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Research Paper

Native Hawaiian wellbeing and transdiagnostic trauma symptoms: The protective role of physical activity in dissociation



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ABSTRACT

Objectives: Native Hawaiians (NH) report higher rates of interpersonal trauma in childhood or adolescence (ITCA) as well as higher rates of chronic physical illness and psychopathology. Given that physical activity (PA) has positive impacts on physical and mental health, it may also serve as a protective factor in the development of poor health outcomes in adulthood following ITCA. The present study investigated what factors contribute to wellbeing and transdiagnostic posttraumatic sequelae for individuals with exposure to ITCA using a dataset from a longitudinal study cohort (n = 989) of ethnically diverse older individuals (mean age = 60) in Hawai'i.

Methods: Five univariate general linear models were used to explore the unique effects of: PA; ITCA level; NH status; interactions with ITCA level; and interactions with NH status on the dependent variables: posttraumatic sequelae (i.e., dissociation, avoidance, interpersonal difficulty) and aspects of wellbeing (i.e., satisfaction with life [SWL], self-rated health).

Results: PA was a significant predictor of SWL, self-rated health, and dissociation, while exposure to ITCA predicted SWL. NH group status interacted with PA to uniquely predict dissociation. Exposure to ITCA differentially predicted SWL.

Conclusions: Findings support prior evidence that processes in posttraumatic experience are significantly associated with poor health-promoting behaviors (e.g., PA). Additionally, for NHs, PA may reduce dissociation, or levels of dissociation already present in the NH group may play a role in disengagement from PA. Future research should consider whether PA holds benefits across trauma types (e.g., historical trauma), or if culturally based PA is differentially more protective.

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Introduction

Pū'ali kalo i ka we'ole

Taro, for lack of water, grows misshapen—for lack of care, one may become ill

~Hawaiian Proverb

Native Hawaiians (NHs) often report lower rates of self-rated general health (Zhang et al., 2010) and have the lowest life expectancy of the different racial and ethnic groups in the state of Hawai'i (Ka'opua et al., 2011). As is common among Indigenous groups across the United States (Blue Bird Jernigan, D'Amico, & Keawe'aimoku Kaholokula, 2020; Stanley et al., 2017) and internationally (Anderson et al., 2006; Gracey & King, 2009; King et al., 2009), Hawai'i's Indigenous peoples are also at a disproportionately higher risk for a host of

chronic and acute physical health conditions (Hébert et al., 2015; Madan et al., 2012; Mau et al., 2009; Office of Hawaiian Affairs, n.d.). In Hawai'i, NHs and Filipinos report significantly more lifetime exposure to trauma, neglect, and household dysfunction than any other ethnic group (i.e., Japanese/Okinawan, Chinese, and Caucasian) (Klest et al., 2013).

The stress imposed by trauma experience may be one factor that contributes to poor health and wellbeing in the NH community. Trauma exposure is associated a wide range of mental disorders, including post-traumatic stress disorder, anxiety disorders, major depression, and substance abuse (McLaughlin et al., 2010, 2012; Shalev et al., 1998; Wilsnack et al., 1997). Trauma exposure is also associated with poor physical health outcomes, potentially as a result of increasing negative mental states (Kendall-Tackett et al., 2003; Kendall-Tackett, 2007), dissociation (Beck, 2009; Haven, 2009), or inflammation (Kendall-Tackett, 2009). When controlling for education and employment status, the association between trauma exposure and health is worse for NHs, compared to other ethnic groups (Klest et al.,

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2013). Little is known, however, about the relationships between trauma exposure, trauma-related symptoms, and wellbeing in the NH community.

The NH worldview places special value on relational connections (McCubbin et al., 2013) with an emphasis on the sociocultural level, rather than the individual level (McCubbin, 2006; McGregor et al., 2003). Given this core cultural orientation, and the importance of *pilina* (mutually sustaining relationships) in NH wellbeing (Kūkulu Kumuhana Planning Committee, 2017), interpersonal traumas may result in uniquely deleterious effects for this group. The current study will build from past work couched in betrayal trauma theory (e.g., Klest et al., 2013) by employing data from the Hawaii Longitudinal Study of Personality and Health to examine the differential impact of interpersonal trauma in childhood or adolescence on NHs, and test potential factors that exacerbate or mitigate the impact of trauma on wellbeing.

