of existing literature and used previously validated survey questions whenever possible. The final survey consisted of questions related to the respondents' experience of the 2020 Oregon wildfires, as well as their information seeking, policy support, and disaster preparedness and community helping behaviour during the disaster (for additional information, see Zanocco et al., 2022; Boudet et al., 2023; Giordono et al., 2023). We also conducted pilot testing with a small group of individuals to ensure the clarity and comprehensibility of the survey questions.

Operationalisation and descriptive statistics of variables

Outcome variables

We operationalised two outcome variables of interest: the number of actions respondents took to prepare for future wildfires (disaster preparedness); and whether they donated to or volunteered with groups responding to the 2020 Oregon wildfires (community helping behaviour). Respondents were asked: 'Have you taken any of the following actions to prepare for future wildfires'. They were provided with a list of eight actions derived from similar studies and were asked to check all that apply (Champ, Donovan, and Barth, 2013; McNeill et al., 2013; Wolters et al., 2017).

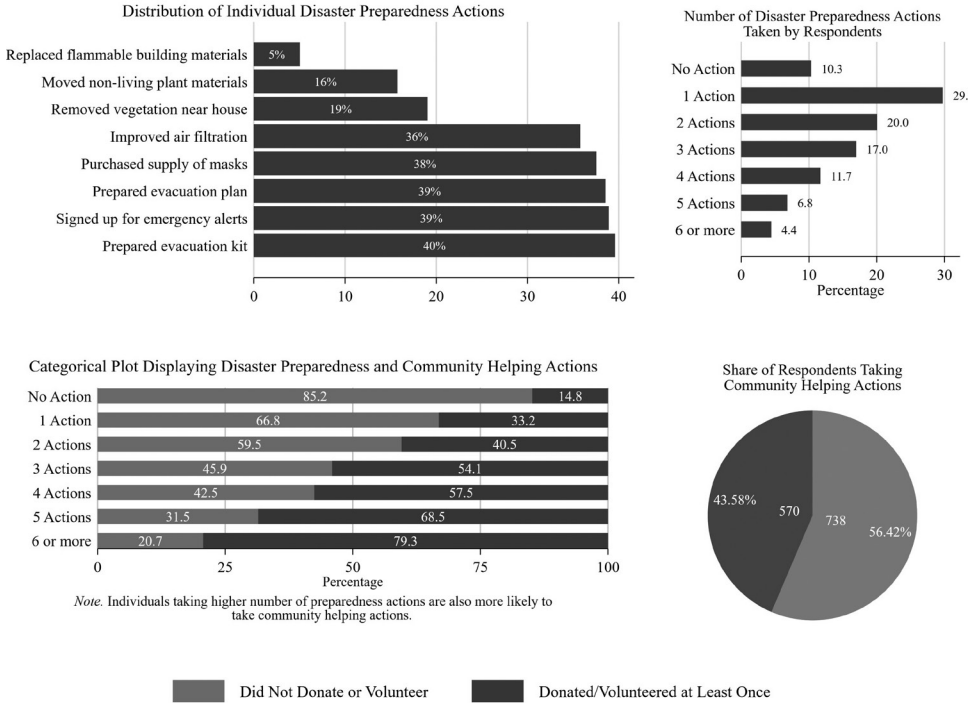
The outcome variable measuring disaster preparedness was developed as the sum of actions each respondent reported having taken, which is in line with prior research on wildfire preparedness. While a few studies have treated the sum of actions as a continuous variable (Collins, 2008b; Martin, Martin, and Kent, 2009; McNeill et al., 2013; Wolters et al., 2017), we treated it as an ordinal variable to avoid making the assumption that all actions have equal importance or weightage (Brenkert-Smith, Champ, and Flores, 2012; Champ, Donovan, and Barth, 2013; Dickinson et al., 2015). Figure 1 shows the percentage of people who reported having taken each action and the distribution of the number of actions taken by respondents. We collapsed the last three categories into one as the last two categories incorporated less than one per cent of the respondents. The outcome variable ranges from '1' ('none of the actions taken') to '7' ('six or more actions taken') (mean=3.28; standard deviation (SD)=1.61).

Our second outcome variable is a composite measure of donations and volunteering reported by respondents during the 2020 Oregon wildfires. Respondents were asked: 'Thinking about your experience with the 2020 Oregon wildfires, how often, if ever, did you . . . (i) donate to a group responding to the 2020 Oregon wildfires; (ii) volunteer with a group responding to the 2020 Oregon wildfires'. The responses to both statements were recorded on a four-point scale: '1'='None', '2'='Once', '3'='Several times (two to three

times)', and '4'='Many times (four or more times)'. However, in the wake of local or state-level disasters, most of the voluntary efforts to help communities are carried out through citizen-led initiatives, which involve donating both time and money, blurring the distinction between donating and volunteering (Whittaker, McLennan, and Handmer, 2015; Boulianne, Minaker, and Haney, 2018). We combined the responses to the questions about donations and volunteering to develop a binary variable of engagement in any efforts to help (that is, community helping behaviour), where '1'='Donated or volunteered at least once during the 2020 wildfires' (43.6 per cent) and '0'='Did not donate or volunteer' (56.4 per cent). Figure 1 shows that those who took a higher number of disaster preparedness actions were also more likely to exhibit community helping behaviour.

Table 2 presents the operationalisation and descriptive statistics of the independent variables of interest used in our models predicting disaster preparedness and community helping behaviour. The demographic variables for which we controlled were as follows: age, measured in years (range=19–90; mean=46; SD=17.4); sex ('1'='Female' (50.2 per cent), '0'='Not female' (49.8 per cent)); race ('1'=White (79.9 per cent), '0'=Not White (20.1 per cent)); community type ('1'='Rural' (34.7 per cent), '0'='Urban' (65.3 per cent)); educational attainment ('1'='Bachelor's degree or higher' (64.0 per cent), '0'='Less than Bachelor's degree' (36.0 per cent)); household income (10 categories ranging from '1'='Less than USD 10,000' to '10'='USD 170,000 or more'); presence of minors in the household

Figure 1. Disaster preparedness and community helping behaviour during the 2020 Oregon wildfires



Source: authors.

