A Psychological Model of Climate Change Adaptation: Influence of Resource Loss, Posttraumatic Growth, Norms, and Risk Perception Following Cyclone Winston in Fiji

David N. Sattler, Albert Whippy, James M. Graham and James Johnson

Abstract This chapter examines behavioral intentions to prevent climate change and climate change risk perceptions among people living in coastal communities in Fiji following Cyclone Winston, a natural disaster whose strength was likely increased by climate change. Cyclone Winston was one of the strongest cyclones ever recorded in the Southern Hemisphere and the strongest to make landfall in Fiji. The study extends our psychological climate change risk perception model to examine how posttraumatic growth following Cyclone Winston influenced behavioral intentions to prevent climate change (Sattler and Graham 2017). Posttraumatic growth can occur in response to experiencing a traumatic stressor and involves reflecting on life priorities and what gives live meaning (Calhoun and Tedeschi 2001). We also tested van der Linden's (2015) climate change risk perception model by considering how individual and socio-cultural variables influence climate change risk perception, and extended it to predict behavioral intentions to prevent climate change. For this study, we used behavioral intentions as a proxy for behavioral adaption. The participants, 274 persons (160 men, 114 women) in coastal communities in Fiji (age: $M = 39$, $SD = 14$), completed measures assessing climate change risk perception; knowledge, affect, and social norms concerning climate change; behavioral intention to prevent climate change, and demographics.

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The findings show three pathways to climate change adaptation/behavioral intention to prevent climate change: (1) posttraumatic growth mediates the relationship between resource loss due to the cyclone and education with behavioral intentions to prevent climate change, (2) resource loss due to the cyclone activates social norms concerning climate change action, which in turn leads to behavioral intention to prevent climate change, and (3) climate change risk perception mediates the influence of social norms, knowledge, and affect on behavioral intentions to prevent climate change. The findings support and extend our psychological model and van der Linden's model. Implications of the findings for climate change adaptation and education are discussed.

Introduction

This chapter examines behavioral intentions to prevent climate change and climate change risk perceptions in the wake of Cyclone Winston, one of the strongest storms ever recorded in the Southern Hemisphere and the strongest to make landfall on Fiji. On February 20, 2016, the category 5 storm devastated communities across Fiji (Earth Observatory 2016). Climate change was implicated as a contributor to the storm's strength as a result of increasing ocean temperature. Heat energy in the ocean is a source of fuel for cyclones (also referred to as hurricanes and typhoons) and warmer waters can result in stronger storms with greater destructive potential (National Oceanic and Atmospheric Administration 2013).

Cyclone Winston impacted more than one-third (40%) of Fiji's population (United Nations Development Programme 2016) and damaged or destroyed more than 28,000 houses. Nearly all of the buildings were leveled in several communities. Property damage was approximately US $1.4 billion or approximately one-third (30%) of Fiji's gross domestic product (Asian Development Bank 2016). The cyclone destroyed significant portions of the ecosystem, including crops and coconut trees.

The gravity of the threats imposed by climate change on South Pacific island nations and coastal communities around the world was underscored by Fiji President Jioji Konousi Konrote at the COP23 United Nations Climate Change Conference. President Konrote stated, "…Fiji intends to do whatever is in its power to persuade the global community about the root cause of extreme weather events such as Winston that are causing pain for our people and other vulnerable nations around the world… We must get the community of nations to continue reducing carbon emissions. This is a fight we must win. Our entire way of life is at stake" (Armbruster 2017).

Climate Change Risk Perception Models

Few studies have examined in detail how psychological reactions to surviving a natural disaster whose strength is associated with climate change influence climate change adaptation, or how individual and social-cultural variables influence climate change adaptation following disaster exposure. These are significant limitations. Natural disasters threaten lives and property and have a profound influence on quality of life, health and safety, and individual and societal functioning. As a result of surviving a disaster, people may gain new insight into the vulnerability of their community and the immense challenges to recovery (Sattler et al. 2000). Research is needed to examine how such experiences influence climate change perceptions and adaptation. The present study is among the first to examine how coping and mental health responses as well as social-cultural variables influence climate change adaptation and risk perceptions following exposure to a catastrophic natural disaster whose strength was associated with climate change.

