Cite as: Gibson, K.E., Barnett, J., Haslam, N. and Kaplan, I., 2020. The mental health impacts of climate change: Findings from a Pacific Island atoll nation. *Journal of anxiety disorders*, *73*, p.102237.

The mental health impacts of climate change: Findings from a Pacific Island atoll nation

Authors and author affiliations

Gibson. K. E.[*1,2], Barnett, J.[3], Haslam, N.[2], Kaplan, I.[4]

[*]*Corresponding author*

[1] *Phoenix Australia Centre for Posttraumatic Mental Health, The University of Melbourne, Level 3, 161 Barry Street, Carlton, VIC, 3053, Australia.*

Kari Edwina Gibson. Tel: +61 3 9035 5599. Email: kari.gibson@unimelb.edu.au. ORCID iD: 0000-0002-4207-5882

[2] *School of Psychological Sciences, The University of Melbourne, Level 12, Redmond Barry Building, Parkville, VIC, 3010, Australia.*

Nick Haslam. Tel: +61 3 8344 6379. Email: nhaslam@unimelb.edu.au. ORCID iD: 0000-0002-1913-2340

[3] *School of Geography, The University of Melbourne, 207-221 Bouverie St., Carlton, VIC, 3053, Australia.*

Jon Barnett. Tel: +61 3 8344 0819. Email: jbarn@unimelb.edu.au. ORCID iD: 0000-0002-0862-0808

[4] *The Victorian Foundation for Survivors of Torture, 4 Gardiner Street, Brunswick, VIC, 3056, Australia.*

Ida Kaplan. Tel: +61 3 9389 8900. Email: kaplani@foundationhouse.org.au

Author contributions

K.G. conducted the fieldwork, analysed the findings, and drafted the manuscript.

J.B revised the manuscript.

K.G, J.B., N.H and I.K contributed to the development of the study methodology and interview questions.

All authors approved the final version of the published manuscript.

Acknowledgements and funding sources

The authors wish to acknowledge the contributions made by Mrs Teawa Toromon and Miss Angela T. Nitz, who worked as Research Assistants during fieldwork, and Ms Luanna-Marie Latasi, Mr Monise Toloa and Mr Paani Laupepa, who assisted with the translation of assessment materials.

This work was supported by a Golden Key International Honors Society project grant.

The interview schedule and syntax used for the analyses described in this study are available for research purposes from the corresponding author on request.

Key words

Climate change, Pacific Island, Tuvalu, mental health, distress.

Competing interests statement

The authors declare they have no actual or potential competing financial interests.

Ethical statement

This research was conducted with the knowledge and approval of the University of Melbourne Human Ethics Sub Committee, Ethics ID 1646416.1, and was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Abstract

Background: Climate change is anticipated to have profound effects on mental health, particularly among populations that are simultaneously ecologically and economically vulnerable to its impacts. Various pathways through which climate change can impact mental health have been theorised, but the impacts themselves remain understudied.

Purpose: In this article we applied psychological methods to examine if climate change is affecting individual mental health in the Small Island Developing State of Tuvalu, a Pacific Island nation regarded as exceptionally vulnerable to climate change. We determined the presence of psychological distress and associated impairment attributed to two categories of climate change-related stressor in particular: 1) local environmental impacts caused or exacerbated by climate change, and 2) hearing about global climate change and contemplation of its future implications.

Methods: The findings draw on data collected in a mixed-method study involving 100 Tuvaluan participants. Data were collected via face-to-face semi-structured interviews that lasted 45 minutes on average and were subjected to descriptive, correlational, and between-group analyses.

Results: The findings revealed participants' experiences of distress in relation to both types of stressor, and demonstrated that a high proportion of participants are experiencing psychological distress at levels that reportedly cause them impairment in one or more areas of daily life.

Conclusions: The findings lend weight to the claim that climate change represents a risk to mental health and obliges decision-makers to consider these risks when conceptualizing climate-related harms or tallying the costs of inaction.

1. Introduction

Climate change represents a major threat to mental health (APA Task Force, 2009; Doherty & Clayton, 2011; McMichael et al., 2003). It is thought that climate change-related mental health impacts can occur through three pathways (APA Task Force, 2009; Clayton, Manning, Krygsman, & Speiser, 2017; Doherty & Clayton, 2011; Fritze, Blashki, Burke, & Wiseman, 2008). First, it is well understood that extreme weather events can adversely impact mental health among those directly or indirectly exposed (North & Pfefferbaum, 2013), causing heightened psychological distress and increased rates of psychiatric disorder (Beaglehole et al., 2018). Common post-disaster disorders include alcohol abuse disorder, posttraumatic stress disorder, obsessive compulsive disorder and major depressive disorder (Reifels, Mills, Dückers, & O'Donnell, 2019). Populations at risk of chronic or repeated disaster may be at heightened risk of mental health problems (Morrissey & Reser, 2007). If climate change is perceived to be the cause of disaster, the disaster experience may be perceived as a portent of worsening impacts to come, potentially compounding distress (Lowry, 2011).

Second, observations of gradual environmental change can also impact mental health. Sometimes described by the term 'solastalgia' (Albrecht et al., 2007) and elsewhere as 'ecological loss' (Cunsolo & Ellis, 2018) or 'ecological stress' (Helm, Pollitt, Barnett, Curran, & Craig, 2018), psychological distress can arise from observing changes to one's environment over time and experiencing an associated sense of loss (Connor, Albrecht, Higginbotham, Freeman, & Smith, 2004; Connor, Higginbotham, & Albrecht, 2001; Cunsolo Willox, Harper, Edge, et al., 2013). This loss may be especially great for individuals and communities with strong identity ties and attachment to their environment (Ellis & Albrecht, 2017; Fresque-Baxter & Armitage, 2012), both of which are often essential to the mental health of indigenous populations in particular (Berry et al., 2008; Green, 2006). In the case of both extreme weather events and gradual environmental changes, it is not just the immediate impacts, but the resulting medium- and long-term social, economic, and cultural changes that act as drivers of distress and disorder (Cunsolo Willox, Harper, Ford, et al., 2013;

Cunsolo Willox et al., 2012; Fritze et al., 2008), together with the creation of social conditions that can undermine mental health, such as increased competition for resources, fracturing of communities, and displacement (Clayton et al., 2017).

