






# “Na Neitou Qele Ga Qo” (“This Is Our Only Land”): Adaptation to the Effects of Climate Change in Rural Indigenous Fijians

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## Abstract

It has long been recognized that the Pacific Small Island Developing States are highly vulnerable to the effects of climate change, emphasizing the urgency with which adaptation planning and efforts need to be realized. History supports the resiliency of Pacific peoples, though a number of challenges to adaptive capacity have been noted in the previous literature, which has largely focused on low-lying atoll nations. To provide a different perspective, we interviewed 71 Indigenous and other traditional Fijians living in rural villages across a range of geographical locations to collect information on observed environmental changes, and adaptation efforts and challenges. Following an inductive thematic analysis, results identified changing patterns of consumption and production related to unpredictable and extreme weather patterns, with impacts on both overall food security and the financial viability of these communities. A number of physical adaptations to the villages themselves had been effected, which were costly and met with equivocal success. Consideration of migration to different geographical locations was minimal and undesirable. We provide recommendations for the culturally responsive, co-production of knowledge, resilience building, and adaptation planning with Indigenous and other traditional



communities that meaningfully integrates scientific knowledge and respect for the wishes of these communities.

## Keywords

adaptation, Pacific Small Island Developing States, barriers, Fiji, climate change

### Non-Technical Summary

#### Background

The island nations of the South Pacific have a higher vulnerability to the anticipated negative consequences of climate change than many other regions of the world due to their geographical location and relative reliance on subsistence agriculture and fishing practices. Adaptation to extreme weather and rising sea levels is required and ongoing, but these efforts have been met with a number of challenges.

#### Why was this study done?

Much of the research so far has been conducted in low-lying atoll nations, as these countries have been suffering the earliest and most extreme effects of rising sea levels associated with climate change. We conducted this study in Fiji because we were interested to get an understanding of the experience of the relatively less investigated rural Indigenous and other traditional Fijians—what changes they had noticed in their environment, how this was affecting aspects of their lifestyles, and how they were managing any challenges they were experiencing.

#### What did the researchers do and find?

We interviewed 71 rural Indigenous and other Fijians who lived in one of seven traditional villages in coastal areas, the coastal hinterland, and a river delta region on the islands of Viti Levu and Ovalau. Community members from all villages had observed environmental changes, and many reported that this had affected their ability to grow or access the foods they typically farm or harvest. This difficulty had consequent impacts, namely a growing reliance on less nutritious convenience store foods, and increased financial costs related to: 1) having to purchase more food than normal, and 2) having less food to sell at local markets. Many coastal villages had tried to build or raise sea walls, but many of these did not function as well as the community had hoped. Planting mangroves to mitigate village flooding was also met with equivocal success. All of the villages had heard about other villages in Fiji needing to relocate due to rising sea levels, but interviewees were reluctant to move, stating concerns about where they would go and how the move would be financed.

#### What do these findings mean?

These findings provide new insights into the experiences of Indigenous and other Fijians who are living in traditional rural communities in Fiji. Despite relatively less research attention being paid to the larger and more mountainous nation of Fiji (as compared to many

other island nations in the South Pacific), we found that these individuals were also experiencing a significantly changing environmental landscape, which was having effects on their ability to engage in traditional cultural practices and leaving them at risk for compounding negative economic consequences. Many adaptation efforts had been undertaken but were met with equivocal success. Village relocation or migration had been considered by many villagers, but this was clearly not something that they wanted. We provide recommendations for how to engage rural communities in a culturally sensitive manner in the co-design of adaptation planning.

### Highlights

- Climate change adaptation efforts in the Pacific Small Island Developing States are urgent but face a number of challenges.
- Interviews with rural Indigenous and other traditional Fijians highlight challenges in these contexts, including food insecurity and consequent financial stresses, and physical adaptation measures to encroaching seas and rivers.
- Relocation or migration is a very undesirable outcome for these communities.
- Adaptation planning should engage rural communities in the co-design of adaptation measures in a culturally responsive and respectful manner.

The latest Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2023), concluded that the pace of climate change in most parts of the world is greater than was formerly predicted for this point in time. It has long been expected that the Pacific Small Island Developing States (PSIDS) would be more vulnerable to the negative impacts of climate change than many regions of the world (Kelman, 2014; Nunn & Kumar, 2019). This disproportionate vulnerability is derived from both geographical and cultural factors.

The islands of the South Pacific, home to approximately 10 million people, are spread across nearly one-third of the Earth's surface, yet land mass accounts for only 0.34% of this total area (Scott-Parker et al., 2017). Of particular concern have been the effects of sea level rise on the largely coastal communities in this region. Hayward et al. (2020) noted that sea level rise is already four times higher in some PSIDS than the global average which, when accompanied by coastal erosion, is already challenging the long-term habitability of many island communities and states (Tschakert et al., 2019). The PSIDS are also exposed to frequent and severe weather events (e.g., tropical cyclones)—predicted to increase in average intensity with advancing climate change (Walsh et al., 2016)—which threatens both short- and long-term human survival due to the impacts on food and water sources, livelihoods, and infrastructure (Hashim & Hashim, 2016; Mycoo et al., 2022). Many of these changes have not gone unnoticed in Pacific Island communities, with many residents of Kiribati (Kuruppu & Liverman, 2011) and Solomon

Islands (Asugeni et al., 2015) reporting environmental changes consistent with climate change predictions in their local areas.

These observations may relate to the second major source of vulnerability in this region, which derives from the traditional subsistence lifestyles of many Pacific Island people. According to Nunn et al. (2014), most communities in the PSIDS continue to rely to a large extent or entirely on the foods they grow or obtain in their local terrestrial and nearshore environments. With estimates that agricultural yields may decline up to 50% by 2050, and coral bleaching may reduce the availability of nearshore seafood (Tukuitonga & Vivili, 2021), food security is anticipated to become an increasingly urgent issue in both coastal and inland communities (Barnett & Campbell, 2010; Campbell, 2015). In a systematic review of global intangible harms resulting from climate change, Tschakert et al. (2019) specifically highlighted future harms as most pronounced in the Pacific Island nations, where coastal erosion and sea level rise were already threatening food and water security, as well as livelihoods. Indigenous peoples and others following traditional livelihoods were also identified as experiencing a higher vulnerability to climate change-related harms, highlighting the intersectional disadvantage experienced by these inhabitants of the PSIDS.