We examined behavioral intentions to prevent climate change and climate change risk perceptions in coastal communities that experienced significant damage as a result of Cyclone Winston. The project was guided by our climate change risk perception model that details how psychological reactions to a catastrophic cyclone are associated with climate change risk perceptions (Sattler and Graham 2017; Sattler et al. 2016), and van der Linden's (2015) comprehensive climate change risk model, which considers individual and social-cultural influences.

A psychological climate change risk perception model. We developed a psychological climate change risk perception model based on our studies examining the associations between personal experience with a cyclone, mental health, and climate change risk perceptions in the Philippines and Fiji (Sattler and Graham 2017; Sattler et al. 2016). These studies were among the first to examine in detail the relationships between reactions to a traumatic event and climate change risk perceptions. Survivors completed measures assessing resource loss due to the cyclone, posttraumatic stress symptoms, coping, social support, posttraumatic growth, and climate change risk perceptions. The resource loss measure assessed loss of object resources (e.g., home, possessions), condition resources (e.g., employment), energy resources (e.g., time for adequate sleep), and personal characteristics (e.g., sense of optimism; Hobfoll 2012). The posttraumatic stress measure assessed symptoms associated with posttraumatic stress, which may occur in response to a life threatening traumatic event wherein the individual experiences flashbacks about the event, nightmares and severe anxiety, and intrusive thoughts about the event (National Center for PTSD 2017). Posttraumatic growth can occur in response to experiencing a traumatic stressor and involves the individual reflecting on life priorities and what gives life meaning (Calhoun and Tedeschi 2001).

Our model was developed with data we collected after Super Typhoon Haiyan in the Philippines and confirmed with data we collected after Cyclone Winston in Fiji.

The model shows that resource loss as a result of a cyclone contributes to posttraumatic stress symptoms, which in turn activates coping, which then activates posttraumatic growth, and which then influences climate change risk perceptions. Posttraumatic growth mediated the influence of these variables on climate change risk perception.

The model suggests that climate change risk perceptions are greatest when people experience loss due to an environmental catastrophe associated with climate change, and then reflect on the meaning of life and their values. This finding underscores the importance of resource loss, mental health functioning, and self-reflection in influencing climate change risk perceptions.

A comprehensive climate change risk perception model. van der Linden's (2015) comprehensive climate change risk perception model considers how knowledge, experiences, and socio-cultural factors influence climate change risk perception. *The cognitive component* includes knowledge about the causes of climate change, the impact of climate change on the environment and humans, and actions that can reduce climate change. More knowledge is associated with higher risk perceptions. *The experiential processes component* includes affective or emotional responses to and personal experiences with climate change, such as personal loss and distress. More negative emotional responses and higher levels of loss and distress are associated with higher risk perceptions. *The socio-cultural component* includes broad value orientations and social norms; both reflect cultural influences. Three broad value orientations are identified: biospheric values concern being sensitive to and attending to the environment, egoistic values focus on increasing outcomes for the individual, and socio-altruistic values focus on being sensitive to and considering other people. These values are considered primary guiding principles that influence behavior (Stern 2000; van der Linden 2015), with biospheric and socio-altruistic values being positively associated with climate change risk perception. Descriptive and prescriptive social norms influence risk perceptions. Descriptive norms describe other people's actions and prescriptive norms suggest behavioral expectations that an individual should perform. Social norms to take action against climate change are associated with higher risk perceptions. Finally, the model identifies a *socio-demographic component* which includes gender, age, and education. The model considers these as control variables rather than as directly associated with risk perception.

van der Linden (2015) found support for the model with a sample of residents in the United Kingdom. Gender, political party, knowledge, social norms, value orientation, affect, and personal experience predicted climate change risk perceptions in the expected directions. The experiential and socio-cultural components accounted for more risk perception variance than the cognitive and socio-demographic components. van der Linden suggests that an implication of these findings is that risk communication may be more effective if it includes information addressing the three main components in the model: knowledge (causes, impact, actions to reduce climate change), experiential processes, and socio-cultural values and norms.