Third, messages conveyed through public discourse about the predicted future impacts of climate change, or impacts occurring elsewhere in the world, can also affect individual mental health (Dodgen et al., 2016; Fritze et al., 2008; Morrissey & Reser, 2007; Moser, 2013; Moser & Dilling, 2008). A small number of studies have demonstrated that individuals, including those who are well insulated from any directly observable climate change impacts, often experience distress (including fear, helplessness, sadness, guilt, anger and worry) on hearing or learning about climate change (Böhm, 2003; Maibach, Roser-Renouf, & Leiserowitz, 2009; Norgaard, 2006; Reser, Bradley, Glendon, Ellul, & Callaghan, 2012; Searle & Gow, 2010). However, on the whole, the relationship between mental health and these more temporally or geographically distant climate change stressors, learned about through public discourse, remains poorly understood. Research has yet to clarify the impacts of climate change-related distress derived from messages about future or distant climate change impacts of these stressors on individual functioning, or on any other indicator of potential clinically-significant distress. This is problematic, because if the mental health impacts of climate change are inadequately captured in research or are routinely minimised as fleeting affective states without mental health implications, they risk being unacknowledged and unaddressed.

Another important lacuna in climate change and mental health research is the gap in evidence concerning the impacts of climate change on the mental health of people who are most vulnerable to climate change. For example, while the particular vulnerability of Small Island Developing States (SIDS) to global climate change is widely recognized (Nurse et al., 2014), there are few published empirical studies that focus explicitly on the individual mental health toll associated with climate change stressors in these countries. A rare exception is a mixed-method study published by Asugeni et al., which documented levels and impacts of worry associated with sea-level rise in a coastal region of the Solomon Islands (Asugeni, MacLaren, Massey, & Speare, 2015). Addressing these gaps,

we applied psychological methods to examine if climate change is affecting mental health in the Small Island Developing State of Tuvalu, and the effects this has on individual functioning.

1.1 Understanding the mental health impacts of climate change in Tuvalu

Tuvalu is a small Pacific Island nation comprised of atolls with an average elevation less than two meters above sea level. Climate change is creating challenges here that, in combination with other social and economic changes, could ultimately render the nation uninhabitable (Farbotko, Stratford, & Lazrus, 2015). Local observations of coastal inundation and erosion, storm wave damage, groundwater salinization, rising temperatures, crop failures, and droughts are widespread (Dix, 2011; Gibson, 2018; Lazrus, 2015; Tuvalu Department of Environment, 2007). Moreover, stories of future climate-related dangers circulate widely within Tuvalu, such that the globally-oriented 'Tuvalu is sinking' trope is equally well-known among locals (Gibson, 2018). Tuvaluans therefore have high levels of exposure to both local and abstract climate change stressors, yet no study has previously investigated the individual mental health burden associated with climate change in Tuvalu.

In this study we draw a distinction between two categories of potential climate change stressor. 'Locally observed climate changes' refer to environmental changes and events, attributable in whole or part to climate change, that people directly observe. These environmental changes and events may or may not be associated with climate change according to the individual, but if they adversely affect daily life, or undermine the social conditions that protect mental health, they are likely to drive distress irrespective of how individuals explain them. In contrast, 'abstract knowledge of climate change' refers to geographically or temporally distant environmental changes or threats that individuals come to associate with the term 'climate change'. These are encountered when people hear about climate change or reflect on its implications, and are mediated by media and other communicators of climate change information. Abstract climate change stressors are further influenced by the values, ideologies and receptivity of the receiving audience to the climate change messages in circulation (Hulme, 2009; Leiserowitz, 2005). For example, in the case of deeply

Christian Tuvalu, religious interpretations of the covenant made between God and Noah (Genesis, 9:9-16, King James Version) have at times worked against recognition of climate change risks and acceptance of scientific narratives regarding its causes (Gibson, Haslam, & Kaplan, 2019). With these two types of climate change stressor thus defined, we aimed to answer the following questions:

1) Do participants report distress on account of each type of climate change stressor?
2) To what extent does reported distress impact on individuals' daily functioning?

2. Methods

To understand distress associated with the two types of stressor under investigation - 'locally observed climate changes' and 'abstract knowledge of climate change' - we interviewed 100 Tuvaluan participants on Funafuti atoll. One participant per household was eligible to participate, with the sample constituting 11.43 percent of total Funafuti households. The study formed part of a larger, mixed-method, cross-sectional study conducted on Funafuti atoll between August and October 2016.

Semi-structured interviews were conducted with residents at their homes by the first named author and a Tuvaluan research assistant. Participants could complete the interview in Tuvaluan or English. To ensure a representative sample from across the different villages of Funafuti, the number of participants recruited from each village was proportionate to the number of residents per village, according to census data (Tuvalu Government, 2013). Within each village, houses were targeted if there were signs of occupation at the time of recruiting. Recruitment ensured an equal number of men and women, and an equal number of participants across four age groups: 18-24 (youth), 25-39 (young adults), 40-54 (middle-aged adults), and ≥ 55 (older adults). All participants identified as Tuvaluan, were at least 18 years of age, and were residents of Funafuti. Participants' demographic information is shown in Table 1.