('1'='One or more minors in the household' (31.2 per cent), '0'='No minors in the household' (68.8 per cent)); and household vulnerabilities (such as presence of pregnant women and individuals with chronic conditions, where '1'='One or more vulnerabilities' (62.2 per cent) and '0'='No vulnerabilities' (37.8 per cent)). We included political ideology as a belief-related variable in our model, measured on a five-point scale from very conservative to very liberal (mean=3.1; SD=1.2) (see Appendix B). While all of our variables have been directly developed from the responses to the survey questionnaire, community type was identified using respondents' self-reported zip codes based on urban or rural categories of data from the Oregon Office of Rural Health (n.d.; for more details, see Giordono et al., 2023).

Independent variables

The primary measure of event experience in our model is a composite mean index of perceived harm owing to the wildfires, including harm to daily activities, property, finances, and physical and mental health (range=1–4; mean=2.0; SD=0.6; Cronbach's alpha=0.77). We also asked our respondents: 'As a result of your experiences with the 2020 Oregon wildfires, are you less concerned, more concerned, or did your views remain unchanged about climate change?'. Responses were measured on a five-point scale ranging from '1'='Much less concerned' to '5'='Much more concerned', with '3'='Views unchanged' in between them. We recoded the response categories to develop a dummy variable with '1'='More or much more concerned about climate change after experiencing the 2020 wildfires' (51.4 per cent) and '0'='Else' (views unchanged or less concerned) (48.6 per cent).

We developed four measures related to information sources and social norms: informal discussions about wildfires; formal/official sources of information; number of information sources consulted; and descriptive norms about wildfire preparation. The variables measuring how often respondents talked with family/friends about the 2020 Oregon wildfires within and outside their communities were recorded on a four-point scale ranging from '1' (never) to '4' (many times—four or more times). A vast majority of our respondents reported that they talked about the wildfires within (mean=3.3; SD=0.8) as well as outside of their communities (mean=2.9; SD=0.9). The composite additive scale ranges from '2' (never talked about the 2020 wildfires) to '8' (talked about the 2020 wildfires many times within and outside their communities) (mean=6.2; SD=1.4). Formal/official sources of information was developed as a binary variable, where '0'='Did not consult city, county, or state websites' (41.5 per cent) and '1'='Consulted city, county, or state websites for wildfire information' (58.5 per cent). The next variable is the sum of information sources consulted to seek out information about the 2020 Oregon wildfires, ranging from '1' (used only one source) to '5' (five or six sources consulted) (mean=2.7; SD=1.3). The descriptive norm variable represents the peer effect, developed as a standardised composite mean index of three 11-point scale variables measuring the percentage of friends, neighbours, and community members who the respondent thought were taking actions to prepare for future wildfires. The index ranges from -1.8 to 2.0 with a mean of zero and a standard deviation of 0.9 and has acceptable reliability (Cronbach's alpha=0.89).

Table 2. Operationalisation and descriptive statistics of independent variables of interest

Measures	Survey questions and response categories	Operationalisation and descriptive statistics
Event experience		
Self-reported harm	For each type of harm listed below, how much were you or members of your household harmed by smoke and/or fire from the 2020 Oregon wildfires? Daily activities (due to power outages, impediments to travel) Property (such as damage to your home, yard, or vehicle) Finances (such as lost income or time at work) Physical health (such as breathing issues or injury) Mental health (such as stress, worry, or anxiety) Response scale: '1'='Not at all' '2'='Only a little' '3'='A moderate amount' '4'='A great deal'	 Mean=2.2; SD=0.98 Mean=1.4; SD=0.69 Mean=1.5; SD=0.85 Mean=2.3; SD=0.94 Mean=2.5; SD=0.99 Composite index: Range=1–4 Mean=2.0; SD=0.6 Cronbach's alpha=0.77
More concerned after wildfire experience	As a result of your experiences with the 2020 Oregon wildfires, are you less concerned, more concerned or did your views remain unchanged about climate change? Response scale: '1'='Much less concerned' '2'='Less concerned' '3'='Views unchanged' '4'='More concerned' '5'='Much more concerned'	'0'='Else' (48.6 per cent) '1'='More concerned about climate change after the 2020 Oregon wildfires' (51.4 per cent)
Information sources and descriptive norms		
Informal discussions about wildfires	Thinking about your experience with the 2020 Oregon wildfires, how often, if ever, did you talk with family or friends . . . (i) in your community about the 2020 Oregon wildfires?; (ii) outside your community about the 2020 Oregon wildfires? Response scale: '1'='Never' '2'='Once' '3'='Several times (two to three times)' '4'='Many times (four or more times)'	Additive scale '2'='Never talked about the 2020 wildfires' '8'='Talked about the 2020 wildfire many times within and outside the community' Mean=6.2; SD=1.4
Formal/official sources of information	How did you seek out information about the 2020 Oregon wildfires? (Check all that apply) Watched local TV news and weather broadcasts (74.8 per cent) Listened to local radio news and weather broadcasts (34.3 per cent) Read local newspapers (print or online) (34.9 per cent) Consulted online sources (e.g., Twitter, Facebook, Google) (58.9 per cent) Checked city, county, or state websites (58.5 per cent) Other (6.2 per cent)	Consulted official sources: '0'='No' (41.5 per cent) '1'='Yes' (58.5 per cent)

Measures	Survey questions and response categories	Operationalisation and descriptive statistics
Number of information sources	Same question as above.	Sum of information sources consulted: '1'='One source' (22.2 per cent) '2'='Two sources' (25.4 per cent) '3'='Three sources' (25.5 per cent) '4'='Four sources' (16.8 per cent) '5'='Five or six sources' (10.0 per cent) Mean=2.7; SD=1.3
Descriptive norm about wildfire preparedness	What percentage of the following groups do you think have taken actions to prepare for future wildfires? a. Your friends b. Your neighbours c. Members of your community Eleven-point scale, where '1'='0 per cent' and '11'='100 per cent'	Standardised composite mean index: Range=-1.8–2.0 Mean=0; SD=0.9 Cronbach's alpha=0.89

Source: authors.