Present Study: Climate Change Adaptation/Behavioral Intentions to Prevent Climate Change

In the present study, we applied our psychological climate change risk perception model and van der Linden's climate change risk perception model to examine behavioral intentions to prevent climate change, and to address questions raised in prior studies. For this study, we consider behavioral intentions to be a proxy for behavioral adaption.

We addressed several questions raised by van der Linden (2015). Because participants in that study had limited experience with large scale weather events or disasters associated with climate change, the first question was "Will the climate change risk perception model hold for people who experienced a large scale catastrophic disaster associated with climate change?" The second question was "Will the model generalize to a location and culture other than the United Kingdom?" The third question was "Would the factors in the model predict both climate change risk perceptions as well as behavioral intentions to prevent climate change?"

We also considered our psychological climate change risk perception model which shows posttraumatic growth mediates the relationships between resource loss, posttraumatic stress symptoms, coping, and social support and climate change risk perceptions for people with living in communities severely impacted by a cyclone. Because we previously found that posttraumatic growth mediate these relationships, we only included the resource loss and posttraumatic growth components of our model in the present study. This allowed us to integrate our model with van der Linden's model more simply. We included resource loss because it is a measure of the degree to which the disaster impacted individuals, and as such, may influence responses and perceptions.

In order to extend these models, we developed a behavioral intentions scale to assess actions relevant to people living in small, rural coastal villages in Fiji. We developed the scale to assess behaviors that have the potential to reduce or prevent climate change (based in part on Stern 2010). These behaviors include changing household consumer behaviors; supporting sustainable practices, goals, and policies; and engaging in environmental activism.

Because the project was exploratory, we did not have specific hypotheses.

Method

Participants

Fifteen months after Cyclone Winston made landfall, 274 persons (160 men, 114 women) in coastal communities in Fiji completed the survey (age: $M = 39$, $SD = 14$, range: 18–79 years). Nearly half (46%) had less than a secondary school

education, about one-quarter completed secondary school (22%), and about one-third (32%) had some college or a college degree. They lived within 2 km of the coast. Most individuals agreed to participate; the response rate was 92%.

Assessment Instruments

A cover letter introduced the study, presented informed consent information, and indicated responses were anonymous. Table 1 shows the means, standard deviations, and Cronbach alpha reliabilities for the instruments. Participants completed the instruments in the following order.

Climate change risk perceptions and affect. Five items assessed the degree to which participants believed they would experience negative consequences as a result of climate change and their level of concern. The items were adapted by van der Linden (2015). An example is "In your lifetime and in your judgment, how likely are you to experience serious threats to your health or overall well-being as a result of climate change?" We summed the items to create a total score, and higher scores indicate stronger perceived risk as a result of climate change.

Two items assessed affect concerning climate change, based on van der Linden (2015). An example is "Do you think climate change is something that is unpleasant?" Higher scores indicate more negative affect toward climate change. Participants used a 5-point scale (from 1 = not at all to 5 = very much) to indicate their answers.

Table 1 Correlations and descriptive statistics (N = 274)

Variable	1	2	3	4	5	6	7	8	9			
(1) Education	–											
(2) Personal Loss	0.02											
(3) Post-Traumatic Growth	0.31	0.19										
(4) Values Orientation	0.17	0.18	0.42									
(5) Social Norms	0.05	0.20	0.12	0.28								
(6) Knowledge	0.36	0.09	0.50	0.35	0.029							
(7) Holistic Affect	−0.10	0.09	−0.13	0.16	0.32	0.18						
(8) Risk Perception	0.09	0.28	0.17	0.32	0.37	0.31	0.51			–		
(9) Behavioral Intent	0.20	0.26	0.22	0.25	0.42	0.31	0.20	0.39				
Mean	2.85	4.59	3.86	5.11	3.70	0.64	4.17	4.25	4.16			
Standard Deviation	1.10	0.61	0.73	1.02	0.80	0.16	0.93	0.72	0.68			
Cronbach's Alpha	–	−0.68	0.91	0.90	0.77	0.82	0.64	0.73	0.86			

Note Correlations greater than 0.21 are statistically significant at the $p < 0.001$ level, greater than 0.16 at the $p < 0.01$ level, and greater than 0.12 at the $p < 0.05$ level

Personal experience with extreme weather (Cyclone Winston). Four items developed by the first author assessed hardship and loss created by Cyclone Winston. An example is "How much hardship did Cyclone Winston create for you." Participants used a 5-point scale (from 1 = not at all to 5 = very much) to indicate their answers. Higher scores indicate greater experiences of hardship and loss.