Table 1: Participant demographic information

Demographic category	Sub-category / range	*n* / M
Age	18 – 24	23
	25 – 39	26
	40 – 54	25
	≥ 55	26
Gender	Male	50
Village	Central village	63
	Outer village	37
Island of ancestry	Funafuti	25
	Outer island	73
	Another country	2
Island of birth	Funafuti	34
	Outer island	43
	Other*	23
Highest level of completed education	Primary	25
	Secondary	46
	Tertiary or vocational training	29
Primary occupation	Employed	29
	Home-based business	21
	Unpaid work (subsistence or voluntary)	9
	Study	11
	Retired	10
	Unemployed	20
Marriage status	Married	66
Children (biological or adopted)	Yes	72
Household size	2 - 26	7.97
Number of formally employed household members	0 - 6	2.18
Sufficient household income to meet basic needs	Yes	44
	Sometimes	38
	No	18
Number of household subsistence activities	0 - 5	3.00
Church membership	EKT	65
	Other	35
Church activities attended per week	0 - 7	1.68
Access to a trusted confidant	Yes	78
Current medical condition	Yes	27

*12 participants were born on Banaba Island (aka Ocean Island) or elsewhere in the Republic of Kiribati. Eight participants were born on Nauru, one was born on Kioa Island, one in New Zealand and one in Samoa. All participants identified as Tuvaluan.

Interviews adhered to an interview schedule comprising a demographic section, a psychological distress questionnaire (a culturally-adapted version of the 25-item Hopkins-Symptom Checklist), a section on locally observable climate changes, and a section on abstract knowledge of climate change. The complete interview schedule and the process of adapting the HSCL-25 are outlined in Gibson (2018).

The section on locally observable climate change stressors consisted of i) a checklist of 10 local climate change stressors, which participants answered 'yes' or 'no' to according to whether or not they had been exposed to each one; ii) a 4-point Likert scale comprising the same 10 stressors, which participants used to indicate the degree to which they appraised each stressor as problematic; iii) a 4-point Likert scale comprising four, widely-used Tuvaluan terms for distress (*fanoanoa*, sadness; *manavase,* worry/anxiety; *kaitaua* anger; *se lei, se malosi/vaaivai,* poor health/unwell), which participants used to indicate their level of distress about those local climate change stressors that they had been exposed to (collectively); and iv) a 4-point Likert scale comprising five activity domains common across Tuvalu, which participants used to indicate their level of impairment in each domain resulting from distress caused by locally observed climate changes. These domains were derived on the basis of a previous qualitative study conducted in Tuvalu (Gibson, 2018), and comprised caring for household members; contributing to household tasks; attending community, church or social events; engaging in leisure activity; and studying or working (where applicable). The ten types of local climate change stressors investigated were based on what Funafuti residents and key informants working in environment reported to be local impacts of climate change in a previous study (Gibson, 2018). These included difficulty growing crops, trees/plants dying or falling down, cyclones or cyclone warnings, decreasing fish or marine life, high temperatures, changing weather/seasonal patterns, drought, high tides, coastal erosion, and water pooling above ground.

The section on abstract knowledge of climate change consisted of the same four sections, but each section pertained to the three abstract climate change stressors, instead of the 10 local climate change stressors. These three abstract climate change stressors were hearing about climate change;

reflecting on the implications of future climate change impacts for self, family and community; and reflecting on the implications of future climate change impacts for Tuvalu.

Responses were recorded in writing and open-ended questions were audio-recorded. Interviews lasted 45 minutes on average. In two cases, the interview was terminated prior to completion and the distress protocol was enacted as a result of the participant expressing extreme levels of distress when completing the HSCL-25 Tuvalu. These two cases were excluded from all demographic and statistical analyses. Descriptive, correlational and between-group analyses were then conducted.

The adopted methodology was chosen in light of the absence of any measures of climate change exposure, appraisal, or distress, or any measure of psychological distress, having been previously used or validated in Tuvalu. Consequently, all measures used were purposively designed or adapted for this study and were translated and back-translated (blind) before use. Cronbach's alpha estimates of internal consistency was derived for climate change distress and impairment scales, and for the adapted psychological distress scale, with results indicating robust levels of internal consistency (alpha estimates ranged from.80 to .87) (Taber, 2018). The project relied exclusively on self-report data.

3. Results

Climate change stressors (locally experienced or abstract) were reported to be a cause of distress in all but five cases. A majority of participants (62.24%) reported at least one extreme indicator of distress (i.e. extreme *fanoanoa* (sadness), *manavase* (worry/anxiety), *kaitaua* (anger), or *se lei, se malosi/vaaivai* (poor health), in response to local or abstract climate change stressors (or both). In the majority of cases (87%), this distress was at a level that impaired people's ability to perform typical daily tasks (Table 2).

Table 2. The aggregate mean and standard deviation for levels of distress and associated impairment attributed by participants to local and abstract climate change stressors respectively

Outcome	Stressor	M(SD)	Scale range (min, max)
Climate change distress	Local observations of climate changes	2.33(.87)	(1.00, 4.00)
	Abstract knowledge of climate change	2.20(.89)	(1.00, 4.00)
Impairment attributed to climate change distress	Local observations of climate changes	1.83(.81)	(1.00, 4.00)
	Abstract knowledge of climate change	1.89(.84)	(1.00, 4.00)

In response to questions about local climate change stressors, 90 of 98 participants (91.84%) reported distress, while 53 (54.08%) participants described their experience of *fanoanoa* (sadness), *manavase* (worry/anxiety), *kaitaua* (anger), or *se lei, se malosi/vaaivai* (poor health) as 'extreme'.