Analytical approach

Multivariate analyses were conducted to assess the effects of independent variables on disaster preparedness (ordinal logistic regression) and community helping behaviour (logistic regression). We included the same covariates in both of our models and used robust standard errors to present conservative estimates. We also ran our models with clustered robust errors for zip codes; the results are very similar in terms of significance and magnitude (only the presence of minors variable in the community helping behaviour model becomes insignificant) (see Appendix C). The Brant Test was insignificant (χ^2=84.1; p=0.354) for the disaster preparedness model (only two variables, political ideology and change in concern after the wildfire experience, were individually significant), which means that the parallel odds assumption holds in our ordinal logistic regression model (disaster preparedness), and the results can be interpreted in terms of odds ratios (see Appendix D). To compare the effect of independent variables within one model, we also estimated our models using standardised independent variables; the results are not different from the models presented in the paper (see Appendix E). To compare the effect of independent variables across models on disaster preparedness and community helping behaviour, we estimated cross-model differences using the post-estimation technique of Seemingly Unrelated Estimation (SUE) (Mize et al., 2019). To test for the significance transitivity of independent variables in our ordinal logistic model, we used margins plots for the continuous or count variables (see Appendix F) and comparative predicted probabilities for '0' versus '1' values of binary variables (see Appendix G).

Results

Tables 3 and 4 contain regression models predicting our outcome variables. We present two models for each of our outcome variables. The first model includes all control and independent variables of interest; and in the second model, we have included disaster preparedness as a predictor of community helping behaviour and vice versa. The results show that almost all of our event experience- and communication-related variables have a significant effect on both outcome variables, with several demographic variables yielding significant coefficients in the expected directions.

Disaster preparedness

We used ordinal logistic regression to assess the effect of independent variables on the disaster preparedness of our respondents (see Table 3). For demographic variables (RQ2), females were significantly less likely than males to take a higher number of disaster preparedness actions (OR=0.68, $p<0.001$). Respondents from rural areas were 1.6 times more likely to take three or more actions to prepare for future wildfires than respondents from urban areas ($p<0.001$). Respondents who reported having one or more individuals belonging to vulnerable groups in their household were more likely to take a higher number of wildfire preparatory actions (OR=1.60, $p<0.001$). We also included vulnerabilities in our models as a categorical variable and as individual variables for each vulnerability. As a categorical variable, household vulnerabilities was positively associated with a higher number of disaster preparedness actions: one vulnerability (OR=1.53, $p<0.001$); two vulnerabilities (OR=1.93, $p<0.001$); and three to four vulnerabilities (OR=2.6, $p<0.05$). Concerning individual vulnerabilities, those households with individuals with chronic conditions and limited access to medical care were 54 per cent ($p<0.001$) and 32 per cent ($p<0.05$) more likely, respectively, to take a higher number of disaster preparedness actions (see Appendix H). However, age, race, education, income, presence of minors in the household, and political ideology were not significantly associated with disaster preparedness. We also tried categorical (conservative, moderate, liberal) and binary (conservatives versus moderate/liberals) versions of the political ideology variable and it remained insignificant in all forms (see Appendix I). This is noteworthy considering the widely acknowledged association of political ideology with climate change attitudes and support for mitigation and some adaptation policies in the US (Giordono et al., 2023; Siddiqi and Wolters, 2023).

The harm index was significantly positively associated with disaster preparedness (OR=1.77, $p<0.001$)—the respondents who reported a higher level of harm were more likely to report taking a higher number of actions (three or more) to prepare for a future wildfire. Figure 2 shows that as the level of self-reported harm increases, the probability of reporting inaction decreases significantly. For the second experience-related variable, respondents who reported more concern about climate change after their experience of the 2020 Oregon wildfires were 1.5 times more likely to take at least three actions to prepare for future wildfires (as compared to no or just one action) than those whose views remained unchanged or became less concerned after the experience ($p<0.001$). The

Table 3. Ordinal logistic regression models predicting disaster preparedness behaviour

	Disaster preparedness behaviour			
	Model 1		Model 2	
	OR	SE	OR	SE
Demographics				
Age	1.000	(0.003)	1.000	(0.003)
Female	0.685***	(0.074)	0.695***	(0.075)
Race (White)	0.846	(0.113)	0.831	(0.110)
Rural	1.598***	(0.178)	1.595***	(0.178)
Bachelor's degree or higher	1.024	(0.118)	1.033	(0.119)
Annual household income	1.037	(0.025)	1.028	(0.025)
Household with minors	1.202	(0.144)	1.161	(0.139)
Household vulnerabilities	1.601***	(0.173)	1.587***	(0.174)
Political ideology	1.000	(0.003)	1.000	(0.003)
Harm and experience				
Harm index	1.769***	(0.175)	1.638***	(0.163)
Change in climate change concern after wildfire experience	1.521***	(0.172)	1.493***	(0.168)
Information sources and norms				
Formal sources of information	1.662***	(0.219)	1.701***	(0.227)
Informal discussions about wildfire	1.108*	(0.045)	1.086*	(0.044)
Number of information sources consulted	1.317***	(0.074)	1.295***	(0.073)
Descriptive norms about wildfire preparedness	1.941***	(0.125)	1.868***	(0.120)
Behaviours				
Community helping behaviour	–	–	1.930***	(0.207)
N	1,301	–	1,301	–
Chi-square	456.5	–	484.6	–
McFadden Pseudo R^2	0.113	–	0.121	–
Nagelkerke Pseudo R^2	0.341	–	0.361	–

Notes: exponentiated coefficients as odds ratios; standard errors in parentheses; n-1 cut-off points included but not shown. All models use robust standard errors. * p<0.05, ** p<0.01, ***p<0.001.