Interpersonal trauma

Interpersonal trauma that occurs in childhood or adolescence (ITCA) is prevalent and a major public health issue in the United States (U.S.; Magruder et al., 2015; Shern, Blanch, & Steverman, 2016; Shonkoff et al., 2012). Interpersonal traumas involve a human perpetrator of the trauma, either experienced or witnessed (e.g., experiencing or witnessing domestic violence); this is in contrast to an event-based trauma in which there is no human perpetrator (e.g., a hurricane). Interpersonal trauma results in more severe mental, behavioral (Ferry et al., 2014; Hapke et al., 2006; Kessler et al., 2017; Köbach et al., 2015), and physical health (Lange et al., 2003; Matthieu & Ivanoff, 2006; Velden et al., 2006) outcomes, compared to non-interpersonal trauma exposure.

Trauma before the age of 18 is particularly impactful as victims tend to have fewer coping mechanisms (Brown et al., 2014) and are developmentally vulnerable across a number of physiological systems (De Bellis et al., 1999; Perry, 2000). Trauma exposure before the age of 18 increases risk for both chronic physical and psychiatric conditions (Anda et al., 2006; Kendall-Tackett, 2009), disrupting a range of processes across social, emotional, cognitive, and behavioral domains (Cicchetti & Rogosch, 2002; Koenen et al., 2003). ITCA, in particular, is associated with worse trauma symptomology compared to non-interpersonal traumas (Cicchetti & Toth, 1995; Grossman et al., 2017; Higgins & McCabe, 2000; O'Donnell et al., 2017).

Such findings align with work couched within betrayal trauma theory (Freyd, 1996). This theoretical framework points to how the context and timing of traumatic events matter for their impact on individuals' later health and the time course of this impact. Specifically, work couched in this theory points to how traumatic events that hinder interpersonal attachments may prove particularly deleterious for later psychological wellbeing (e.g., Freyd et al., 2005; Goldsmith et al., 2011). In terms of prevalence, ethnic minorities are more at-risk for exposure to interpersonal trauma (Contractor et al., 2018; Roberts et al., 2011; Westphal et al., 2013) with Indigenous populations being particularly susceptible (Bachman, 1991; Buchwald et al., 2000; Greenfeld & Smith, 1999; Perilla et al., 2002; Tjaden & Thoenes, 2000). According to Behavioral Risk Factor Surveillance System data in the state of Hawai'i, NHs have the highest rates of most forms of ITCA compared to other ethnic groups in the state (Ye & Reyes-Salvail, 2014). Within emerging adulthood, NHs are more likely to have experienced violence and sexual violence, though not significantly higher compared to other ethnic minority groups (Archambeau et al., 2010).

Transdiagnostic posttraumatic sequelae

Exploring posttraumatic sequelae as transdiagnostic allows for a more nuanced view of the long-term effects of ITCA exposure.

Transdiagnostic constructs are those which appear across several dimensional diagnoses, such as those found in the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; Sauer-Zavala et al., 2017). While much of the research on posttraumatic outcomes have focused on psychiatric diagnoses (e.g., PTSD), a transdiagnostic approach may be more helpful in case-conceptualization, intervention research, and practice as it allows for a more process-level analysis (Hayes et al., 2019) and may avoid common biases found in the DSM-5 (Masuda et al., 2020). Comorbidities (Ford et al., 2006; Hefernan & Cloitre, 2000; Rytwinski et al., 2013; Vujanovic et al., 2018) and subclinical expressions of diagnoses following trauma (Lilly & London, 2015; Pietrzak et al., 2011) suggest a transdiagnostic approach may be more useful than the diagnostic approach. This is particularly true when providing research and treatment for at-risk individuals (Forbes et al., 2014) and low-resourced communities to Martin et al. (2018). Avoidance, dissociation, and interpersonal difficulty are interrelated and important transdiagnostic processes that help explain links between ITCA and poor wellbeing.