Participants most commonly reported worry/anxiety (n=84) in response to local climate change stressors, which, when elaborating on their responses during interviews, they described being especially prominent in response to wave damage, cyclone, and freshwater shortages. Participants also reported profound sadness about observed environmental impacts (n=79), particularly in response to losing their homes in consequence of erosion and cyclone, and their decreasing capacity to grow subsistence crops.

> I'm sad for everything I've built. We can't stop it, just try and escape from it. *(Participant 56, male, 38 years old)*

> I'm sad because of losing our house, because the house is like your parent, where you live all your life. It protects you. *(Participant 79, female, 54 years old)*

Of these 90 participants, 68 (75.56%) reported consequent impairment in at least one area of daily life, and 30 (33.33%) reported that at least one area of daily life had been 'extremely' impaired on account of this distress.

> If the thoughts are there, it can stop me going to social events. I just stay home. *(Participant 52, male, 51 years old)*
>
> It's a problem, because when I want to attend church, or family occasions, the thought always comes into my mind, 'If I'm here at a family occasion, and there's a warning of a cyclone, it is very far for me to get from the village back home'. *(Participant 70, female. 56)*

In response to questions about abstract climate change stressors, 82 participants (83.67%) reported distress, while 42 (42.86%) participants described their experience of *fanoanoa* (sadness), *manavase* (worry/anxiety), *kaitaua* (anger), or *se lei, se malosi/vaaivai* (poor health) as 'extreme'.

Participants' distress in response to abstract climate change stressors most commonly took the form of sadness (n=77) and worry (n=76), often about safety and lack of disaster preparedness, and about where to go in the event of having to leave Tuvalu.

> I feel really scared hearing all this on the radio, about climate change. You never know if it comes true. Maybe we won't be prepared. We just sit there and wait to die. *(Participant 68, female, 20 years old)*
>
> I know I'll be leaving soon, but when news comes that Tuvalu is affected or will sink, it makes me cry. Because I was born here, I'm Tuvaluan. *(Participant 84, female, 63 years old)*

Of these 82 participants, 65 (79.27%) reported consequent impairment in at least one area of daily life, and 23 (28.05%) reported that at least one area of daily life had been 'extremely' impaired due to this distress.

> Sometimes I want to sleep, but I can't because those thoughts about climate change keep popping up… Thoughts about this distract me from my study. *(Participant 53, male, 18 years old)*
>
> I hardly go out, because of those feelings. *(Participant 56, male, 38 years old)*

> The thoughts can pop up in my head and be distracting. It disturbs my leisure time, my relaxation *(Participant 55, male, 53 years old)*

The average level of distress reported in response to local (M=2.33, SD=.87) and abstract (M=2.20, SD=.89) climate change stressors did not significantly differ, t(93)=1.81, *p*=.07.

In the case of both local and abstract climate change stressors, participants with greater financial hardship reported significantly greater distress. Specifically, participants who reported having the capacity to meet their basic household needs (n=44) reported significantly less distress from local climate change stressors (M=2.10, SD=.83) than those who reported *not* consistently being able to meet household needs (n=54, M =2.52, SD =.86), t(96)=2.48, *p* =.015. Similarly, participants who reported having the capacity to meet their basic household needs reported significantly less distress from abstract climate change stressors (M=1.95, SD=.78) than other participants (M=2.39, SD=.92), t(92)=2.43, *p* =.017.

Distress attributed to both types of climate change stressor showed small-to-moderate correlations with psychological distress more broadly defined, which was measured using a culturally-adapted and translated version of the 25-item Hopkins Symptom Checklist (r =.212, n=98, *p*=.036 in the case of local climate change stressors, and r=.240, n=82, *p*=.030 in the case of abstract climate change stressors).

4. Discussion

It is often stated that the mental health impacts of climate change will be greatest for people already facing multiple sources of hardship (Berry, Bowen, & Kjellstrom, 2010), yet due to challenges inherent in conducting research in such settings, these populations remain underrepresented in psychological research. This research goes a small way towards redressing this gap.

This study demonstrated for the first time that both local climate changes unfolding in Tuvalu, as well as abstract knowledge of future climate change threats, are causing Tuvaluans psychological

distress. This distress is extreme for the majority of residents, and leads to impairment in daily functioning, according to participants own self-reporting. The results showed little difference in levels of distress or impairment in response to local observations of climate change or to abstract knowledge of climate change; both mattered to residents' mental health to approximately equal degrees.

These findings support the claim that local climate change stressors can impact mental health, consistent with existing evidence of the mental health impacts of extreme weather events (Beaglehole et al., 2018; North & Pfefferbaum, 2013) and gradual environmental changes (Connor et al., 2004; Connor et al., 2001; Cunsolo Willox, Harper, Edge, et al., 2013). The present findings contribute to this pool of evidence by contributing the first account of such impacts in Tuvalu, where we can see that the impacts of local environmental changes attributable in whole or part to climate change are driving extreme distress among a majority of participants. In Tuvalu, as in other low-resource settings whose vulnerability to environmental change and disaster is predicted to escalate with continued climate change, there is clearly a need for increased social and mental health services capable of responding to a likely surge in climate change-related mental health difficulties. This need is pressing when we consider that the majority of participants sampled are already reporting impairment in one or more areas of daily life in consequence of climate change-related distress, which inevitably carries implications for broader community and societal functioning.