Source: authors.

comparative predicted probabilities for '0' versus '1' values show that the effect was not significant for the two-actions category (see Appendix G). We found support for the following hypotheses:

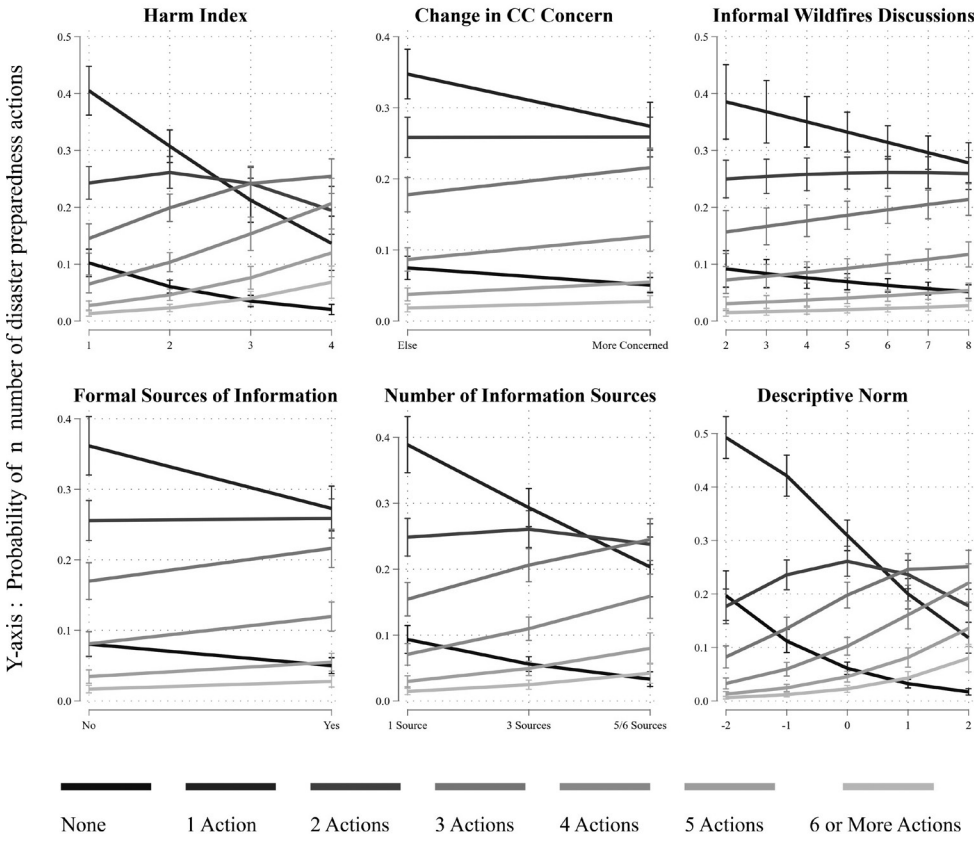
$H1_A$: *Wildfire-related harm was positively associated with disaster preparedness behaviour.*

H2$_A$: *Respondents who were more concerned about climate change after experiencing the 2020 Oregon wildfires were more likely to take a higher number of disaster preparedness actions.*

Respondents who sought information about the 2020 wildfires from formal sources (city, county, or state websites) were 1.7 times more likely to take three or more disaster preparatory actions (p<.001) than those who did not consult formal sources of information. Informal discussion with family/neighbours/friends about the 2020 wildfires was significantly associated with a higher probability of taking three or more disaster preparedness actions (OR=1.11, p<0.05). The count of information sources was also positively associated with the number of actions to prepare for future wildfires (OR=1.32, p<0.001).

The descriptive norm index had the most significant and pronounced effect on disaster preparedness behaviour (OR=1.94, p<.001). A one-point increase in a respondent's perception of the share of their friends, neighbours, and community members taking actions to prepare for future wildfires corresponds to a 1.9 times higher probability of reporting more of their own preparedness actions. Figure 2 shows that the descriptive

Figure 2. Margins plots showing the effect of independent variables of interest on the probability of n number of disaster preparedness actions



Source: authors.

norm index has a significant impact on all outcome categories of the disaster preparedness variable (except for the two-actions category). These results show support for the following hypotheses:

$H3_A$: *Respondents who sought wildfire-related information from formal sources (city, county, or state websites) were more likely to take a higher number of disaster preparedness actions.*

$H4_A$: *Informal discussions with friends, family, and neighbours about wildfires were positively associated with disaster preparedness actions.*

$H5_A$: *The number of information sources consulted to seek out information about wildfires were positively associated with disaster preparedness behaviour.*

$H6_A$: *Descriptive norms about wildfire-related disaster preparedness were positively associated with disaster preparedness behaviour.*

Community helping behaviour

Household income (OR=1.08, $p<0.01$) and the presence of minors (OR=1.32, $p<0.05$) were the only demographic variables significantly associated with community helping behaviour (see Table 4). The rest of the demographic variables and political ideology were not significant (RQ2).