Knowledge about climate change. We used van der Linden's items to assess knowledge and followed the procedure to score each item as correct or incorrect and sum the items. Ten items assessed *knowledge concerning the causes of climate change*. Participants used a 4-point scale (major cause, minor cause, does not contribute, and do not know) to indicate their answers. Ten items assessed *knowledge concerning the consequences and impacts of climate change*. Participants used a 4-point scale (likely to decrease, no change, likely to increase, do not know). Ten items assessed *knowledge concerning actions to reduce climate change*. Participants used a 4-point scale (reduce it a lot, reduce it a little, not going to reduce it, do not know).

Social norms concerning climate change. Seven items developed by van der Linden (2015) assessed social norms. An example is "Most people who are important to me are doing something to reduce the risk of climate change." Participants used a 5-point scale (from 1 = not at all to 5 = very much) to indicate their answers. Higher scores indicate social norms more supportive of climate change action.

Broad value orientations. Eight items developed by van der Linden (2015) assessed biospheric and socio-altruistic values. Participants used a 6-point scale (1 = very much opposed to 6 = very important) to indicate how well each item matched their values. An example is "Respecting the Earth and living in harmony with other species." Higher scores indicate more biospheric and socio-altruistic values.

Posttraumatic growth. The 21-item Posttraumatic Growth Inventory assessed degree of growth (Calhoun and Tedeschi 2001). An example is "Priorities about what is important in my life." Participants used a 7-point scale (1 = *great decrease* to 4 = *no change* to 7 = *great increase*). Higher scores indicate a greater degree of posttraumatic growth.

Behavioral intentions to prevent climate change. Twelve items written by the first and fourth authors assessed the degree to which participants would be willing to take action regarding climate change. Examples include "Participate in a march to raise awareness about climate change" and "Use less energy at home to help stop climate change." Participants used a 5-point scale (from 1 = not at all to 5 = very much). Higher scores indicate greater willingness to take action to prevent climate change.

Demographics. Three items asked for gender, age, and education. Participants checked their choices or wrote in a number to indicate their answers.

Procedure

The study was approved by the Human Participants Research Committee at Western Washington University and the Institutional Review Board at the University of the South Pacific, and followed the American Psychological Association ethical guidelines. Prior to administering the survey, the first author trained 10 advanced university students in questionnaire administration. We administered the questionnaire in five villages that experienced extensive damage as a result of Cyclone Winston. We approached people in their homes. Participation was voluntary and no inducements were offered. It took about 20 min to complete the survey.

Results

Model Building Data Analytic Plan and Procedures

We used a model building approach to create and test a path model describing predictors of behavioral intentions to prevent climate change and climate change risk perception. During model development, determining which paths should be removed based on a single sample may cause it to be unduly influenced by sampling error. To address this problem, we randomly divided the data and used one sample to create the model (the exploratory sample, $N = 146$) and the second sample to confirm the model and test its generalizability (the confirmatory sample, $N = 128$). We used Amos version 24 (Arbuckle 2016) to conduct the path analyses with maximum likelihood estimates.

Several fit indices assessed model fit: chi square test, Standardized Root Mean Residual (SRMR), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). The chi square test examines the null hypothesis that the data did not fit the hypothesized model; non-significant chi square values indicate acceptable fit. SRMR is a measure of absolute fit, with values less than 0.08 indicating a good fit (Hu and Bentler 1999). We used CFI as a measure of incremental fit; it generally has a maximum value of 1, with larger numbers indicating better fit. A CFI of 0.95 or greater is considered a good fit (Hu and Bentler 1999). RMSEA is a measure of fit that rewards parsimonious models. It has a minimum value of 0, with lower numbers indicating better fit; cut off points values of 0.01, 0.05, and 0.08 indicate excellent, good, and poor fit (MacCallum et al. 1996).