The findings of the present study also lend weight to claims that encountering climate change abstractly can adversely impact mental health. In Tuvalu, the level of distress attributed to abstract climate change stressors was extreme for close to half of the participants sampled, and was comparable to the level of distress attributed to local climate change stressors. This is contrary to what might be anticipated on the basis of existing research, which has largely overlooked the potential mental health impacts of abstract climate change stressors. Furthermore, this distress is driving individual impairment for a majority of people. By documenting the consequences of distress arising from abstract knowledge of climate change upon individual impairment, these findings

extend the emerging body of evidence that to date has given voice to individuals' experiences of emotional distress in response to learning or thinking about climate change (Böhm, 2003; Maibach et al., 2009; Norgaard, 2006; Reser et al., 2012; Searle & Gow, 2010), but has not examined the significance of this distress in relation to individual functioning or any other marker of clinical significance or severity. By considering both distress and its functional consequences for the individual, the present findings convey the significance of these experiences to people's everyday lives. Similarly, the comparable level of distress attributed by participants to abstract knowledge of climate change on the one hand, and local climate changes on the other, reinforces the significant mental health consequences that thinking and reflecting on the threat of climate change can have for individual mental health.

The distress that participants attributed to both types of climate change stressor showed small-to-moderate correlations with psychological distress more broadly defined. The sizes of these correlations broadly align with correlations between climate change distress and psychological distress reported elsewhere (Searle & Gow, 2010), and support the conclusion that individual distress about climate change may contribute to the development and/or maintenance of clinical levels of depression and anxiety (Searle & Gow, 2010). It is also in keeping with the premise, dominant in psychiatry and clinical psychology, that psychological disorder arises from a combination of biological, psychological, and social factors (Borrell-Carrió, Suchman, & Epstein, 2004; Penninx et al., 2008; Santos, Bashaw, Mattcham, Cutcliffe, & Giacchero Vedana, 2018), with climate change representing just one of many social factors relevant to mental health in this setting (Gibson et al., 2019). Nonetheless, these correlations, in conjunction with the considerable impairment that participants reported in consequence of climate change distress specifically, suggest that climate change is a factor worthy of attention if we want to protect the future mental health of residents living in settings where the adverse impacts of climate change are only likely to escalate.

In addition to furthering our understanding of the relationship between climate change and mental health, the finding that abstract climate change stressors are associated with distress at a level that can cause impairment carries important implications for how climate change is communicated. Social institutions and actors mediate what climate change information is disseminated and how. In doing so, they stand to influence the individual mental health consequences associated with abstract climate change stressors. While the potential for dissemination of climate change information to cause distress may well be regarded as an acceptable consequence of providing information that can potentially lead to increased mitigative or adaptive efforts, if dissemination is failing to achieve these aims, its value relative to its mental health costs is a matter warranting debate.

Existing research on climate change communication provides reason for caution when assuming that information dissemination translates into desired action. The relationship between exposure to climate change messages and attitudinal and behavioural outcomes has been a focus of much previous psychological research (Feldman & Hart, 2017; Geiger, Swim, & Fraser, 2017; Hine et al., 2016; Spence, Pidgeon, & Uzzell, 2008), motivated often by a desire to reduce climate change apathy and motivate pro-environmental behavioural change among populations of high-emitting nations. This research has demonstrated the fallacy of assuming that simply providing information about climate change will translate into the desired behavioral changes (Gardner & Stern, 1996; Swim, Geiger, & Zawadzki, 2014). How climate change information is shared, and who shares it, matters greatly when it comes to changing people's minds or behaviors (Fielding, Hornsey, & Swim, 2014; Guber, 2012). If media outlets provide information perceived by audiences to be associated with ideologies different to their own, or targeted to communities of interest they do not belong to, the information is likely to be ignored or discounted in favour of narratives shared by trusted persons that align with individuals' existing beliefs (Stern & Raimi, 2015). In the meantime, as demonstrated in this study, such messages may nonetheless cause adverse mental health impacts. Further, recent research concerning the role of affect in climate change communication suggests that messages about climate change threat might only be effective at promoting engagement when

accompanied by messages about efficacy (Hart & Feldman, 2014), although this remains contested (Skurka, Niederdeppe, Romero-Canyas, & Acup, 2018). Threatening messages are widely successful at evoking fear and increasing issue salience, but fear appeals can also lead to counterproductive outcomes such as problem minimization, distancing, scepticism, and helplessness (Feinberg & Willer, 2011; Nabi, Gustafson, & Jensen, 2018; O'Neill & Nicholson-Cole, 2009; Smith & Leiserowitz, 2014). These findings point to the need for careful design and pretesting to ensure that climate change information is received, processed, and responded to as intended, as has been recommended elsewhere (Maibach, Roser-Renouf, & Leiserowitz, 2008), without causing undue psychological distress and impairment.

The findings of the present study also provide evidence that that people who are already relatively disadvantaged are likely to suffer the greatest distress about climate change; a claim supported by research in other settings (Doherty & Clayton, 2011; IPCC, 2013). Climate change distress was particularly high among persons who reported insufficient household income to meet their basic needs. This finding resonates with a previous study conducted in Tuvalu, which identified salient social, cultural, and environmental stressors in contemporary Funafuti (Gibson et al., 2019). In that study, participants identified financial hardship as a key determinant of distress, which occurred in a context of increasing dependency on monetary income relative to subsistence-based activities - a change partly attributable to climate change (Gibson et al., 2019). Considering these findings together with those of the present study, we can see the intersection of two important stressors: poverty and climate change. Each carries its own implications for mental health, while also potentially increasing individual vulnerability to the other stressor, thereby compounding distress. These intersections between stressors and their implications for individual mental health are poorly understood, and represent promising areas for future research.