Avoidance. Avoidance has been implicated as an important transdiagnostic process in the development of psychopathology (Chawla & Ostafin, 2007; Ellard et al., 2010; Hayes et al., 1996; Watson et al., 2005). Most evidence suggests that avoidance is more common in individuals with a history of interpersonal trauma, compared to those with a non-interpersonal trauma history (Forbes et al., 2012; Forbes et al., 2014; Kelley et al., 2009), though latent class analysis (LCA) research has recently produced potentially contrary results (Contractor et al., 2018). Longitudinal evidence (Shenk et al., 2014) indicates avoidance following trauma uniquely predicts development of other symptoms associated with posttraumatic stress in individuals with a history of ITCA.

Dissociation. Prospective evidence suggests that dissociation is a common outcome of exposure to ITCA (Lansford et al., 2002). Number of betrayal traumas (i.e., a form of interpersonal trauma) predicts dissociation and physical health complaints in young adults (Goldsmith et al., 2012). Specifically for ethnic minority emerging adults, dissociation related to interpersonal trauma may play a key role in the development of other trauma-related symptoms (Gómez, 2019).

Interpersonal difficulty. Adults with a history of ITCA commonly report difficulties with interpersonal relationships and fear of intimacy (Davis et al., 2001) and experience detachment from others at higher rates than those who have experienced non-interpersonal traumas (Forbes et al., 2012; Graham et al., 2016; Kelley et al., 2009). ITCA has been linked with challenging interpersonal relationships in prospective (Labella et al., 2018) and intervention research studies (Keating et al., 2018), and is a common issue across many forms of ITCA, including complex trauma (Cloitre et al., 2013) and betrayal trauma (Owen et al., 2012). The social and health impacts of interpersonal difficulty for individuals with an ITCA history are significant.

Physical activity

PA may be an important complementary treatment option to address a number of transdiagnostic processes. PA shows promise as a treatment for depressive symptoms (Cooney et al., 2013) and as a treatment and prevention tool for posttraumatic symptoms (LeardMann et al., 2011). Some forms of PA, via incidental socializing, may improve both the individual cohesiveness and social integration of participants (Hassmén et al., 2000).

While research is limited regarding whether preventative health behaviors can influence the development of symptoms related to trauma, PA may be a powerful tool attenuating trauma's impact on an individual (Hall et al., 2015). One prospective study suggests that vigorous activity is associated with significantly reduced odds of *new or persistent* trauma symptoms (LeardMann et al., 2011). In an assessor-blinded randomized controlled trial comparing usual care to usual care plus a PA program, PA was found to improve symptoms of

trauma exposure beyond the effects of usual care and improved symptoms of depression and cardiometabolic risk (Rosenbaum et al., 2015). These findings support prior evidence indicating that PA results in significant reductions of trauma symptoms in pre- and post-measures (Fetzner & Asmundson, 2015; Manger & Motta, 2005).

The health-promoting effects of PA could be particularly important for individuals who experienced ITCA as chronic physical illnesses are prevalent in this population (Corso et al., 2008; Hughes et al., 2017). ITCA has been linked to poor cardiovascular reactivity (Batten et al., 2004), obesity (Danese & Tan, 2014), autoimmune disease (Dube et al., 2009), and chronic pain (Nelson et al., 2016). PA, on the other hand, is an efficacious primary and complementary treatment for poor cardiovascular reactivity (Huang et al., 2013), obesity (Paley & Johnson, 2018), autoimmune disease (Kjølhede et al., 2012; Plasqui, 2008), and chronic pain (Mior, 2001). For individuals who experienced ITCA, risk for several health concerns increases—health concerns that could be prevented or attenuated by participating in PA.