Self-reported harm had the most pronounced effect on community helping behaviour (OR=1.83, $p<0.001$). Likewise, respondents who reported more concern about climate change after their experience of the 2020 wildfires were 1.36 times more likely to exhibit community helping behaviour ($p<0.05$) than those whose views remained unchanged or became less concerned after experiencing wildfires. The results show support for the following hypotheses:

$H1_B$: *Wildfire-related harm was positively associated with community helping behaviour.*

$H2_B$: *Respondents who were more concerned about climate change after experiencing the 2020 Oregon wildfires were more likely to take community helping actions.*

Consulting city, county, or state websites for wildfire-related information was not significantly associated with community helping behaviour ($H3_B$). The respondents who talked more frequently about wildfires with their family or friends within and outside their communities were more likely to have engaged in efforts to help their communities (OR=1.18, $p<0.001$). The number of sources used to seek information about the 2020 wildfires was also positively associated with community helping behaviour (OR=1.13, $p<0.05$). The respondents who scored higher on the descriptive norm about wildfire preparation had a higher probability of donating or volunteering (OR=1.41, $p<0.001$). We also ran the community helping behaviour model without the descriptive norm variable, as our descriptive norm measure was not specifically about donations and volunteering but instead about preparedness. Doing so increases the magnitude of the effect of the harm

Table 4. Logistic regression models predicting community helping behaviour

	Community helping behaviour			
	Model 1		Model 2	
	OR	SE	OR	SE
Demographics				
Age	0.998	(0.004)	0.998	(0.004)
Female	0.857	(0.108)	0.932	(0.120)
Race (White)	1.199	(0.188)	1.249	(0.197)
Rural	1.123	(0.144)	1.023	(0.134)
Bachelor's degree or higher	1.002	(0.140)	0.991	(0.141)
Annual household income	1.084**	(0.031)	1.082**	(0.032)
Household with minors	1.320*	(0.186)	1.278	(0.182)
Household vulnerabilities	1.081	(0.141)	0.999	(0.133)
Political ideology	0.987	(0.057)	0.981	(0.057)
Harm and experience				
Harm index	1.829***	(0.200)	1.668***	(0.186)
Change in climate change concern after wildfire experience	1.365*	(0.180)	1.245	(0.169)
Information sources and norms				
Formal sources of information	0.954	(0.148)	0.872	(0.138)
Informal discussions about wildfire	1.180***	(0.059)	1.161**	(0.058)
Number of information sources consulted	1.131*	(0.069)	1.071	(0.067)
Descriptive norms about wildfire preparedness	1.411***	(0.102)	1.260**	(0.095)
Behaviours				
Disaster preparedness behaviour	–	–	1.308***	(0.059)
N	1,301	–	1,301	–
Chi-square	163.2	–	188.5	–
McFadden Pseudo R^2	0.107	–	0.127	–
Nagelkerke Pseudo R^2	0.183	–	0.214	–

Notes: exponentiated coefficients as odds ratios; standard errors in parentheses. All models use robust standard errors. * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Source: authors.

index on community helping behaviour (OR=2.00, $p<0.001$). It also slightly decreases the Pseudo R-square, which indicates that the descriptive norm about wildfire preparedness has an independent effect on community helping behaviour (see Appendix J). The results show support for the following hypotheses:

$H4_B$: *Informal discussions with friends, family, and neighbours about wildfires were positively associated with community helping actions.*

$H5_B$: *The number of information sources consulted to seek out information about wildfires was positively associated with community helping behaviour.*

$H6_B$: *Descriptive norms about wildfire-related disaster preparedness were positively associated with community helping behaviour.*

Cross-model comparison

We compared the effect of each independent variable on disaster preparedness and community helping behaviour (RQ1) using the post-estimation technique, SUE (see Table 5). However, SUE works best when the outcome variables have the same level of measurement. Therefore, we recoded our disaster preparedness measure into a binary variable, where '0'='No, one, or two actions taken to prepare for future wildfires' (60.1 per cent) and '1'='Three or more actions taken' (39.9 per cent). The cut-off point for the recoding of the binary variable was informed by the margins plots (see Figure 2). Margins plots show how probabilities of different categories of outcome variable change across the entire range of an independent variable. They present a test for the significance transitivity of independent variables (that is, even if an independent variable is significant in the ordinal logistic model, it may not have a significant impact on all outcome categories of the dependent variable). If fitted probabilities and their confidence intervals are increasing or decreasing across the entire range of a continuous or count independent variable, we can claim that higher values of that variable increase or decrease the likelihood of lying within a particular ordinal category of our dependent variable (disaster preparedness). Figure 2 shows that positively associated independent variables increase the probability of taking three or more actions and decrease the probability of taking no or one action. Hence, we combined three or more actions categories into one for recoding disaster preparedness actions into a binary variable.

Table 5 presents the differences in the coefficients on independent variables across the two models. The results show that the effects of most of the independent variables are not statistically different in the two models. Only three variables have statistically different effects on disaster preparedness and community helping behaviour: rural residence (β=0.48, p<0.05); formal sources of information (β=0.61, p<0.05); and descriptive norms (β=0.26, p<0.05). All three variables have stronger positive associations with disaster preparedness than with community helping behaviour.

We also included community helping behaviour as a predictor of disaster preparedness behaviour (see Table 3, Model 2) and vice versa (see Table 4, Model 2). The results indicate that those who reported donating to or volunteering with groups responding to the 2020 Oregon wildfires were 1.93 times more likely to take three or more actions as compared to those who did not donate or volunteer (p<0.001). Disaster preparedness behaviour was also positively associated with community helping behaviour (OR=1.31, p<0.001).