## Challenges to Adaptation

Despite the known risks of climate change in the Pacific Island nations, uptake of adaptation measures has been slow (Nunn et al., 2014) and primarily focused on intra- and international migration (McNamara et al., 2022). A host of challenges (often referred to as “barriers”) has been identified in the past two decades as to why this may be the case. One issue identified early on was a relative lack of awareness or understanding of climate change and what it portended for vulnerable Pacific Island nations (Di Falco & Sharma-Khushal, 2019). For example, relatively dismissive attitudes that climate change is a normal, natural process and therefore nothing to worry about have been reported (Shen & Gemenne, 2011). A number of Tuvaluans reported that climate change is “God’s plan” (Gibson et al., 2019), with some believing that divine intervention will rescue them from climate change “at the 11th hour,” and therefore there is no need to be concerned (Mortreux & Barnett, 2009; Shen & Gemenne, 2011).

Generally speaking, Pacific Island people are very connected and attached to their land and environment (Hayward et al., 2020; Henry & Pam, 2012; Kuruppu & Liverman, 2011; Shen & Gemenne, 2011) which also contributes to a resistance to proposed relocation or migration. Mortreux and Barnett (2009) reported on the highly valued characteristics of Tuvaluan lifestyle (e.g., low-stress working environment, close family networks, enjoyment of natural environment), highlighting how these factors were associated with a reluctance to relocate. The importance of locally grown foods and significant ancestral places has been noted by residents of Moch in Micronesia, contributing to a reluctance to leave the island (Henry & Pam, 2012). Furthermore, the hierarchical governance struc-

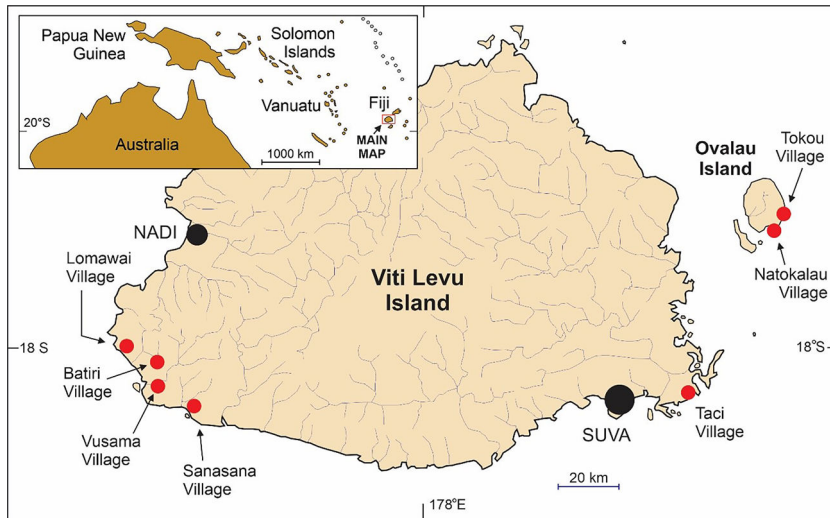
tures of many rural communities, which have also been criticized as focusing too much on short-term issues, has also been noted as a potential barrier to adaptation activities (Lata & Nunn, 2012).

Challenges exist even for Pacific Island communities who are willing or motivated to migrate. Traditional territorial boundaries often preclude a simple intra-national relocation (Asugeni et al., 2015), which may lead to increased interpersonal and land-use conflicts (Locke, 2009) as greater numbers of people place demands on diminishing available resources. Nunn et al. (2014) also observed that even though settlements and infrastructure can be relocated, the increasingly flood-prone high-quality fertile soils used for agriculture cannot. Furthermore, many have pointed out that this relocation would require external assistance (Asugeni et al., 2015; Janif et al., 2016; Shen & Gemenne, 2011). Crucially, while international migration may offer some personal economic benefits, it comes at the risk of a potential loss of culture and identity (Henry & Pam, 2012).

Lastly, increasing criticism has been directed at media portrayals of Pacific Island peoples as “victims” and “climate refugees,” observing that this may contribute to feelings of resignation and despair, reducing resilience and agency (Farbotko & Lazrus, 2012; Farbotko & McMichael, 2019; Henry & Pam, 2012). The narrative of “it’s too late” contributes to feelings of hopelessness and helplessness (Hayward et al., 2020), with efforts to increase global awareness of climate change impacts in the PSIDS creating a disabling message for those living in them, in effect stifling adaptation efforts (Kuruppu & Liverman, 2011). These narratives ignore the agency and resilience of Pacific Island peoples (Foley et al., 2022; McGuigan et al., 2022), and both the adaptation efforts that require external support (Mortreux & Barnett, 2009) and those that are already underway (Hayward et al., 2020). It is worth noting that this kind of messaging and framing of the issue is strongly rejected by both many of those living in the region (Farbotko & Lazrus, 2012) and their leaders, even when it would aid their efforts to garner more international support for adaptive measures (McNamara & Gibson, 2009). It is also worth stressing that Pacific Island peoples have been coping with and adapting to climate variability and changing seascapes for millennia (Henry & Pam, 2012; Nunn, 2007). Additionally, migration is a normal part of everyday life in this region (Shen & Gemenne, 2011); therefore, it does not need to be experienced or portrayed as highly traumatic or as a crisis (Farbotko & Lazrus, 2012). As per Tacoli (2009), migration should be considered a potential part of the solution as opposed to an inherent problem. Of course, how this accords with the observed reluctance to leave one’s home in many of these populations remains to be seen.

## Climate Change in Fiji

The nation of Fiji is an archipelagic nation comprised of more than 330 islands located in Melanesia (see Figure 1). Eighty-seven percent of its population of around 880,000 lives on the two islands of Viti Levu and Vanua Levu, with three-quarters of Fijians

**Figure 1***Map of Fiji*

living on the country's coasts. Indigenous Fijians (*iTaukei*) comprise approximately 54% of the overall population, many of whom adhere to a Christian religion (Janif et al., 2016). A relatively wealthy nation (second only to Papua New Guinea with respect to GDP of Pacific Island nations), most of its income is earned from tourism. Fiji is also quite mountainous, with an average elevation range of 662 meters above sea level. Consistent with many other Pacific Island nations, governance and decision-making in traditional indigenous rural communities tends to be hereditary, hierarchical, and non-democratic (Lata & Nunn, 2012). These authors also noted that at the time of their data collection in the Rewa Delta region, climate change was not considered a risk, and no one reported having considered relocating due to climate change impacts; the situation there has changed since then (e.g., Nolet, 2016) and undoubtedly continues to evolve.