4.1 Limitations

The reported findings must be interpreted with respect to the study's limitations. As noted in the methods section, the measures used were designed or adapted for the purpose of this study and have not been previously used or validated in this setting. The sampling approach adopted, though systematic, was not random, and extrapolation of the findings to the wider Tuvaluan population must therefore be made with caution. Working across cultures and languages also creates challenges for reliability. The author relied on the interpreting skills of two Tuvaluan research assistants who were trained to attend to factors that could compromise the reliability of interview data, and they and the author met regularly to discuss any ambiguous Tuvaluan terms or discrepancies in interpretation. Even so, it is possible that nuances of meaning conveyed subtly by participants were sometimes missed or overlooked. The small size of the population also meant that some participants were already acquainted with the research assistants, and the author was not privy to how the relationship history between the participants and research assistants might have influenced what was communicated in interviews.

4.2 Conclusions

This study provides novel insights into the relationship between different types of climate change stressors and mental health (specifically distress and associated impairment) in the Pacific Island atoll nation of Tuvalu, a setting where this relationship has hitherto never been investigated. The finding that distress is being experienced to a degree that individuals report causes significant impairment in their day-to-day functioning strengthens the widespread assumption that residents of nations highly vulnerable to climate change are already experiencing climate change in ways that undermine individual mental health. The findings also further understanding of the different stressors subsumed under the label of 'climate change' that can impact distress, and encourages reflection on the ways in which different approaches to climate change communication may implicate this relationship. Collectively, the findings of the present study compel researchers, mental health practitioners, and policy-makers alike to pay attention to the impacts arising from multiple

different types of climate change stressor that are simultaneously impacting individuals when attempting to tally the mental health costs associated with climate change.

References

Albrecht, G., Sartore, G., Connor, L., Higginbotham, N., Freeman, S., Kelly, B., . . . Pollard, G. (2007). Solastalgia: The distress caused by environmental change. *Australasian Psychiatry, 15 Suppl 1*, S95-98. doi:10.1080/10398560701701288

American Psychological Association Task Force on the Interface Between Psychology and Global Climate Change. (2009). *Psychology and global climate change: Addressing a multifaceted phenomenon and set of challenges*. Retrieved from http://www.apa.org

Asugeni, J., MacLaren, D., Massey, P. D., & Speare, R. (2015). Mental health issues from rising sea level in a remote coastal region of the Solomon Islands: Current and future. *Australasian Psychiatry, 23 Suppl 6*, S22-25. doi:10.1177/1039856215609767

Beaglehole, B., Mulder, R. T., Frampton, C. M., Boden, J. M., Newton-Howes, G., & Bell, C. J. (2018). Psychological distress and psychiatric disorder after natural disasters: Systematic review and meta-analysis. *British Journal of Psychiatry, 213*(6), 716-722. doi:10.1192/bjp.2018.210

Berry, H. L., Bowen, K., & Kjellstrom, T. (2010). Climate change and mental health: A causal pathways framework. *International Journal of Public Health, 55*(2), 123-132.

Berry, H. L., Kelly, B., Hanigan, I. C., Coates, J. H., McMichael, A. J., Welsh, J. A., & Kjellstrom, T. (2008). *Garnaut climate change review: Rural mental health impacts of climate change*. Retrieved from The Australian Government's Department of Climate Change and Energy Efficiency website: http://www.garnautreview.org.au

Böhm, G. (2003). Emotional reactions to environmental risks: Consequentialist versus ethical evaluation. *Journal of Environmental Psychology, 23*(2), 199-212. doi:10.1016/S0272-4944(02)00114-7

Borrell-Carrió, F., Suchman, A. L., & Epstein, R. M. (2004). The biopsychosocial model 25 years later: Principles, practice, and scientific inquiry. *Annals of Family Medicine, 2*(6), 576-582. doi:10.1370/afm.245

Clayton, S., Manning, C., Krygsman, K., & Speiser, M. (2017). *Mental health and our changing climate: Impacts, implications, and guidance*. Retrieved from the American Psychological Association website: https://www.apa.org

Connor, L., Albrecht, G., Higginbotham, N., Freeman, S., & Smith, W. (2004). Environmental change and human health in the Upper Hunter communities of New South Wales, Australia. *EcoHealth, 1*(2), 47-48.

Connor, L., Higginbotham, N., & Albrecht, G. (2001). *Health social science: A transdisciplinary and complexity perspective*. Oxford: Oxford University Press.

Cunsolo, A., & Ellis, N. R. (2018). Ecological grief as a mental health response to climate change-related loss. *Nature Climate Change, 8*(4), 275-281. doi:10.1038/s41558-018-0092-2

Cunsolo Willox, A., Harper, S. L., Edge, V. L., Landman, K., Houle, K., & Ford, J. D. (2013). The land enriches the soul: On climatic and environmental change, affect, and emotional health and well-being in Rigolet, Nunatsiavut, Canada. *Emotion, Space and Society, 6*(0), 14-24. doi:10.1016/j.emospa.2011.08.005

Cunsolo Willox, A., Harper, S. L., Ford, J. D., Edge, V. L., Landman, K., Houle, K., . . . Wolfrey, C. (2013). Climate change and mental health: An exploratory case study from Rigolet, Nunatsiavut, Canada. *Climatic Change, 121*(2), 255-270. doi:10.1007/s10584-013-0875-4

Cunsolo Willox, A., Harper, S. L., Ford, J. D., Landman, K., Houle, K., & Edge, V. L. (2012). "From this place and of this place": Climate change, sense of place, and health in Nunatsiavut, Canada. *Social Science & Medicine, 75*(3), 538-547.

Dix, C. V. (2011). *Tuvalu: Balancing climate change and development initiatives in a Small Island Developing State.* (Master's thesis), Retrieved from ProQuest Dissertations & Theses Global Database (Accession number 881755748).