PA may be of unique importance to NHs in achieving or maintaining optimal wellbeing as they are at a higher risk for experiencing ITCA, compared to other ethnic groups (Ye & Reyes-Salvail, 2014). Further, there is evidence to suggest that NH community members may not be engaging in optimal levels of PA (Moy et al., 2010). If NHs are at increased risk for ITCA, and the potential health sequelae that follow, health-promoting behaviors such as PA may be of particular importance.

Current study

The primary focus of this study is to provide insight into the question, "For Native Hawaiians who have experienced interpersonal trauma in childhood or adolescence, are they more likely to exhibit atypical well-being status as adults, and what were the protective or iatrogenic factors?". This guiding question takes a positive deviance perspective (Marsh et al., 2004; Pascale et al., 2010; Spreitzer & Sonenshein, 2004) in that it aims to identify individuals who have, either consciously or not, broken from the post-ITCA patterns of poor mental and physical wellbeing and instead present with overall satisfying levels of health. Positive deviants are individuals, groups, or entities that are least likely to overcome a specific pervading problem, and yet, they defy the norm. The positive deviance theory has been used to explore health behavior change in minority (Foster et al., 2018; Ober et al., 2018) and Indigenous (Kadetz, 2014) populations, overcoming poverty in academic settings in Asia (Cheang & Goh, 2018), and supporting psychological resilience (Bouman et al., 2014), among others. By identifying health-promoting behaviors which are particularly important for NHs, a high-risk group for ITCA and poor health outcomes, the present study can provide data to answer the broad question stated above. Although positive deviance methods (i.e., qualitative) are not utilized here to identify *specific individuals* and their perspectives on what determined their positive outcomes, it marks an important first step in information gathering to this end.

Methods

Participants

Data for the current study were drawn from surveys administered to the Hawai'i Personality and Health cohort (Waves 5, 6, and 7). The cohort is part of a longitudinal study aiming to measure personality and health over time. The original study (see Digman, 1963) took place between 1959 and 1967 with over 2000 participants from elementary schools on the islands of O'ahu and Kaua'i. These students were observed by their teachers who recorded information regarding personality via surveys. The purpose of the study was to examine the structure of children's personality traits, the findings of which contributed to the Big Five factor structure of personality (Digman, 1990;

Digman & Takemoto-Chock, 1981; Goldberg, 1993). Approximately 75% of the original cohort were located in 1998 and over 60% of those located agreed to report on their health status and habits (see Hampson et al., 2001).

The current study offers an ethnically diverse participant sample ($n = 989$; 35.6% Japanese or Japanese-American; 21.6% Caucasian; 20.4% Hawaiian; 9.4% Filipino; 6% Chinese; 4.1% Okinawan; 2.8% Latino) with 51% identifying as female. The analytic sample differs based on which waves of data were employed; the measures were only captured in one wave and analyses that employed data across waves yield smaller samples. All sample sizes are reported below specific to the analyses of interest. The mean age in this cohort was 60 years old ($SD = 2.03$) by Wave 7. Most participants in this cohort had completed some college or community college (27.5%), or were college graduates (25.9%), with a postgraduate or professional degree (19%), or had completed high school (18.3%).

Measures

ITCA exposure: Brief Betrayal Trauma Survey (BBTS; Goldberg & Freyd, 2006). The BBTS is a self-report measure of trauma exposure, designed to compare betrayal and non-betrayal traumas (Goldberg & Freyd, 2006). This measure was employed by the Hawai'i study's earlier collaborators (i.e., Klest et al., 2013) who were interested in examining the clinical implications of betrayal trauma across different racial and ethnic groups. Respondents were asked to indicate whether traumatic events happened to them by indicating *Yes, No, Don't Know/Can't Remember, and Prefer not to respond*, at three time points (i.e., *Before age 12, Age 12 through Age 17, and Age 18 and Older* (see Freyd, 2008). Answering *Yes* was coded as a "1" and the other answers were coded as a "0." For the purposes of this study, having no experience with ITCA was scored as a "0," one experience across childhood or adolescence years was scored as a "1," and 2 or more experiences across childhood or adolescence years was scored as a "2." The BBTS includes questions about a variety of types of traumatic events, ranging from traumas without a betrayal component to traumas with a very high degree of betrayal, describing events behaviorally instead of using labels such as "abuse." The BBTS has demonstrated good test-retest stability and both percentage agreement in validation work with another sample (Goldberg & Freyd, 2006).