Fiji was ranked as “highly vulnerable” to climate change by Nunn et al. (2016) as per the Environmental Vulnerability Index (Kaly et al., 2004). Research dating back nearly 30 years has reported on the observed effects of climate change in Fiji, highlighting increased rates of shoreline erosion and inundation even then (Nunn, 1994). At the turn of the 21st century, most shoreline protection initiatives, such as mangrove planting and seawall construction, had failed (Nunn, 2000). Considering that the best available evidence supports continuously increasing sea level rise in Fiji, it is anticipated that hundreds of rural and peripheral coastal communities will need to relocate before 2100 (Janif et al., 2016; McMichael & Katonivualiku, 2020; Piggott-McKellar et al., 2021). Geo-

graphically, this may be possible, yet traditional land ownership boundaries and resource access make this a challenging prospect (Campbell, 2010), which is further complicated by the prediction that these communities may need to develop and implement relocation strategies on their own (Atkinson-Nolte et al., 2021; Nunn & Kumar, 2019).

## The Current Study

Much of the psychosocial research in the Pacific Islands related to climate change has focused on the atoll nations (principally Kiribati and Tuvalu). Fiji represents an interesting test case for climate adaptation for a number of reasons. First, the mountainous geography *could* facilitate greater intra-national migration than that available to atoll nations; indeed, the government of Kiribati has purchased land in Fiji for the future relocation efforts of I-Kiribati, a contentious move (Hermann & Kempf, 2017). Second, little is yet known about the experiences of environmental change on the Indigenous and other traditional Fijian populations, especially to what degree traditional knowledge can help sustain them in the future (Korovulavula et al., 2020). Third, we wished to avoid the research-fatigued low-lying atoll nations (e.g., Mortreux & Barnett, 2009) and to provide a new perspective on these issues. Accordingly, we aimed to interview a wide range of Indigenous (and similar) Fijians to gather information about their experiences of environmental change in their local areas, any existing efforts to adapt to these changes, and challenges associated with such.

## Method

### Participants

Participants were sourced from seven traditional rural villages; five were located on the main island of Viti Levu, and two were located on Ovalau, a smaller island off the eastern coast of Viti Levu. The researchers aimed to gather information from a broad range of geographical locations to capture the potentially varying experiences of climate change in these different areas. Accordingly, interviews were conducted in four coastal villages (Lomawai, Natokalau, Sanasana, Tokou), two coastal hinterland villages (Batiri, Vusama), and one village in the Rewa River Delta region (Taci). Village selection was also guided by the pre-existing relationships with members of the research team and the local interpreter, as entrance into the villages would not have been permitted without these introductions.

Fourteen (mostly group) interviews were conducted across a period of ten days toward the end of the wet season. Inclusion criteria required that participants be 18 years of age or older and currently living in the local community. A total of 71 Indigenous and other traditional Fijians were interviewed ( $M_{\text{age}} = 49.15$ ,  $SD = 16.15$ , range = 22 to 82), with a gender breakdown of 38 men ( $M_{\text{age}} = 52.03$ ,  $SD = 14.95$ ) and 33 women ( $M_{\text{age}} =$

45.00,  $SD = 16.57$ ); age data were missing for 8 women and 2 men (see Table 1 for more information about the interviewees and their villages/regions).

**Table 1**

*Demographic Information for Target Regions, Villages, and Interviewees*

Survey Category	Description
<b>Western Division, Nadroga/Navosa province: Villages of Batiri, Lomawai, Sanasana, and Vusama</b>	
<b>Educational level</b>	Most residents left school in Year 5.
<b>Employment status</b>	On average, fewer than 10% of adult residents are in wage employment (part- or full-time), though Sanasana has around 25% employment due to nearby hotel.
<b>Food and water supply</b>	Food obtained locally (subsistence economy), water typically obtained from rainwater roof-catchment systems and wells (though Sanasana has piped water).
<u>Batiri</u>	
Population	136 people (75 male, 61 female; 48% in 25–64 age range)
Interviewees	a) Interview 1: 6 men (age range 55 – 78, $M = 62.00$ , $SD = 9.19$ ) b) Interview 2: 4 women (age range 29–67, $M = 44.00$ , $SD = 17.47$ )
<u>Lomawai</u>	
Population	220 people (105 male, 115 female; 51% in 25–64 age range)
Interviewees	a) Interview 1: 6 men (age range 45 – 72, $M = 56.33$ , $SD = 9.37$ ) b) Interview 2: 3 women (age range 50 – 70, $M = 59.00$ , $SD = 10.15$ )
<u>Sanasana</u>	
Population	463 people (239 male, 224 female; 43% in 25–64 age range)
Interviewees	a) Interview 1: 2 men, aged 43 and 56 b) Interview 2: 1 woman, aged 76
<u>Vusama</u>	
Population	208 people (117 male, 91 female; 39% in 25–64 age range)
Interviewees	a) Interview 1: 1 man, aged 65 b) Interview 2: 8 women, ages unavailable c) Interview 3: 6 men (age range 42 – 82, $M = 64.60$ , $SD = 18.06$ ), 8 women (age range 28 to 68, $M = 37.63$ , $SD = 12.86$ )
<b>Central Division, Rewa province: Village of Taci</b>	
<b>Educational level</b>	Most residents left school in Year 7.
<b>Employment status</b>	On average, fewer than 5% of adult residents are in wage employment (part- or full-time).
<b>Food and water supply</b>	Food is obtained locally (subsistence economy), water typically obtained from rainwater roof-catchment systems and wells.



Survey Category	Description
<u>Taci</u>	
Population	126 people (56 male, 70 female; 37% in 25–64 age range)
Interviewees	a) Interview 1: 7 men (age range 37–57, $M = 48.43$ , $SD = 12.15$ ) b) Interview 2: 5 women (age range 45–74, $M = 55.60$ , $SD = 11.72$ )
<b>Eastern Division, Lomaiviti province: Villages of Natokalau and Tokou</b>	
<b>Educational level</b>	Most residents left school in Year 7
<b>Employment status</b>	On average, fewer than 15% of adult residents are in wage employment (part- or full-time); this is slightly higher than many other villages on Ovalau due to the proximity of the fish factory in Levuka.
<b>Food and water supply</b>	Food is obtained locally (subsistence economy), water typically obtained from rainwater roof-catchment systems and wells.
<u>Natokalau</u>	
Population	378 people (192 male, 186 female; 42% in 25–64 age range)
Interviewees	a) Interview 1: 1 man, aged 49; 2 women, aged 27 and 48 b) Interview 2: 8 men (age range 23–40, $M = 32.14$ , $SD = 6.36$ ), 2 women aged 20 and 22
<u>Tokou</u>	
Population	426 people (232 male, 194 female; 42% in 25–64 age range)
Interviewee	Interview: 1 man, aged 63

*Note.* Descriptive data for villages and regions obtained from *2017 Fiji Population & Housing Census* (Fiji Bureau of Statistics, 2018).