Dodgen, D., Donato, D., Kelly, N., La Greca, A. M., Morganstein, J., Reser, J. P., . . . Ursano, R. J. (2016). Mental health and well-being *The impacts of climate change on human health in the United States: A scientific assessment* (pp. 217-246). Washington, DC: United States Global Change Research Program.

Doherty, T. J., & Clayton, S. (2011). The psychological impacts of global climate change. *American Psychologist, 66*(4), 265-276.

Ellis, N. R., & Albrecht, G. (2017). Climate change threats to family farmers' sense of place and mental wellbeing: A case study from the Western Australian Wheatbelt. *Social Science & Medicine, 175*, 161-168. doi:10.1016/j.socscimed.2017.01.009

Farbotko, C., Stratford, E., & Lazrus, H. (2015). Climate migrants and new identities? The geopolitics of embracing or rejecting mobility. *Social and Cultural Geography, 17*(4), 533-552. doi:10.1080/14649365.2015.1089589

Feinberg, M., & Willer, R. (2011). Apocalypse soon? Dire messages reduce belief in global warming by contradicting just-world beliefs. *Psychological Science, 22*(1), 34-38. doi:10.1177/0956797610391911

Feldman, L., & Hart, P. S. (2017). Is there any hope? How climate change news imagery and text influence audience emotions and support for climate mitigation policies. *Risk Analysis, 38*(3), 585-602. doi:10.1111/risa.12868

Fielding, K. S., Hornsey, M. J., & Swim, J. K. (2014). Developing a social psychology of climate change. *European Journal of Social Psychology, 44*(5), 413-420. doi:10.1002/ejsp.2058

Fresque-Baxter, J. A., & Armitage, D. (2012). Place identity and climate change adaptation: A synthesis and framework for understanding. *WIREs Climate Change, 3*, 251-266. doi:10.1002/wcc.164

Fritze, J. G., Blashki, G., A., Burke, S., & Wiseman, J. (2008). Hope, despair and transformation: Climate change and the promotion of mental health and wellbeing. *International Journal of Mental Health Systems, 2*(13), 13-23.

Gardner, G. T., & Stern, P. C. (1996). *Environmental problems and human behavior*. Needham Heights, MA: Allyn & Bacon.

Geiger, N., Swim, J. K., & Fraser, J. (2017). Creating a climate for change: Interventions, efficacy and public discussion about climate change. *Journal of Environmental Psychology, 51*, 104-116. doi:10.1016/j.jenvp.2017.03.010

Gibson, K. (2018). *The Relationship between Climate Change and Psychological Distress: A case study from Tuvalu. PhD.* (Master of Psychology (Clinical) / Doctor of Philosophy PhD), The University of Melbourne, School of Psychological Sciences.

Gibson, K., Haslam, N., & Kaplan, I. (2019). Distressing encounters in the context of climate change: Idioms of distress, determinants, and responses to distress in Tuvalu. *Transcultural Psychiatry, 56*(4), 667-696. doi:10.1177/1363461519847057

Green, D. (2006). *Climate change and health: Impacts on remote indigenous communities in Northern Australia*. Retrieved from the CSIRO website: https://publications.csiro.au

Guber, D. L. (2012). A cooling climate for change? Party polarization and the politics of global warming. *American Behavioral Scientist, 57*(1), 93-115. doi:10.1177/0002764212463361

Hart, P. S., & Feldman, L. (2014). Threat without efficacy? Climate change on U.S. network news. *Science Communication, 36*(3), 325-351. doi:10.1177/1075547013520239

Helm, S. V., Pollitt, A., Barnett, M. A., Curran, M. A., & Craig, Z. R. (2018). Differentiating environmental concern in the context of psychological adaption to climate change. *Global Environmental Change, 48*, 158-167. doi:https://doi.org/10.1016/j.gloenvcha.2017.11.012

Hine, D. W., Phillips, W. J., Cooksey, R., Reser, J. P., Nunn, P., Marks, A. D. G., . . . Watt, S. E. (2016). Preaching to different choirs: How to motivate dismissive, uncommitted, and alarmed audiences to adapt to climate change? *Global Environmental Change, 36*, 1-11. doi:10.1016/j.gloenvcha.2015.11.002

Hulme, M. (2009). *Why we disagree about climate change: Understanding controversy, inaction and opportunity*. New York: Cambridge.

IPCC. (2013). *Climate change 2013: The physical science basis. Contribution of Working Group I to the fifth assessment report of the Intergovernmental Panel on Climate Change*. [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge, UK: Cambridge University Press.

Lazrus, H. (2015). Risk perception and climate adaptation in Tuvalu: A combined cultural theory and traditional knowledge approach. *Human Organization, 74*(1), 52-61.

Leiserowitz, A. (2005). American risk perceptions: Is climate change dangerous? *Risk Analysis, 25*(6), 1433-1442. doi:10.1111/j.1540-6261.2005.00690.x

Lowry, R. (2011). Is risk itself a climate-related harm? *Climatic Change, 106*(3), 347-358. doi:10.1007/s10584-010-9960-0

Maibach, E. W., Roser-Renouf, C., & Leiserowitz, A. (2008). Communication and marketing as climate change-intervention assets: A public health perspective. *American Journal of Preventive Medicine, 35*(5), 488-500. doi:10.1016/j.amepre.2008.08.016

Maibach, E. W., Roser-Renouf, C., & Leiserowitz, A. (2009). *Global warming's six Americas 2009: An audience segmentation analysis*. Retrieved from New Haven, CT: Yale School of Forestry & Environmental Studies website: http://environment.yale.edu

McMichael, A. J., Campbell-Lendrum, D. H., Corvalán, C. F., Ebi, K. L., Githeko, A. K., Scheraga, J. D., & Woodward, A. (Eds.). (2003). *Climate change and human health: Risks and responses*. Geneva: World Health Organization.