We separated the variables into four levels, based on the theoretically-anticipated causal direction of the variables:

Level 1: Education and personal experiences of loss
Level 2: Posttraumatic growth, value orientation, social norms, knowledge, and holistic affect

Level 3: Climate change risk perception
Level 4: Behavioral intentions to take action to reduce climate change

We first created a fully saturated path model wherein every variable was allowed to relate to every other variable. Variables were allowed to correlate to variables at the same level and predicted variables at subsequent levels.

The fully saturated model resulted in a "just identified" model that perfectly replicated the sample. We ran this model, examined the correlations and regression paths, and removed those with the lowest critical ratio (those that were least statistically significant). We re-ran the new, simplified model, examined the correlations and regression paths, and again removed those with the lowest critical ratios. We continued this process until all of the remaining paths were significant at the $p < 0.05$ level, and paid careful attention to the fit indices. Removing paths results in a worsening of fit compared to the original fully saturated model; our aim was to create as simple a model as possible while maintaining acceptable fit.

Early in this process, we removed the paths from value orientation to risk perception and from value orientation to behavioral intent because they were not statistically significant. Therefore, we removed value orientation from the model because did not predict any primary variables of interest. Removing value orientation does not suggest that it is not a useful predictor. In fact, the correlations between value orientation and risk perception ($r = 0.32$) and behavioral intention ($r = 0.25$) suggest that values do predict outcomes. The removal of value orientation here is the result that, in the context of the other predictors, it does not result in additional explanatory power. The same process with a different sample might result in the retention of value orientation.

Predicting Climate Change Risk Perceptions and Behavioral Intentions: A Path Model

Figure 1 shows the final path model. The fit of this model in the exploratory sample was outstanding, as shown by the statistically non-significant chi square, X^2 (12) = 13.66, $p = 0.323$. The other fit indices also show good overall fit of the model: SRMR = 0.051, CFI = 0.991, RMSEA = 0.031.

To account for the possibility that sampling error might influence the model, we tested the fit of the final model with the confirmatory sample. Predictably, although the fit of the model was not as strong in the confirmatory sample as in the exploratory sample, the fit of the confirmatory sample was satisfactory. While the chi square was significant, X^2 (12) = 21.63, $p = 0.05$, it was only just so, suggesting marginal fit. All other fit indices were within the acceptable ranges: SRMR = 0.075, CFI = 0.961, RMSEA = 0.078. This suggests that the model generalizes reasonably well to the other sample.

Predicting behavioral intentions to prevent climate change. Three main predictors explained 18% and 32% of the variance in behavioral intention to take