## Interview Questions

The interview was conducted in a semi-structured format to provide flexibility in data collection. Questions were developed in consultation with members of the research team based on their experiences and understanding of existing knowledge gaps with respect to climate change and adaptation in Fiji. The basic structure of the interviews remained the same across all locations, but some questions evolved across the data collection period in response to answers received in previous interviews. Following general introductory questions about the village itself, participants were asked a series of questions about their experiences living in their local villages, including any changes they had observed in their local environment, and how they felt about their futures in the village. Participants were also asked how they managed any problems associated with changing environments and any future adaptations that might be required, as well as what their understanding of climate change was and how it may impact them. Finally, participants were asked questions around migration, including if they had heard of people needing to move away from their homes permanently, and whether migration had been considered in their local context. Nearly all interviews were conducted in the standard Bauan Fijian language via the Fiji-based interpreter. The interpreter provided some real-time transla-

tion into English so that the rest of the research team could ask follow-up questions; she also asked some of her own follow-up questions during the interviews to ensure overall comprehension and comprehensiveness.

## Data Collection

Following official invitation into the village by the local headman and as per local custom, each set of interviews began with a traditional *yaqona* (kava) ceremony with members of the research team, village leaders, and any interested local community members. After the research team had been officially welcomed to the village, and as per recommendations for culturally responsive cross-cultural research (Broesch et al., 2020), we discussed the reason for our presence with the village, and the interpreter read the *Information Sheet for Participants* in the local language. Attendees were invited to ask any questions they had, assured that they could participate or not as they wished, and were reminded that all responses would be reported anonymously. After providing written consent, the interviews began. Save two interviews that were conducted one-on-one with individuals of particular local prominence (e.g., the village chief or headman), most interviews were conducted in groups, some mixed-sex and others with only men or women. The constitution of the interview groups was left to the discretion and preferences of the participants. Interviews lasted approximately one hour, and no incentive was offered for participation.

Once data collection was completed, recordings of the interviews were transcribed into English by an Australia-based Indigenous Fijian research affiliate (not the original interpreter) who is fluent in both English and Fijian languages and had previous experience with interview transcription. A different Australia-based Indigenous Fijian research affiliate provided transcriptions of the quotes used in the manuscript into Bauan Fijian (see Table 2), which were obtained from the original interview recordings, using a technician approach (Abfalter et al., 2021).

Table 2

*Quotes in English and Translated Into the Bauan Fijian Language*

Quote in English	Bauan Fijian Translation
<p>Due to excessive dry conditions the soil is very hard and infertile. We cannot plant yams, breadfruit and coconuts keep dying after we plant them. Cassava had to be replanted because the soil had to be cultivated. We use cassava for our own domestic use and sell them in kilos as part of our income ... now the weather pattern is different and the sizes of the crops are much smaller (Batiri) (pg. 12).</p> <p>When we want to plant, we cannot plant because of the heat and then when we want to plant when it rains, we can't because it rains very heavily and we can't plant... When the time when we want to plant there is more flood (Vusama) (pg. 13).</p>	<p>Tei uvi sa sega. Sa veisau na draki, sa veisau talega na qele. Eso madaga na uto, e lei tei mami mate. Na niu keimami teya era mate. Na tavioka, eso vanua keimami tei vakarua. Keimami volitaki tavioka mei vurevure ni lavo ka vakayagataki tale ga mei vurevure ni kakana. Era dau voltitaki vaka bibi (kilo).</p> <p>Ni keimami via teitei, e sega ni rawa ni keimami teitei ena vuku ni draki mamaca. Ia na draki ucauca e sega tale ga ni dua na ka e tei rawa ena levu ni suasua...Na gauna keimami via teiteivaki kina, e veitararavi tale mai na waluvu.</p>
<p>Rock cods could be easily found under rocks as they are turned in the reefs but are no more. This includes the sea clams which have decreased in sizes and numbers...We could easily gather sea kelp and sea grapes very close to the shore but due to the heat we could not find them anymore where they used to be found (Batiri) (pg. 13).</p> <p>There are times when the swamps are completely dried up that we cannot get any sea foods. (Lomawai) (pg. 13).</p>	<p>Na kawakawa esa lutu sobu tiko na kena kunei. E liu era se dau kunei rawarawa ena ruku ni vatu. Ni kua sa sega. Na vasua talega esa sega sotu... I matasawa ga qo e voleka ga e waitui, ra lako ga lai kau mai na nama na lumi.</p> <p>Eso na gauna e dau mamaca na veidogo ni sega ni lakova mai na ua.</p>
<p>Our eating patterns have changed. Before, cassava can be eaten during lunch and dinner, however, today we hardly get cassava when we want it. This is due to the dry season and excess heat. We now rely on flour and rice... We rely on the convenience foods from the shops (Batiri) (pg. 14).</p>	<p>Na veiveisau ga keimami sa raica tiko na koro qo. E liu na veisiga ga na kana tavioka. Na sigalevu na yakavi. Ia na veiveisau e laurai ena gauna qo, na gauna dodonu me lau kana kina na tavioka sa sega. Sa raisi, falawa qo baleta na veiveisau ni draki. Na katakata ni siga ka vakavuna na mamaca ni qele. Dua na gauna balavu e cila tu ga na matami siga ka sega na uca... Keimami sa vakamuini tu ga ena sitoa.</p>
<p>Spinach, yams and taro are some foods that we used to plant before and in abundance, now days we just do a lot of food buying from the market (Vusama) (pg. 14).</p>	<p>E liu era se dau teya na uvi na dalo, na gauna qo sa sega ni vuavuai vinaka. Sa levu ga na ka sa voli nikua.</p>