For the purposes of this investigation, the conception of interpersonal trauma in childhood or adolescence (ITCA) was informed by the National Child Traumatic Stress Network (NCTSN; Pynoos et al., 2008). ITCA here refers to maltreatment, interpersonal violence, abuse, assault, and neglect experiences encountered by participants before the age of 18. This category includes: physical, sexual, emotional abuse and incest; physical, medical, and emotional neglect; witnessing domestic violence; and caregiver mental illness, substance abuse, criminal involvement. Only questions regarding experience with interpersonal trauma were used for the purposes of this study. Scores on this measure were computed by summing the number of "yes" responses. The three items assessing neglect and household dysfunction were modeled after items from the Adverse Childhood Experiences study (Felitti et al., 1998).

Physical activity. The purpose of the Leisure Time Exercise Questionnaire (LTEQ) is to assess level of PA during leisure time (Godin & Shephard, 1985) using two items. The questionnaire was designed to classify people into several activity categories to allow for examination of this aspect of behavior in relation to psychosocial variables. The present study examined only moderate and strenuous PA frequency by averaging answers to two questions ($\alpha = 0.58$).

Wellbeing. The Satisfaction With Life Scale (SWLS; Diener et al., 1985) measures global life satisfaction. Five self-report items are usually rated on a 7-point scale (1 = strongly disagree to 7 = strongly

agree), however the scale was adjusted for the purposes of this study to include only 5 answer options ($\alpha = 0.88$).

Wellbeing was also measured by a single self-rated health question which asked the participants about how they perceive their health as compared to other people their age: "Compared to others of your same age and sex, would you say that in general your health is: Poor, Fair, Good, Very good, Excellent." Single-question reports of health have been shown to reliably predict health status and mortality across ethnic groups (McGee et al., 1999). The responses from Wave 7 were used for the purposes of this study.

Interpersonal difficulty. The Center for Epidemiologic Studies Depression Scale (CES-D) is a self-report measure of 20 items which ask respondents about frequency of symptom experience over the last month (Radloff, 1977). A 5-point scale ranging from 0 (Not At All) to 4 (Most or All of the Time). The measure has good reliability and validity for use with community samples (Tsai & Chentsova-Dutton, 2002). The original 20 items were classified by Radloff into four sub-categories (depressed affect, positive affect, somatic and retarded activity, and interpersonal problems). Kanazawa et al. (2007) added five items as part of an interpersonal difficulty subscale. The five added interpersonal connection items ("feel uncomfortable around people," "feel distant from people," "feel that you could not relate well to your family and friends," "avoid interacting with other people," "feel rejected by other people") loaded well onto the interpersonal problems factor ($\alpha = .88$; Kanazawa et al., 2007).

Avoidance. PTSD Checklist—Civilian Version (PTSD-C; Weathers et al., 1991) is a 17-item self-report instrument designed to assess symptoms of PTSD, as defined in the DSM-IV. Participants indicate the degree to which they are bothered by symptoms in the last month using a 5-point Likert-scale ranging from 1 (not at all) to 5 (extremely). The avoidance variable was calculated by averaging answers to two questions from this measure. The two items were: "Avoid thinking about or talking about a stressful experience from the past or avoid having feelings related to it"; and "Avoid activities or situations because they remind you of a stressful experience from the past" ($\alpha = .82$).