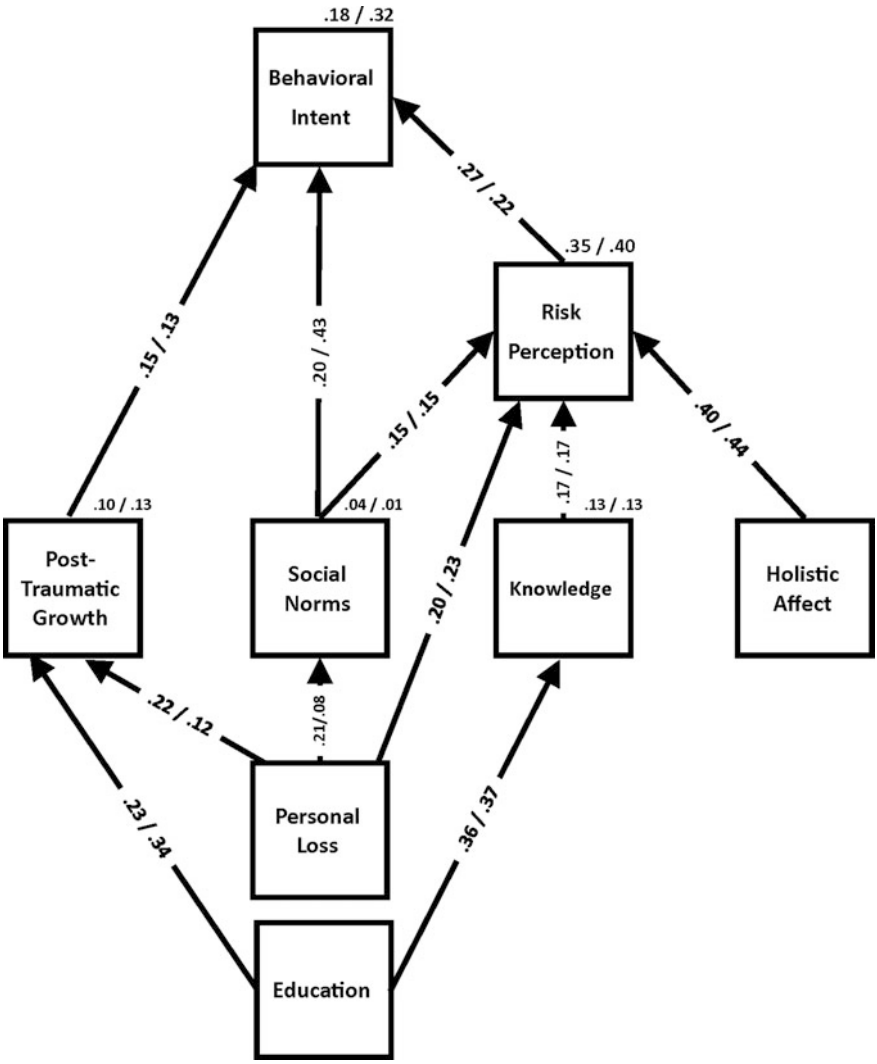

Fig. 1 Standardized path coefficients for the final path model. Coefficients before the "/" are for the exploratory sample (N = 146). Coefficients following the "/" are from the confirmatory sample (N = 128). The offset values on endogenous variables are R^2 effect-sizes. While not shown here, social norms, knowledge, and holistic affect correlated with one another, and posttraumatic growth correlated with knowledge and holistic affect

action to prevent climate change for the exploratory and confirmatory samples, respectively. Social norms was a main predictor. Figure 1 shows that participants who reported being surrounded by others who are committed to taking action to prevent climate change were more likely to express intent to take action themselves. This finding may reflect a potential "snowball effect" for climate change action. As

more individuals commit to taking action against climate change, the more normative such action becomes. Likewise, as normative action increases, the more individuals commit to action.

Figure 1 also shows that climate change risk perceptions predicted behavioral intent to prevent climate change. Higher levels of climate change risk perceptions were associated with greater behavioral intention to reduce climate change. This finding suggests a possible extension of van der Linden's (2015) climate change risk perception model. Risk perception appears to mediate the effect of most climate change risk perception predictors on behavioral intention to reduce climate change. Future research might further extend van der Linden's (2015) climate change risk perception model by using risk perception to predict behavioral intent and, ultimately, behavioral action.

Finally, Fig. 1 shows that posttraumatic growth played a role in predicting behavioral intent. In line with our previous study (Sattler et al. 2016), loss due to Cyclone Winston was associated with higher levels of posttraumatic growth. However, unlike our previous study, posttraumatic growth did not predict climate change risk perceptions in the context of the other predictors. Here, posttraumatic growth predicted behavioral intentions to prevent climate change. As such, the reprioritization of values associated with posttraumatic growth mediated the effect of loss on behavioral intentions. The extent to which Cyclone Winston survivors were able to use their traumatic experiences due to the storm and re-evaluate their priorities predicted their intention to take action concerning climate change. Finally, level of education predicted posttraumatic growth, with higher levels of education being associated with more posttraumatic growth.

Additional analysis: Posttraumatic growth, social norms, and behavioral intentions to reduce climate change. To further examine the role of posttraumatic growth in predicting behavioral intent, we ran a separate analysis on the entire sample using Hayes's (2012) PROCESS macro for SPSS, predicting behavioral intent with social norms, posttraumatic growth, and the interaction between the two. The predictors explained 25% of the variance in behavioral intention, $F(3, 270) = 30.63$, $p < 0.001$. All predictors were significant in the expected directions. Social norms and posttraumatic growth were positively associated with high levels of behavioral intention. The interaction suggested that higher levels of social norms weaken the relation between posttraumatic growth and behavioral intent, $\beta = -0.19$, $p < 0.001$. For individuals whose social norms were less supportive of climate change action, posttraumatic growth was a stronger predictor of behavioral intent. For individuals with stronger social norms, posttraumatic growth was relatively unrelated to behavioral intent. These findings suggest that posttraumatic growth is a particularly important pathway to behavioral intentions for individuals whose social norms do not already support climate change action. For individuals who have a strong social context supporting action, posttraumatic growth is less important, and social norms might better determine behavioral intentions.