Quote in English	Bauan Fijian Translation
<p>Many times it's difficult now to get school things for the children, since most of the time we get our income from fishing and selling the produce from the sea. Crabs and prawns are hard to find now due to the weather (Taci) (pg. 14).</p>	<p>E leve na gauna sa dredre na vaqara ka ni vuli, nida bula tiko qo ena ka e rawati mai waitui. Levu na gauna sa warai ni cabe na qari se na kuka.baleta na veisau ni drake.</p>
<p>Before the older generation used to plant a lot and now we have to buy food from the town and things are expensive now days (Vusama) (pg. 14).</p>	<p>E liu e se rawarawa na bula, qai levu na nodra dau teitei, nikua sa voli na ka sa sivia na kenai sau.</p>
<p>In the past when our elders were there we did not buy much since there was a lot of planting but now most youths and villagers are working in the hotels (Vusama) (pg. 15).</p>	<p>E liu oira na neimami qase era dau gumatua na teitei, ia qo oira na neimami tabagone kei na so na lewe ni koro era sa lai cakacaka ena vei otela.</p>
<p>Most villagers are now working at the new resort in [town]. In the past the main source of income was the sugar cane farming (Lomawai) (pg. 15).</p>	<p>So era bau cakacaka toka ena Otela (Momi Bay). E liu na dovu, waitui kei na pine.</p>
<p>We are just concentrating on some craft and sewing skills where we can teach our younger generation to make things and sell their stuffs to other villages and get some income (Batiri) (pg. 15).</p>	<p>Sa levu na goneyalewa vou, sa vinakati me ra vuli culacula me rawa ni tauri ira talega. Tikini lavo me rawa talega kina eso na veika lalai.</p>
<p>We have the sea wall in the village but it is being damaged due to sea water. No matter how many times they rebuild the sea wall it will still deteriorate (Natokalau) (pg. 16).</p>	<p>Sa kavica ni tara ni ba ni ua qo. Se voroki tikoga mai. Sa toso cake tikoga na ua.</p>
<p>During our village meetings we are planning to seek assistance from the government to raise our sea wall (Sanasana) (pg. 16).</p>	<p>Sa tukuni tiko vei turaga ni koro me dua na taqotaqomaki me keitou kerea na matanitu me taqomaka na bai ni ua me toso cake.</p>
<p>The village headman has to ensure that the Government is aware and comes to get it fixed since he is the only one who can liaise with the government (Taci) (pg. 16).</p>	<p>Nai tavi nei turaga ni koro me sasagataka na gaunisala ni veitaratara kei na matanitu, ka me kauta mai na matanitu me mai qarava na cakacaka ya.</p>
<p>We are planting mangroves on our shores. Before we don't have mangroves but we have some that had been growing naturally (Tokou) (pg. 16).</p>	<p>Na veisau ga ni draki qo, keimami sa tei dogo tiko mai wai. E loma qo a sega ni dau bula kina. Eso era sa tekivu bula tiko mai.</p>
<p>when the big strong waves strike it uproots the mangroves and whatever is in its way (Sanasana) (pg. 16).</p>	<p>na vanua qo edau loka wasoma (waibula) ni dau lako ga mai e cavulaka na dogo.</p>
<p>the old people think that it's not a good idea since it pollutes the sea (Natokalau) (pg. 16).</p>	<p>eso era sega ni vinakata me tei, era kaya ni vakalevu benu.</p>
<p>there is digging of the river to divert water from the village (Lomawai) (pg. 16).</p>	<p>So na vanua e kau mai na digger (keliketi) Sagai me vakamuai na wai me lako tani.</p>

Quote in English	Bauan Fijian Translation
we feel that they need to continue digging and dredging the place deeper for water to flow freely to prevent flooding (Taci) (pg. 16).	me vakaikuratakaki na kelikei koya e caka tiko.
build houses with long stilts, since most houses here are on the ground (Lomawai) (pg. 17).	Na vale me tara, me vakarewa i cake.
get soil and cover the sea front and raise the low-lying area within the village (Taci) (pg. 17).	me bulu ga na neitou koro.
young people who are recently married are asked to build their houses on higher level (Vusama) (pg. 17).	oira na vakawati vou, era sa kerei me ra lai tara vale ena vei delana.
When we were told to relocate, we did not like it, most of us were not happy about it. In [village] life is easy here, since we have everything here. That is our view, everything is here and houses, plantations, and we are near the sea ... it will be very hard to move or relocate (Lomawai) (pg. 17).	Na gauna e tukuni mai kina, keimami sega ni vinakata. Keimami via tikoga eke. Veitalia ni luvu tu ga e veigauna, me keimami kua ga ni biuta na neimami vanua. Neimami rai mada ga ni sa tara tu eke na neimami vale. E rawarawa eke na bula. Na bula ni lako i waitui, kei nai feitei... dredre na toso nida na lai tekivu tale.
It will take a long time for us to move since no one from the village wish to move (Tokou) (pg.17).	Ena taura edua na gauna balavu me keimami qai toki.
if sea water level continues to rise then we shall have no choice but to follow [the neighboring village] and relocate that's if worse comes to worst (Natokalau) (pg. 17).	vakabauta ke caka tiko na ba ni ua e veiyabaki, kevaka e toso cake tikoga na wai, sa na via soli ga na vakasala koya sa caka tiko mai Tokou ya.
Where else would we move to, this is our only land where we have lived in all our lives, if the government will give us a piece of land then good (Vusama) (pg. 18).	Keimami sa na vakasaltaki ga me keimami sa na toki ena vanua cere.
We just wish to move to our own land, not to other lands that belong to other villages (Vusama) (pg. 18).	Me keitou toso tale i vei. Na neitou qele ga qo. Ke solia vei keitou na matanitu na qele, sa na vinaka sara.
If we have to relocate to a new place these questions arise; is there any house there? Who will buy the materials for our new home? Who will build the house? (Natokalau) (pg. 18).	Keimami via toki ena vanua me neimami, sega ni qele ni dua tale na koro.
If we have to relocate to a new place these questions arise; is there any house there? Who will buy the materials for our new home? Who will build the house? (Natokalau) (pg. 18).	Da vakasamataka taka na kena dredre ni vale qo se simeede. Na cava eda na lai tara e ke ya nisa tukumi na toso? Ocei ena lai tara? Ocei e solia na yaya ni vale me lai tarai?

## Data Analysis

Data were analyzed using an inductive thematic analysis (Braun & Clarke, 2013), at the semantic level from a realist epistemology (Braun & Clarke, 2006). Data analysis was iterative, with initial codes generated and reviewed by two coders. These codes were reviewed by a third analyst, with codes and data collated and reviewed to identify recurring patterns of responses across the dataset related to climate change adaptation. From these initial themes, overarching themes and subthemes were identified. These themes were reviewed and refined with another author in order to ensure both coherence and that themes accurately represented the data. Ongoing review of the analysis by multiple authors (all who have experience in climate change research, three have a background in psychology, two have resided in Fiji—one of whom is Fijian) across all analytic stages helped to manage researcher biases, as well as to ensure the rigor, consistency, and truth value of the analysis (Noble & Smith, 2015). For more detail, please see Lykins et al. (2023).