Dissociation. The dissociation variable was created by adding the scores for 6 subscale questions about dissociation from the Trauma Symptom Checklist-40 (TSC-40). The TSC-40 demonstrates good reliability and validity in samples of adults and the dissociation subscale also demonstrates good reliability and validity (Briere & Runtz, 1989; Elliott & Briere, 1992). Participants were asked about frequency of experience using a 4-point Likert scale: *Not at all*; *A little bit*; *Moderately*; and *Quite a bit*; they were also asked about their lifetime experience with each symptom in relationship to three life phases: *As a child* (before age 12); *As a teenager* (age 12-17); and *As an adult* (18+). Only the adult-era scores were used in the analysis. Examples of items include: "Feeling that things are "unreal"; and "Feelings that you are not always in your body" ($\alpha = 0.73$).

Procedure

Analytic plan. To answer the question, "Do differences in adult wellbeing exist across interpersonal trauma exposure in childhood and adolescence?", a one-way ANOVA was performed. To answer the question, "Will PA be a uniquely important protective factor for NH posttraumatic outcomes (i.e., dissociation, avoidance, interpersonal difficulty)?", univariate general linear modeling was used with NH status as a fixed factor. Separate analyses were conducted for each aspect of wellbeing as a dependent variable, with PA included as a predictor, as well as interaction terms to capture whether NH status interacted with PA to predict aspects of wellbeing (i.e., satisfaction with life, self-rated health). All analyses were run using IBM SPSS v.25. For all analyses described as significant, the threshold was $p < .05$.

Results

In the independent samples t-test, the 202 NH participants ($M = 0.98$) compared to the 851 non-NH participants ($M = 0.72$) reported significantly more exposure to ITCA ($t(287.18) = -3.543, p < .001$), 95% CI [-.408, -.116]. For the entire cohort, being NH was significantly correlated with more exposure to ITCA ($r(1051) = 0.114$) and poor self-rated health, ($r(753) = -0.110$). When the correlation analysis was split by NH vs. non-NH, the strength of several associations revealed a more nuanced perspective on the relationships which informed the subsequent univariate general linear model analysis. See Table 1 for a full presentation of correlations by NH and non-NH groups (see Table 1).

In the split correlation analyses for the NH group and the non-NH group, PA was significantly associated with dissociation only for the NH group ($r(95) = 0.229$). NH status marginally interacted with PA to predict interpersonal difficulty ($p = .053, h^2 = .009$). This supports findings from the correlation analysis, which found that the association between PA and interpersonal difficulty was only significant for the non-NH group ($r(487) = 0.093, p < .05$).

Differences in satisfaction with life across trauma exposure

To examine whether differences in adult wellbeing exist across interpersonal trauma exposure in childhood and adolescence, a one-way ANOVA was performed. Differences across trauma exposure level in satisfaction with life were significant ($F(2, 744) = 11.914, p < .001$). Having no exposure ($M = 3.70, SD = .792$) or one exposure ($M = 3.71, SD = .765$) to ITCA produced higher ratings of satisfaction with life compared to two or more exposures ($M = 3.39, SD = .847$). Tukey's HSD post-hoc comparisons showed significantly higher scores on satisfaction with life for the group exposed to two or more ITCA compared to both the one-exposure group and the no-exposure group (see Table 2).

Physical activity as a predictor of posttraumatic sequelae and aspects of wellbeing

Univariate general linear models were used to explore the unique effects of PA, ITCA level, and interaction of PA with ITCA level on the dependent variables: posttraumatic sequelae (i.e., dissociation, avoidance, interpersonal difficulty) and aspects of wellbeing (i.e., satisfaction with life, self-rated health). To determine whether or not ITCA was a predictor of posttraumatic sequelae and aspects of wellbeing, separate analyses were conducted with these constructs defined as dependent variables. To determine whether or not PA was a unique predictor of posttraumatic sequelae and aspects of wellbeing for NHs, PA was defined as an interaction term with NH status as a fixed factor.