Predicting climate change risk perceptions. In general, the path model for our data supports van der Linden's (2015) climate change risk perception model. Experiencing loss due to Cyclone Winston, knowledge about climate change, affect

concerning climate change, and social norms concerning climate change actions explained 35% and 40% of the variance in climate change risk perceptions in the exploratory and confirmatory samples, respectively. Figure 1 shows that individuals who experienced greater loss due to Cyclone Winston reported higher levels of climate change risk perceptions. While level of education did not directly predict climate change risk perception, it was associated with greater knowledge of the causes of climate change that, in turn, were associated with higher levels of climate change risk perception. Thus, knowledge about climate change mediated the effect of education on climate change risk perception. The findings also show that individuals with negative affect about climate change and who reported social norms consistent with behavioral intention to prevent climate change reported higher levels of climate change risk perceptions.

Discussion

The findings are the first we know of to illustrate the relationships between posttraumatic growth, climate change risk perceptions, and behavioral intentions to prevent climate change following exposure to a catastrophic cyclone in the South Pacific. The findings show three pathways to behavioral intention to prevent climate change (see Fig. 1):

Pathway 1: Posttraumatic growth mediates the relationship between both resource loss due to the cyclone and education with behavioral intentions to prevent climate change. Higher levels of resource loss and education each independently lead to posttraumatic growth, which in turn leads to behavioral intention to prevent climate change.

Pathway 2: Resource loss due to the cyclone activates social norms concerning climate change action, which in turn leads to behavioral intention to prevent climate change.

Pathway 3: Climate change risk perception mediates the influence of social norms, knowledge, and affect on behavioral intentions to prevent climate change. These findings support and extend van der Linden's (2015) model by showing they predict both climate change risk perceptions as well as behavioral intentions to prevent climate change.

The finding that posttraumatic growth influences behavioral intention to prevent climate change extends our psychological climate change risk perception model to behavioral intentions. Why might posttraumatic growth play a key role in behavioral adaptation and risk perception? According to theory and research, coping with a traumatic event can lead people to experience posttraumatic growth, wherein they reflect on their values, life meaning, and life priorities. This process of reflection may lead people to experience positive life change and gain new or heightened awareness and appreciation of life, of relationships with others, and an enhanced sense of self-efficacy (Groleau et al. 2012; Linley and Joseph 2004; Sattler et al. 2014). Posttraumatic growth has been documented among survivors of large scale

natural disasters (Sattler et al. 2006, 2014). The heightened sense of self-efficacy may increase behavioral intentions to take action to mitigate a threat, such as one posed by a cyclone whose strength can be magnified by climate change. Engagement, a positive affective motivational state that can develop in response to experiencing a traumatic event or stressful event, may encourage self-efficacy, self-esteem, and feelings of control (cf. Hobfoll 2012). These processes may explain, in part, the relationship of posttraumatic growth and behavioral intention to prevent climate change. To examine this possibility, future research could examine in more detail self-efficacy and feelings of engagement, the activities that may have promoted them, and their relationship to behavioral intentions to prevent climate change. Research also might compare and contrast the relationship among these variables with those who have little or no experience with climate change related disasters and those who have had significant exposure.