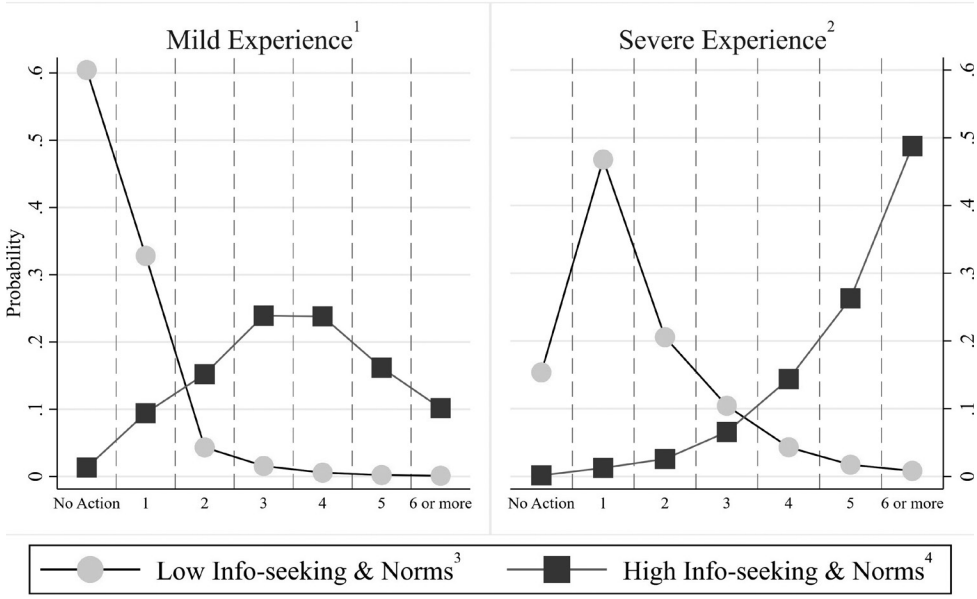
Table 5. Cross-model comparison of the effect of independent variables on disaster preparedness and community helping behaviour

	Disaster preparedness		Community helping		Cross model difference		
	M_1		M_2		$\_b[M_1:Var_x] - \_b[M_2:Var_x]$		
	Log odds	SE	Log odds	SE	*b*	SE	*p*-value
Demographics							
Age	-0.003	(0.004)	-0.001	(0.004)	-0.002	0.006	0.801
Female	-0.400**	(0.139)	-0.101	(0.127)	-0.299	0.198	0.131
Race (White)	-0.087	(0.175)	0.193	(0.157)	-0.280	0.248	0.258
Rural	0.531***	(0.143)	0.048	(0.130)	0.482*	0.203	0.018
Bachelor's degree or higher	0.111	(0.153)	-0.014	(0.141)	0.125	0.218	0.566
Annual household income	0.010	(0.032)	0.080**	(0.029)	-0.069	0.047	0.139
Household with minors	0.192	(0.152)	0.256	(0.142)	-0.064	0.220	0.772
Household vulnerabilities	0.320*	(0.144)	0.039	(0.132)	0.280	0.212	0.187
Political ideology	-0.003	(0.004)	-0.001	(0.004)	-0.002	0.006	0.801
Harm and experience							
Harm index	0.452***	(0.127)	0.541***	(0.110)	-0.089	0.178	0.617
Concern about climate change after wildfire experience	0.615***	(0.143)	0.234	(0.134)	0.381	0.209	0.068
Communications and norms							
Formal sources of information	0.507**	(0.169)	-0.105	(0.157)	0.613*	0.246	0.013
Informal discussions	0.130*	(0.054)	0.152**	(0.050)	-0.022	0.078	0.778
Number of information sources	0.269***	(0.066)	0.086	(0.062)	0.182	0.095	0.054
Descriptive norms	0.543***	(0.083)	0.278***	(0.074)	0.265*	0.115	0.021
Behaviours							
Community helping behaviour	0.636***	(0.135)	–	–	0.001	0.010	0.905
Disaster preparedness	–	–	0.635***	(0.135)			
N	1301	–	1301	–	–	–	–
Chi-square	261.4	–	179.7	–	–	–	–
McFadden Pseudo R^2	0.213	–	0.119	–	–	–	–
Nagelkerke Pseudo R^2	0.337	–	0.202	–	–	–	–

Notes: standard errors in parentheses. All models use robust standard errors.
* $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Source: authors.

Figure 3. Ideal types and predictive margins for disaster preparedness



[1] *Did not experience* **harm** and were *less* **concerned** about climate change after experiencing wildfires
[2] *Experienced high* **harm** and were *more* or *much more* **concerned** about climate change after experiencing wildfires
[3] No **informal discussions**, did not use **formal sources**, lower no. of **info sources**, low level **descriptive norms**
[4] Frequent **informal discussions**, used **formal sources**, higher no. of **info sources**, high level **descriptive norms**

Source: authors.

Figure 3 shows the predicted probabilities for outcome categories of disaster preparedness based on ideal types for individuals with low and high event-related harm/experience and with low and high levels of information seeking and social norms. Wildfire-related communications increase the probability of disaster preparedness for people with and without wildfire-related harm, having a greater impact on those who experienced a high level of harm during the wildfires. Results pertaining to community helping behaviour convey very similar findings.

Discussion

Exploring factors associated with disaster preparedness and community helping behaviour after an extreme event, similarities and differences emerged. We found support for most of our hypotheses. Specifically, we found that wildfire-related harm ($H1_A$ and $H1_B$), climate change concern after experiencing wildfires ($H2_A$ and $H2_B$), informal discussions about wildfire ($H4_A$ and $H4_B$), number of information sources consulted ($H5_A$ and $H5_B$), and descriptive norms about wildfire-related disaster preparedness ($H6_A$ and $H6_B$) were all positively associated with disaster preparedness and community helping behaviour. But seeking wildfire-related information from formal sources was only positively associated with disaster preparedness ($H3_A$), and not with community helping behaviour ($H3_B$).