In terms of significant findings, PA was a significant predictor of satisfaction with life ($p = .002, h^2 = .018$), self-rated health ($p < .001, h^2 = .050$), dissociation ($p = .015, h^2 = .011$) (see Tables 2–4), and exposure to ITCA predicted satisfaction with life ($p = .041, h^2 = .012$) (see Table 2). No additional significant interactions were found between exposure to ITCA and posttraumatic sequelae (see Tables 4–6) nor aspects of wellbeing. NH group status interacted with PA to uniquely predict dissociation ($p = .033, h^2 = .008$) (see Table 4).

Discussion

The present study offers support for several findings from the trauma and wellbeing literature, and substantiates new lines of inquiry for future research in support of the NH community. This study found that statistically higher ITCA existed in the NH group ($M = .98$, compared to a mean of .56 in the Japanese group). ITCA

Table 1
All correlations by native Hawaiian and non-native Hawaiian groups.

			Exer	SRH	SWL	Avoid	Dissoc [^]	ID	ITCA
Not Native Hawaiian	SRH	r	.293**						
		p	.000						
		N	606						
	SWL	r	.177**	.349**					
		p	.000	.000					
		N	601	615					
	Avoidance	r	-.009	-.028	-.206**				
		p	.843	.528	.000				
		N	500	510	508	694			
	Dissoc [^]	r	.023	-.044	-.006	-.029			
		p	.620	.338	.902	.501			
		N	463	474	470	538			
	ID	r	.093*	.128**	.083	-.016	-.035		
		p	.040	.004	.063	.705	.431		
		N	489	499	496	547	516		
	ITCA	r	.030	-.030	-.144**	.217**	-.003	.040	
		p	.454	.451	.000	.000	.932	.304	
		N	609	623	618	694	656	674	
Native Hawaiian	SRH	r	.311**						
		p	.000						
		N	132						
	SWL	r	.146	.352**					
		p	.098	.000					
		N	129	129					
	Avoidance	r	.001	-.166	-.218*				
		p	.993	.106	.035				
		N	96	96	94				
	Dissoc [^]	r	.229*	-.053	-.056	.060			
		p	.024	.604	.587	.519			
		N	97	97	95	119			
	ID	r	-.085	.149	.026	.086	-.106		
		p	.386	.128	.797	.351	.240		
		N	106	106	104	120	125		
	ITCA	r	-.114	-.086	-.228**	.223**	-.047	.117	
		p	.194	.329	.009	.006	.554	.141	
		N	132	132	129	149	160	161	

SRH = Self-rated Health; SWL = Satisfaction with Life; Dissoc = Dissociation; ID = Interpersonal Difficulty; ITCA = Interpersonal Trauma in the Childhood or Adolescence; [^]Dissociation is reverse coded

Table 2
Tests of between-subjects effects: satisfaction with life as the dependent variable.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	23.300	11	2.118	3.221	.000	.064
Intercept	395.353	1	395.353	601.279	.000	.537
Hawaiian – Not Hawaiian	.103	1	.103	.157	.692	.000
ITCA	4.232	2	2.116	3.219	.041	.012
PA	6.304	1	6.304	9.588	.002	.018
Hawaiian_Not * PA	.051	1	.051	.077	.781	.000
Trauma * PA	.687	2	.343	.522	.594	.002
Error	341.253	519	.658			
Total	7260.720	531				
Corrected Total	364.552	530				

Table 3
Tests of between-subjects effects: self-rated health as the dependent variable.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	68.103	7	9.729	12.08	0	.104
Intercept	380.223	1	380.223	472.119	0	0.393
Hawaiian – Not Hawaiian	1.411	1	1.411	1.752	0.186	0.002
ITCA	1.36	2	0.68	0.844	0.43	0.002
PA	30.917	1	30.917	38.39	0	0.05
Hawaiian_Not * PA	0.002	1	0.002	0.003	0.958	0
Trauma * PA	0.486	2	0.243	0.302	0.74	0.001
Error	587.909	730	0.805			
Total	8677	738				
Corrected Total	656.012	737				

Table 4
Tests of between-subjects effects: dissociation as the dependent variable.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	1.518	7	.217	1.087	.370	.014
Intercept	83.770	1	83.770	419.980	.000	.432
Hawaiian – Not Hawaiian	.760	1	.760	3.808	.052	.007
ITCA	.067	2	.033	.167	.846	.001
PA	1.180	1	1.180	5.916	.015	.011
Hawaiian_Not * PA	.911	1	.911	4.567	.033	.008
Trauma * PA	.097	2	.049	.243	.784	.001
Error	110.103	552	.199			
Total	1397.250	560				
Corrected Total	111.621	559				

ITCA = Interpersonal Trauma in Childhood or Adolescence.