## Results

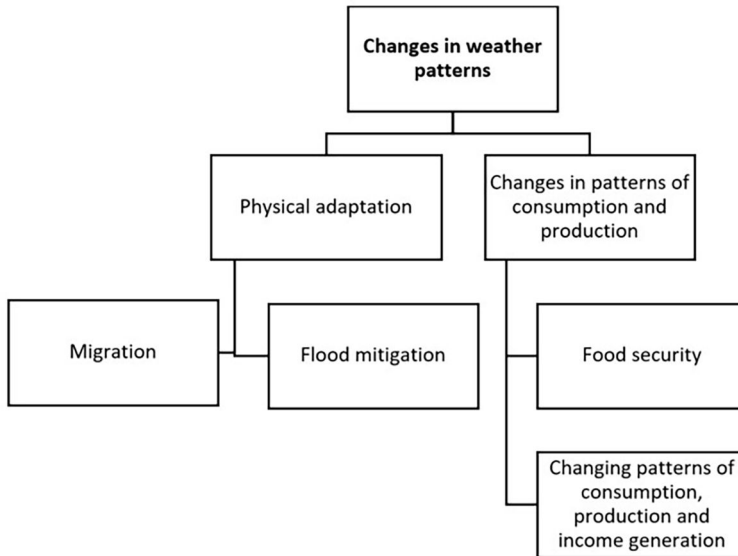
Across all interviews, villagers described having observed changes in weather patterns in recent years, which had led to a series of adaptations to daily life and within the villages themselves. Two main themes in modes of adaptation were identified: changes in consumption and food production, as well as physical adaptation of the villages (see Figure 2 for thematic map). While climate change adaptations were occurring, a range of barriers and challenges encountered was also evident.

### Changing Patterns of Consumption and Production

Villagers described a range of impacts of weather changes on food supply, both for their own consumption and as their source of income. This impact of climate change on food security drove modifications in patterns of consumption, as well as changes to village life with regards to means of production and income generation.

**Figure 2**

*Thematic Map Showing Overview of Overarching Themes and Subthemes*



## **Food Security**

Changes in seasons, rainfall and temperature, as well as increased frequency of flooding, limited food security through impacting agricultural yields, including growth and viability of crops and crop sizes. Such impacts on agriculture were frequently described across the villages:

Due to excessive dry conditions the soil is very hard and infertile. We cannot plant yams, breadfruit and coconuts keep dying after we plant them. Cassava had to be re-planted because the soil had to be cultivated. We use cassava for our own domestic use and sell them in kilos as part of our income ... now the weather pattern is different and the sizes of the crops are much smaller (male, Batiri).

When we want to plant, we cannot plant because of the heat and then when we want to plant when it rains, we can't because it rains very heavily and we can't plant.... When the time when we want to plant there is more flood (male, Vusama).

Further, climate-related changes were also described as impacting tides, and the water depths and temperatures of the ocean and rivers, consequently impacting marine life. These marine impacts also limited food supply and security for fishing villages, such as:

Rock cods could be easily found under rocks as they are turned in the reefs but are no more. This includes the sea clams which have decreased in sizes and numbers...We could easily gather sea kelp and sea grapes very close to the shore but due to the heat we could not find them anymore where they used to be found (male, Batiri).

As is evident in the above extract, accessibility of some marine life had also changed, with certain species harder to source close to the village, and previously fished locations no longer viable for sourcing food, such as:

There are times when the swamps are completely dried up that we cannot get any sea foods (female, Lomawai).

### **Changing Patterns of Consumption, Production and Income Generation**

As a result of the impacts on food security, there was a shift away from traditional sources of food generation, that of fishing and agriculture. Consequently, interviewees described adapting their diet. Primarily, this resulted in a shift to greater reliance on (comparatively nutrient-poor) convenience food purchased from supermarkets rather than growing or sourcing food themselves, as is evidenced in the examples below:

Our eating patterns have changed. Before, cassava can be eaten during lunch and dinner, however, today we hardly get cassava when we want it. This is due to the dry season and excess heat. We now rely on flour and rice... We rely on the convenience foods from the shops (female, Batiri).

Spinach, yams and taro are some foods that we used to plant before and in abundance, now days we just do a lot of food buying from the market (male, Vusama).

Thus, climate change adaptation led to financial challenges for villagers. These financial impacts were twofold: firstly, in terms of loss of income from being unable to sell food and produce and, secondly, from the increased need to purchase food rather than being self-reliant:

Many times it's difficult now to get school things for the children, since most of the time we get our income from fishing and selling the produce from the sea. Crabs and prawns are hard to find now due to the weather (male, Taci).

Before the older generation used to plant a lot and now we have to buy food from the town and things are expensive nowadays (female, Vusama).



These financial impacts led to a need to obtain income through alternative means, which was achieved through a shift from traditional agriculture and fishing to employment in different industries, often outside of the village. The most frequently described source of alternative income was working in hotels, such as:

In the past when our elders were there we did not buy much since there was a lot of planting but now most youths and villagers are working in the hotels (male, Vusama).

Most villagers are now working at the new resort in [town]. In the past the main source of income was the sugar cane farming (male, Lomawai).

Additionally, in some of the villages, alternative means of income generation included selling different products. In these instances, villagers were shifting away from traditional farming and fishing in order to generate other products for sale. For example:

We are just concentrating on some craft and sewing skills where we can teach our younger generation to make things and sell their stuffs to other villages and get some income (female, Batiri).

## Physical Village Adaptation

While changes in food were a central means of climate change adaptation that had substantially changed everyday life in the villages, additional modes of adaptation were also being implemented. These adaptations were occurring at the village level to the physical space, such as methods of flood mitigation and potential village relocation. However, these methods of adaptation also encountered a range of challenges.

### Flood Mitigation

In all interviews, interventions to protect the villages from flooding were reported in response to heightened sea levels, and greater frequency of king tides and flooding rivers. To reduce the impact of rising sea levels, villages had constructed sea walls. Challenging the viability of sea walls, these routinely needed repairs due to deterioration from erosion, or modification to increase height as sea levels continued to rise, for example (Figure 3):

We have the sea wall in the village but it is being damaged due to sea water. No matter how many times they rebuild the sea wall it will still deteriorate (male, Natokalau).