In terms of demographic factors, respondents who identified themselves as male, stated that they were living in rural zip codes, and reported having persons belonging to vulnerable groups in their household were more likely to take a higher number of disaster preparedness actions than females, urban residents, and those who did not report any household vulnerability. In contrast, household income and the presence of minors were the only demographic variables that were positively related to community helping behaviour. Age, race, education, and political ideology were not found to be associated with either disaster preparedness or community helping behaviour. Understanding how demographic characteristics are associated with these actions can inform communication efforts to enhance the adoption of disaster preparedness or risk mitigation behaviour through wildfire education programmes (Lindell and Whitney, 2000; Brenkert-Smith, Champ, and Flores, 2012). To engage those who are not already involved in disaster preparedness and community helping behaviour, policymakers could develop campaigns that are easily accessible and relatable to the audience.

Our findings also show that event-related harm/experience and communication are very similarly associated with disaster preparedness and community helping behaviour. Both of our experience-related measures were significantly positively associated with both disaster preparedness and community helping behaviour, and their effects were not statistically significantly different in the two models. Concerning community helping behaviour, our results support the 'altruism born of suffering' hypothesis (Staub, 2003, 2005) and the findings of related empirical studies on disasters triggered by natural hazards (Kaniasty and Norris, 1995b; Wayment, 2004; Vollhardt and Staub, 2011).

As for disaster preparedness, while our findings on an experience–preparedness link are in line with some studies (Beebe and Omi, 1993; Jacobson, Monroe, and Marynowski, 2001; McCaffrey et al., 2011; Wolters et al., 2017), others present contradictory findings (Jacobson, Monroe, and Marynowski, 2001; Hall and Slothower, 2009; Martin, Martin, and Kent, 2009; Schulte and Miller, 2010). We think that the reason for these seemingly contradictory results may be the way in which experience has been measured in earlier studies. Some have asked about experiences and not about damage or harm incurred, either using a single survey item to query if the participants experienced wildfire in the past (Schulte and Miller, 2010) or several survey items to assess experiences of smoke, prescribed fire, burning of nearby natural area, or evacuation (Jacobson, Monroe, and Marynowski, 2001). Other studies have included survey items pertaining to harm or damage but have primarily focused on damage to property (Martin, Martin, and Kent, 2009). Qualitative studies highlight wide variations in individuals' experiences and interpretations of an event (McGee, McFarlane, and Varghese, 2009), which can lead to different behavioural intentions and outcomes (Brenkert-Smith, Champ, and Flores, 2012). Our more comprehensive measure of harm experience—an index taking into account harm to daily activities, property, finances, and physical and mental health—may more accurately reflect these variations and thus may be more tightly connected to disaster preparedness than experience alone.

Moreover, the effect of harm/experience on behavioural outcomes can depend on how individuals perceive an event. Earlier research has shown that wildfire experience can

lead to greater concern about future wildfires (Vogt, Winter, and Fried, 2005; Fischer, 2011; Champ and Brenkert-Smith, 2016), which in turn can lead to behavioural outcomes. Our second experience-related variable, measuring whether respondents were more concerned about climate change after their experience of the 2020 Oregon wildfires, was also significantly related to both disaster preparedness and community helping behaviour. In other words, respondents who discerned their wildfire experience as part of a bigger problem of climate change were more likely to report having taken a higher number of disaster preparatory actions, as well as having engaged in altruistic activities to help their communities.

Almost all of our information seeking and social norms measures were found to be positively related to disaster preparedness and community helping behaviour. Both formal and informal sources of information were positively associated with disaster preparedness, which is in line with earlier research (Brenkert-Smith, 2010; Brenkert–Smith, Champ, and Flores, 2006; Dickinson et al., 2015). However, community helping behaviour was only associated with informal discussions with friends, family, and neighbours about wildfires; it did not have a significant association with formal sources of information. We also found that the respondents who consulted a higher number of information sources about the wildfires were more likely to engage in disaster preparedness and community helping behaviour. Earlier research shows a relationship between the number of sources consulted and climate change knowledge (Kahlor and Rosenthal, 2009). Future research should explore whether knowledge and risk perceptions mediate the relationship between information sources and behavioural outcomes in the wake of extreme weather events.

Respondents who reported a higher percentage of their friends, neighbours, and community members taking actions to prepare for future wildfires were more likely to take a higher number of disaster preparedness actions themselves, as well as to exhibit community helping behaviour. Our findings are in line with earlier research on the role of subjective norms (Monroe and Nelson, 2004; Bright and Burtz, 2006; Berrens et al., 2007; Schulte and Miller, 2010; McCaffrey et al., 2011) in shaping behavioural intentions and outcomes. However, our study highlights the relationship between behavioural outcomes and a more specific kind of subjective norm: the descriptive norm.

The impact of information seeking and social norms measures on disaster preparedness and community helping behaviour can be attributed to several mechanisms. Information transmission hypothesis, for example, suggests that consulting information sources and having wildfire-related discussions allow individuals to learn about wildfire hazards and available disaster preparedness options that in turn influence behaviour (McCaffrey et al., 2011). Social amplification of risk hypothesis, meanwhile, suggests that wildfire-related discussions can potentially intensify or attenuate risk perceptions that in turn influence behaviour (Brenkert-Smith et al., 2013). In addition to their independent effects, information seeking and social norms can also interact with each other to influence individual behaviours. The influence of descriptive norms, for example, can be mediated by interactions with family and friends. These interactions may serve to reinforce existing norms or challenge them, leading to changes in behaviours (Dickinson et al., 2015).

Furthermore, it is important to consider the potential for a reciprocal relationship between descriptive norms and information seeking measures, as both can influence each other. Moreover, it is important to consider that harm experience may also be associated with information seeking behaviour. Individuals who have experienced more harm from wildfires may be more likely to seek information from official and other sources, and to engage in more social interactions related to disaster preparedness. However, the observational nature of our cross-sectional data limits our ability to determine causality. Future work aimed at understanding further how these factors interplay with disaster preparedness and community helping behaviour could benefit from utilising a variety of research methodologies, including both quantitative and qualitative methods, and experimental and observational techniques.