Why might social norms (1) mediate the relationship between loss of resources and behavioral intention to prevent climate change, and (2) directly influence climate change risk perceptions? We suspect this finding may reflect the effectiveness of the informational campaigns to raise awareness about climate change and the behaviors that contribute to it. In the wake of Cyclone Winston, campaigns in Fiji presented information about the threats imposed by climate change and the behaviors that contribute to it. These campaigns, as well as other experiences following the cyclone such as discussions with friends and neighbors, may have promoted the development of or reinforced existing social norms—expectations about appropriate behavior—concerning actions relevant to climate change. For example, the 350pacific.org organization promoted the Pacific Climate Warrior campaign to educate Fijians and people in other countries about how their own decisions concerning carbon dioxide emission contributes to climate change and thereby adversely affects countries in the South Pacific and around the world. Newspapers and television programs regularly published climate change stories to highlight each citizen's role in preventing it (e.g., Delaiba Tiki 2017; Panapasa 2017). Schools incorporated climate change education at all grade levels (Ministry of Foreign Affairs Ministry of Foreign Affairs, Fiji 2017). Social norms were likely salient in the communities sampled in this study, given that they were small, rural, and located along the coast in areas greatly impacted by the storm. Social norms that prescribe expected behavior, rather than those that describe behavior, may be more effective in promoting desired behavior (e.g., Cialdini et al. 2006).

The findings extend van der Linden's (2015) model by showing that the cognitive, socio-cultural, experiential, and affective components influence behavioral intentions to prevent climate change. However, whereas van der Linden found that that the experiential and socio-cultural components were most influential in climate change risk perception, we found that the experiential (viz., resource loss due to the cyclone) and affect components were most influential for behavioral intentions. It is likely that this difference reflects degree of disaster experience between the two samples and outcome. The participants in our study were living in communities

severely damaged by the cyclone, had to rebuild homes and lives, and were exposed daily to reminders of the devastation in their community. Participants in van der Linden (2015) experienced a lesser degree of damage. These findings also support, in part, a model of antecedents of climate change behavior developed by Reser et al. (2012) in Australia. The model generally states: (1) beliefs about climate change influence concern for climate change and climate change risk perceptions, (2) concern influences feelings of self-efficacy, which then influences distress about climate change, (3) distress is influenced by beliefs about climate change, concern, and risk perceptions, and (4) distress leads to feelings of responsibility, which leads to adaption and adaptive behaviors. We also note that the finding that personal experience influences judgement and behavioral intentions is consistent with the availability heuristic, which predicts that judgments are influenced, in part, by the degree to which thoughts come to mind. Risk perceptions and behavioral intentions may be stronger among people who have personal and tangible negative experience with climate change related weather events (Viscusi and Zeckhauser 2015).

We note a few limitations to the study. Because we were unable to use a pure random sampling strategy, the findings may not generalize to all persons affected by the storm or in other regions. We do not know the interrater reliability across those who administered the survey to participants.

Conclusion

This study is among the first to examine in detail how resource loss and psychological reactions such as posttraumatic growth influence climate change behavioral intentions in coastal communities in the wake of a catastrophic natural disaster whose strength was associated with climate change. The findings show that posttraumatic growth—engaging in a process of self-reflection concerning life priorities and what gives life meaning—led to behavioral intentions to prevent climate change, or adaptation. Higher levels of resource loss as a result of the cyclone and level of education each independently led to posttraumatic growth. One implication of this finding is that focusing people on what is important in their lives and enhancing a sense of self-efficacy that they can may a difference by taking action to reduce threats may motivate behavior change. The findings also show that losing valued resources activates social norms concerning climate change action, which in turn led to behavioral intention to prevent climate change. These findings support and extend our psychological model of climate change risk perceptions. The findings also extend van der Linden's (2015) model by showing climate change risk perception mediates the influence of social norms, knowledge, and affect on behavioral intentions to prevent climate change.

Taken together, the findings provide direction to increase the effectiveness of educational efforts designed to promote behaviors that mitigate climate change.

Educational efforts could underscore the connection between disasters such as hurricanes with climate change and the threats they create to life goals, values, and property, and present clear and tangible actions people can take to reduce and minimize behaviors that contribute carbon dioxide to the atmosphere (viz., minimize their carbon footprint). When people have not experienced the consequences of climate change (e.g., life threat, loss, or engaged in the process of posttraumatic growth) and/or are not aware of how the consequences affect their lives, then educational campaigns could present information in vivid ways about how climate change impacts people. Vivid information influences behavior change to a greater degree than abstract or statistical information (cf. Sattler et al. 1995). One approach would be to share the experiences of survivors of hurricanes associated with climate change and of others whose lives were negatively impacted by climate change (cf. Blennow et al. 2012; Taylor et al. 2014). Research is needed to develop such educational campaigns and assess their effectiveness.

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