**Figure 3**

*Sea Wall Outside of Natokalau*



Such repairs and modifications were costly and thus relied on external support:

During our village meetings we are planning to seek assistance from the government to raise our sea wall (male, Sanasana).

The village headman has to ensure that the Government is aware and comes to get it fixed since he is the only one who can liaise with the government (male, Taci).

An additional strategy being implemented in a range of coastal villages was the planting of mangroves, both replanting mangroves that had been damaged and planting mangroves in areas where they had not previously grown (*We are planting mangroves on our shores. Before we don't have mangroves but we have some that had been growing naturally; male, Tokou*). Yet in some instances, planting was met with challenges to implementation, such as destruction of the mangroves in storms (*when the big strong waves strike it uproots the mangroves and whatever is in its way; male, Sanasana*) and resistance from older generations (*the old people think that it's not a good idea since it pollutes the sea; male, Natokalau*).

Additional flood-related adaptation was being undertaken in some villages, such as diverting rivers (*there is digging of the river to divert water from the village; male, Lomawai*), dredging (*we feel that they need to continue digging and dredging the place deeper for water to flow freely to prevent flooding; female, Taci*) and building houses on stilts (*build*

houses with long stilts, since most houses here are on the ground; male, Lomawai), and reclaiming low-land (get soil and cover the sea front and raise the low-lying area within the village; male, Taci).

## Migration

A further means of physical village-level adaptation was the shifting of villages to higher ground. In some villages, newer housing was being built uphill (*young people who are recently married are asked to build their houses on higher level; male, Vusama*). Yet two of the villages (Lomawai and Tokou) interviewed had been advised by the government to relocate. Migration was the mode of adaptation that was met with the greatest challenges to implementation. Villagers predominantly described being resistant to move (Figure 4):

When we were told to relocate, we did not like it, most of us were not happy about it. In [village] life is easy here, since we have everything here. That is our view, everything is here and houses, plantations, and we are near the sea ... it will be very hard to move or relocate (female, Lomawai).

It will take a long time for us to move since no one from the village wish to move (male, Tokou).

### Figure 4

*Laundry From Tokou That Had Been Washed Away by the Sea During the Previous Night's King Tide and Associated Flooding of the Village*



The possibility for future migration of other villages was also discussed, and was routinely described as non-desirable. Typically, migration was viewed as a last resort and something that would only be done should there be no other choice (*if sea water level continues to rise then we shall have no choice but to follow [the neighboring village] and relocate that's if worse comes to worst; male, Natokalau*). A key reason for reluctance to migrate included pragmatic considerations such as a lack of viable alternative locations, with land already belonging to other communities:

Where else would we move to, this is our only land where we have lived in all our lives, if the government will give us a piece of land then good (male, Vusama).

We just wish to move to our own land, not to other lands that belong to other villages (male, Vusama).

Additionally, interviewees expressed concern over establishing housing and infrastructure upon migrating. A lack of clarity over how such resourcing would be provided was a key source of reluctance to relocate, as evidenced in the following:

If we have to relocate to a new place these questions arise; is there any house there? Who will buy the materials for our new home? Who will build the house? (female, Natokalau).

## Discussion

The present study adds to the growing body of research exploring climate change adaptation in PSIDS, a region requiring ongoing investigation (Kim et al., 2022) due to its disproportionately high exposure to climate change and apparently low adaptive capacity (Kelman, 2020). Villagers in the present study identified two key modes of adaptation: 1) those relating to food production and patterns of consumption in response to food insecurity, and 2) and those related to physically adapting the villages themselves. Yet a number of barriers and challenges to such adaptation remained.

Consistent with previous research highlighting the potential impact of climate change on agricultural yields and marine life (Tukuitonga & Vivili, 2021), villagers described having observed climate changes that substantially impacted food security. Yet adaptation strategies that were underway, such as shifting diets and increased reliance on convenience foods, may leave Fijians vulnerable to a range of nutritional and chronic health sequelae, as well as an overreliance on food aid (Ahlgren et al., 2014; Medina Hidalgo et al., 2022; Trudinger et al., 2023). The reported shifts away from subsistence farming and fishing may also have a negative influence on wellbeing and cultural life. Traditional food production represents cultural links to the land and oceans (Henry & Pam, 2012), with the loss of such patterns of production potentially impacting cultural

ways of life and social structures (Adger et al., 2013). Further, changing norms around the sourcing of food previously has been reported as impacting mental health (Jones, 2017). While food security was cited as a key worry for community members despite adaptation efforts, there remains minimal policy regarding such indirect effects of climate change in the region (Tukuitonga & Vivili, 2021). Furthermore, food insecurity also reportedly led to financial impacts, and thus adaptation efforts potentially threaten the sustainability of the livelihoods of the villagers—an impact likely to worsen as climate change accelerates in coming decades (Janif et al., 2016). Given that Fiji has one of the highest GDPs in the region, Fijians may be better placed to adapt to income losses than those living elsewhere (e.g., Gibson et al., 2019), with alternative employment in the tourist industry a means for some villagers of adapting to loss of traditional income generation. The longer-term impacts of production and consumption changes on health, culture, food, and financial security require ongoing assessment and mitigation.

In the present study, a range of physical adaptation efforts to the villages, including mangrove planting as well as the building and increasing height of sea walls, were reported; these physical adaptation measures encountered challenges, common to similar situations across the Pacific Islands (Nunn et al., 2021). Another reported barrier pertained to the reluctance of older villagers to engage in adaptation measures. Janif et al. (2016) have previously reported that tensions can exist in villages between Western and traditional understandings of climate change and the environment, with older adults often adhering to traditional faiths and belief systems (Luetz & Nunn, 2021). Likewise, competing understandings around climate adaptation appeared to present a challenge to these modes of adaptation, suggesting a benefit for revisiting climate change messaging.