Our study has several limitations. First, it was conducted within three to five months of the September 2020 Oregon wildfires (December 2020 to February 2021), which could have implications for our findings. Earlier researchers have underscored concerns about the duration of the effects of individuals' past experiences (Lindell and Perry, 2000; Hall and Slothower, 2009), as hazard experience can enhance perceived risk but it tends to subside (Sims and Baumann, 1983; Weinstein, 1989; Martin, Martin, and Kent, 2009) as attention fatigue kicks in with time (Kaplan, 1995, 2000). Moreover, repeated occurrences of disasters triggered by natural hazards can also result in acceptance of the phenomenon as a part of life, ultimately decreasing the adoption of disaster preparedness behaviour (Tierney, 1994; Martin, Martin, and Kent, 2009). However, the cross-sectional nature of our survey limits our ability to make such causal inferences. Panel studies can better address these concerns. Also, we did not have several measures that earlier research associates with altruistic behaviour, such as religious affiliation, history of general altruistic actions, and descriptive norms about donations or volunteering. While our findings show that the descriptive norm about wildfire preparation was positively associated with community helping behaviour, the cross-model comparison shows that it was more strongly associated with disaster preparedness than with community helping behaviour. Worth noting, our descriptive norm measure was not specifically about donations and volunteering but instead about preparedness. Both disaster preparedness and community helping behaviour predict each other. However, with cross-sectional data, we cannot identify which behaviour occurs first in time. Future studies should set up panel surveys to investigate this question further.

Concluding remarks

Our findings suggest that individuals who have experienced wildfire-related harm are likely to benefit from improved dissemination of wildfire-related information and frequent social interactions in their efforts to prepare for future wildfires, both for their own disaster preparedness and in terms of community-oriented altruistic actions. Wildfire-related communications increase the probability of disaster preparedness and community helping behaviour among people with and without wildfire-related harm, with a greater

impact on those who experienced a higher level of harm during wildfires. Although our study centred on the responses of Oregon residents to the 2020 wildfires, its findings hold significant implications for informing policies and practices in regions susceptible to wildfires not only across the western US but also in other parts of the world. The evidence of similar associations between harm experience and information seeking measures and disaster preparedness and community helping behaviour in literature from other areas of the globe supports the generalisability of our findings beyond Oregon (Brenkert-Smith, 2010; Whittaker, McLennan, and Handmer, 2015; Boulianne, Minaker, and Haney, 2018).

Our findings are consistent with the recommendation of the Fire Modeling Institute of the Forest Service, encouraging wildfire-related discussion and information sharing: 'If you're in anything but the lowest risk category, you should be talking to your neighbors about risk mitigation and what you can do' (Flavelle and Popovich, 2022). Policymakers could work to foster social connectedness and trust among community members by creating opportunities for dialogue, participation, and collaboration with diverse stakeholders, such as community organisations, government agencies, media outlets, businesses, schools, and faith groups, to foster disaster preparedness and community helping behaviour (Fischer et al., 2014).

Policymakers and emergency response personnel could also promote the use of formal information sources by providing up-to-date information on wildfires and disaster preparedness on government agency, city, county, and state websites. Development and availability of effective and accessible disaster preparedness plans tailored to communities that are at risk of wildfires or other disasters on official websites are likely to enhance disaster preparedness. Furthermore, governments could invest in social media campaigns, fact-checking tools, and mobile applications that can provide real-time information about wildfires and disaster preparedness. These technologies can be designed to send alerts and notifications to users in affected areas, providing them with timely and accurate information about effective preparedness measures, evacuation routes, emergency shelters, and other essential services.

Our research also underscores the significance of descriptive norms in disaster preparedness and community helping behaviour. Policymakers can harness this insight by designing campaigns that highlight what people commonly do in such situations and showcase examples of positive and responsible behaviour. One approach to achieving this could be to feature testimonials from individuals who have first-hand experience of wildfire disasters or have actively engaged in disaster preparedness and community helping behaviour. The power of social influence could also be leveraged by mobilising community leaders, social organisations, churches, and schools to encourage their members to engage in disaster preparedness and community helping activities. Our findings also indicate the need to prioritise education and public awareness efforts that emphasise the link between wildfires, climate change, and disaster preparedness. Respondents who became more concerned about climate change after experiencing wildfires were more likely to take preparedness actions.

Our study offers preliminary insights into sociodemographic, experiential, attitudinal, and communication-related factors associated with disaster preparedness and community

helping behaviour. Future research should consider employing qualitative methods and experimental techniques to provide a more nuanced and in-depth understanding of these complex relationships. This may ultimately lead to the development of more effective disaster preparedness and community helping interventions, tailored to the unique needs and circumstances of different populations.

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Correspondence

Muhammad Usman Amin Siddiqi, School of Public Policy, College of Liberal Arts, Oregon State University, 100P Bexell Hall, 2251 SW Campus Way, Corvallis, OR 97331, United States.
ORCID: https://orcid.org/0000-0003-0168-3029
E-mail: siddiqim@oregonstate.edu or write2siddiqi@live.com

Endnotes

[1] Muhammad Usman Amin Siddiqi is an Instructor and PhD Candidate at the School of Public Policy, Oregon State University, United States; Leanne Giordono is an Assistant Professor at the Department of Political Science, California Polytechnic State University, United States; Chad Zanocco is a Postdoctoral Scholar at the Department of Civil and Environmental Engineering, Stanford University, Stanford, United States; Greg Stelmach is an Instructor and PhD Candidate at the School of Public Policy, Oregon State University, United States; June Flora is a Senior Research Scholar at the Department of Civil and Environmental Engineering, Stanford University, United States; and Hilary Boudet is an Associate Professor at the School of Public Policy, Oregon State University, United States.

[2] Regarding appendices A–J, see the supporting information section at the end of the paper.

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Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.