Morrissey, S. A., & Reser, J. P. (2007). Natural disasters, climate change and mental health considerations for rural Australia. *Australian Journal of Rural Health, 15*(2), 120-125.

Moser, S. C. (2013). Navigating the political and emotional terrain of adaptation: Community engagement when climate change comes home. In S. C. Moser & M. T. Boykoff (Eds.), *Successful adaptation to climate change: Linking science and policy in a rapidly changing world* (pp. 289-305). New York: Routledge.

Moser, S. C., & Dilling, L. (Eds.). (2008). *Creating a climate for change: Communicating climate change and faciilitating social change*. Cambridge, UK: Cambridge University Press.

Nabi, R. L., Gustafson, A., & Jensen, R. (2018). Framing climate change: Exploring the role of emotion in generating advocacy behavior. *Science Communication, 40*(4), 442-468. doi:10.1177/1075547018776019

Norgaard, K. M. (2006). "People want to protect themselves a little bit": Emotions, denial, and social movement nonparticipation. *Sociological Inquiry, 76*(3), 372-396.

North, C. S., & Pfefferbaum, B. (2013). Mental health response to community disasters: A systematic review. *JAMA, 310*(5), 507-518. doi:10.1001/jama.2013.107799 %J JAMA

Nurse, L. A., McLean, R. F., Agard, J., Briguglio, L. P., Duvat-Magnan, V., Pelesikoti, N., . . . A., W. (2014). Small islands. In V. R. Barros, C. B. Field, D. J. Dokken, M. D. Mastrandrea, K. J. Mach, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, & L. L. White (Eds.), *Climate Change 2014: Impacts, adaptation, and vulnerability. Part B: Regional aspects. Contribution of Working Group II to the fifth assessment report of the Intergovernmental Panel on Climate Change* (pp. 1613-1654). New York, NY: Cambridge University Press.

O'Neill, S., & Nicholson-Cole, S. (2009). "Fear won't do it" Promoting positive engagement with climate change through visual and iconic representations. *Science Communication, 30*(3), 355-379. doi:10.1177/1075547008329201

Penninx, B. W. J. H., Beekman, A. T. F., Smit, J. H., Zitman, F. G., Nolen, W. A., Spinhoven, P., . . . Consortium, N. R. (2008). The Netherlands Study of Depression and Anxiety (NESDA): Rationale, objectives and methods. *International Journal of Methods in Psychiatric Research, 17*(3), 121-140. doi:10.1002/mpr.256

Reifels, L., Mills, K., Dückers, M. L. A., & O'Donnell, M. L. (2019). Psychiatric epidemiology and disaster exposure in Australia. *Epidemiology and Psychiatric Sciences, 28*(3), 310-320. doi:10.1017/S2045796017000531

Reser, J. P., Bradley, G. L., Glendon, A. I., Ellul, M., & Callaghan, R. (2012). *Public Risk Perceptions, Understandings and Responses to Climate Change in Australia and Great Britain*. Retrieved from The National Climate Change Adaptation Research Facility website: https://www.nccarf.edu.au/publications/public-risk-perceptions-final

Santos, J. C., Bashaw, M., Mattcham, W., Cutcliffe, J. R., & Giacchero Vedana, K. G. (2018). The Biopsychosocial Approach: Towards Holistic, Person-Centred Psychiatric/Mental Health Nursing Practice. In J. C. Santos & J. R. Cutcliffe (Eds.), *European Psychiatric/Mental Health Nursing in the 21st Century: A Person-Centred Evidence-Based Approach* (pp. 89-101). Cham: Springer International Publishing.

Searle, K., & Gow, K. (2010). Do concerns about climate change lead to distress? *International Journal of Climate Change Strategies and Management, 2*(4), 362-379. doi:10.1108/17568691011089891

Skurka, C., Niederdeppe, J., Romero-Canyas, R., & Acup, D. (2018). Pathways of influence in emotional appeals: Benefits and tradeoffs of using fear or humor to promote climate change-related intentions and risk perceptions. *Journal of Communication, 68*(1), 169-193. doi:10.1093/joc/jqx008

Smith, N., & Leiserowitz, A. (2014). The role of emotion in global warming policy support and opposition. *Risk Analysis, 34*(5), 937-948. doi:10.1111/risa.12140

Spence, A., Pidgeon, N., & Uzzell, D. (2008). Climate change: Psychology's contribution. *The Psychologist, 22*(2), 108-111.

Stern, P. C., & Raimi, K. T. (2015). Simple mental models for information climate choices. *Social Research: An International Quarterly, 82*(3), 581-606.

Swim, J. K., Geiger, N., & Zawadzki, S. J. (2014). Psychology and energy-use reduction policies. *Policy Insights from the Behavioral and Brain Sciences, 1*(1), 180-188. doi:10.1177/2372732214548591

Taber, K. S. (2018). The use of Cronbach's Alpha when developing and reporting research instruments in science education. *Research in Science Education, 48*(6), 1273-1296. doi:10.1007/s11165-016-9602-2

Tuvalu Department of Environment. (2007). *Tuvalu's National Adaptation Programme of Action*. Retrieved from Tuvalu: United Nations Framework Convention on Climate Change website: https://unfccc.int/

Tuvalu Government. (2013). *Tuvalu 2012: Population and Housing Census. Volume 1 Analytical Report*. Retrieved from Pacific Regional Data Repository for Sustainable Energy for All website: http://prdrse4all.spc.int