Although earlier studies in Fiji found that future migration (or relocation) was not identified as a mode of potential adaptation (Lata & Nunn, 2012), awareness of an actual or potential need for migration was reported across villages, suggesting increased awareness over the past decade. While relocation is often viewed as a key solution to sea level rise (Janif et al., 2016; Scott-Parker et al., 2017) especially in consideration of the mountainous landscape of Fiji, interviewees expressed a strong reluctance to relocate or migrate. Questions over how those required to migrate would adapt have remained, with results suggesting migration may prove undesirable both due to loss of current lifestyle, as well as to practical barriers to migration. Therefore, while potentially necessary, the viability and acceptability of any migration, including intra-national relocation, appears to remain limited (McMichael & Katonivualiku, 2020). A broad range of barriers to possible relocation has been reported (Campbell, 2010) and this was echoed in the current findings. As in other PSIDS nations (Asugeni et al., 2015), land ownership and a subsequent lack of viable land for relocation was cited as a key barrier. A lack of clarity around how the costs associated with migration would be funded was a further barrier, with costs associated with migration having received limited consideration when proposing migration as a means of climate change adaptation (Mortreux & Barnett, 2009). Results

thus point to an expectation and need for government support for relocation, both to source alternative land as well as to provide requisite resourcing. Despite this need, it has been suggested that many villages in countries such as Fiji will need to provide their own relocation strategies and may receive little or no government support (Nunn et al., 2014; Nunn & Kumar, 2018; Piggott-McKellar et al., 2021). Relocation might also prove challenging due to loss of fertile soil and farming land that cannot be relocated (Nunn et al., 2014), which may increase food insecurity. Migration may also result in high population densities, which may further reduce access to resources and compound insecurity (Locke, 2009) although the effects of COVID-19 on rural Pacific populations suggests some adaptive flexibility in both food sourcing and urban versus rural living (Foley et al., 2022; Iese et al., 2021).

Irrespective of resourcing and costs, all interviewees expressed a reluctance to relocate. It has previously been argued that promoting migration as a means of adaptation to climate change overlooks the impact of such practices on the lives of those forced to relocate, as well as reducing alternative adaptation efforts (Adger & Barnett, 2005; Mortreux & Barnett, 2009). Accordingly, additional consideration around feasibility and promoting the acceptability of relocation may be required. Further understanding of the social and emotional impact of any such relocation, and how to best support individuals as well as communities with relocation, requires ongoing exploration.

## Limitations

Several limitations are worth noting. The sample we obtained had an average age of nearly 50 years old. In some ways, this is a strength of the study, as older populations are more likely to have greater historical knowledge of the local area and greater awareness of changes over a longer period of time. Yet we did not obtain a good understanding of these issues from a youth perspective. Given Pacific youth's climate action engagement (Hayward et al., 2020), this would be an important viewpoint in future research. Throughout the interviews, we observed that same-sex groups appeared to be more forthcoming about, and less dismissive of, environmental challenges faced than mixed-sex groups. Future work in the region may wish to prioritize same-sex interviews for this reason. Lastly, we did not interview anyone from villages in the remote outer islands of Fiji. This would be an important perspective to obtain in future research.

## Recommendations Moving Forward

There are significant cultural dimensions to how people understand and adapt to climate-related risks, with researchers noting that intervention measures that are not sensitive to local context are unlikely to be effective and could undermine existing resilience (Adger et al., 2013). We echo previous calls for genuine engagement with at-risk communities to co-produce adaptation strategies that both provide relevant scientific

information about the likely effects of climate change in specific areas and empower communities to make decisions about their futures that are respectful of their needs and wishes (e.g., McNamara et al., 2020; Nunn et al., 2014).

Specific recommendations include providing relevant information (e.g., Di Falco & Sharma-Khushal, 2019) in the local vernacular language and phrased in an optimistic manner that encourages adoption of solutions (Scott-Parker et al., 2017). Emphasizing existing strengths in these communities (e.g., traditional knowledge, community unity, respected decision-making processes) and tying future climate change to previous and/or existing threats that have been managed successfully can also aid in building resilience and hope (Janif et al., 2016). The strength of religious and spiritual beliefs points to a potentially important role for religious institutions in facilitating adaptive measures (Luetz & Nunn, 2021; Nunn et al., 2016). It is also worth considering whether place-based attachment can be used in climate change messaging to encourage protection of the valued local environment. We also encourage consideration of designing and implementing community-based interventions (e.g., Welton-Mitchell et al., 2018) to help rural communities prepare for future acute and subacute weather hazards. Lastly, as per the relevant observations of Trudinger et al. (2023) with respect to food systems in PSIDS, we support a holistic systems-based approach to the issue of food security as climate change advances.

## Conclusions

This research extends previous research, especially that conducted in the Global North and West, by providing new data from a relatively un-investigated population of Indigenous peoples from the Global South who are living in a region already at significant risk from climate change, and includes empirically supported recommendations for future adaptation efforts. A number of threats to Indigenous and other Fijians' ways of life and culture were observed during these interviews. Connection to, and loss thereof, traditional foods and agricultural practices pose ongoing physical and mental health risks, as well as immediate and future financial pressures. Loss of traditional lands either via coastal erosion and sea level rise, or due to relocation/migration, also threaten the sustainability of unique customs, beliefs, and languages in rural Fijian culture. In this study, we have provided additional evidence from Fiji of environmental changes and associated potential losses related to climate change, along with recommendations for approaches to adaptive measures that are culturally respectful and, we hope, empowering.

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## Openness and Transparency Statements

The present article has been checked by its handling editor(s) for compliance with the journal's open science and transparency policies. The completed *Transparency Checklist* is publicly available at:

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**Author Contributions.**

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**Diversity Statement.** In the list below, the check mark (☑) indicates which steps were taken to increase diversity within the context of this paper. Steps that were not taken or did not apply are unmarked (☐).

- Ethnically or otherwise diverse sample(s)
- Gender balanced sample(s)
- Inclusive gender measure
- Inclusive materials
- Sampling justification
- Extensive sample description
- Discussion of generalizability
- Diverse reference list
- Underprivileged / minority author(s)
- Early career author(s)
- Degree of privilege/marginalization considered in authorship order
- Author(s) from sampled population (avoiding ‘helicopter science’)

**Supplementary Materials.** The following table provides an overview of the accessibility of supplementary materials (if any) for this paper.



Type of supplementary material	Availability/Access
<b>Data</b>	
Interview Transcriptions.	Data was not made publicly available in order to preserve the confidentiality of the participants.
<b>Code</b>	
No code was involved in the study.	–
<b>Material</b>	
Expanded data analysis	Lykins et al., 2024
<b>Study/Analysis preregistration</b>	
The study was not preregistered.	–

#### Badges for Good Research Practices.

Open data: NO.

Open code: NO.

Open materials: NO.

Preregistration: NO.

Diversity statement: YES.

Note: YES = the present article meets the criteria for awarding the badge. NO = the present article does not meet the criteria for awarding the badge or the criteria are not applicable.

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