Table 5
Tests of between-subjects effects: interpersonal difficulty as the dependent variable.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7.606	7	1.087	2.151	.037	.023
Intercept	187.412	1	187.412	370.980	.000	.371
Hawaiian – Not Hawaiian	.134	1	.134	.266	.606	.000
ITCA	.287	2	.144	.284	.753	.001
PA	.229	1	.229	.453	.501	.001
Hawaiian_Not * PA	.081	1	.081	.161	.689	.000
Trauma * PA	.213	2	.107	.211	.810	.001
Error	317.758	629	.505			
Total	2489.800	637				
Corrected Total	325.364	636				

Table 6
Tests of between-subjects effects: avoidance as the dependent variable.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	20.256	7	2.894	3.475	.001	.040
Intercept	156.078	1	156.078	187.416	.000	.242
Hawaiian – Not Hawaiian	.042	1	.042	.050	.822	.000
ITCA	2.193	2	1.097	1.317	.269	.004
PA	.227	1	.227	.273	.602	.000
Hawaiian_Not * PA	.030	1	.030	.036	.850	.000
Trauma * PA	2.019	2	1.009	1.212	.298	.004
Error	489.678	588	.833			
Total	2238.500	596				
Corrected Total	509.935	595				

ITCA = Interpersonal Trauma in Childhood or Adolescence

predicted significantly lower levels of satisfaction with life. With respect to the PA analyses, it proved a significant predictor of greater satisfaction with life, greater self-rated health, and less dissociation. This study offers at least cross-sectional evidence suggesting that, PA may prove important for helping to reduce dissociation, among an ethnically diverse sample of Hawaiians.

ITCA as a predictor of posttraumatic sequelae and wellbeing

While this study found that higher ITCA exposure predicted significantly lower levels of satisfaction with life, no other significant predictive relationships were found between ITCA and trauma outcomes (i.e., avoidance, dissociation, interpersonal difficulty) nor self-rated health. This is in contrast to strong evidence which suggests that ITCA is highly predictive of avoidance, dissociation, interpersonal difficulty, and self-rated health. Further, this study found that the one-exposure group and the no-exposure group were not significantly different in predicting satisfaction with life. These findings are not in alignment with the extant literature on ACEs (Anda et al., 2006; Chartier et al., 2010; Dube et al., 2009; Jakubowski et al., 2018; Liming & Grube, 2018) which suggests that even one exposure predicts significantly lower levels of life satisfaction. While these contradictions with the literature may be explained in a number of ways,

interpretation should be informed by the fact that the no-exposure group included responses of *No, Do not Know/Can not Remember, and Prefer not to respond*. Respondents who preferred not to respond may have experienced trauma. However, they were not comfortable sharing their experience in a survey, making this group more heterogeneous than would be ideal.

Physical activity as a predictor of posttraumatic sequelae and aspects of wellbeing

Broadly speaking, participants' level of exposure to ITCA did not uniquely impact the extent to which PA was associated with measures of wellbeing. In other words, PA was not more important for individuals with ITCA exposure compared to those without. However, overall, the present study supports the well-established relationships between PA and self-rated general health, as well as PA and satisfaction with life (e.g., Bauman, 2004; Cooney et al., 2013; Penedo & Dahn, 2005), regardless of level of ITCA exposure.

In terms of posttraumatic sequelae, greater PA level predicted less interpersonal difficulty for both NHs and non-NHs. This is in line with prior research suggesting some forms of PA, via incidental socializing, may improve both the individual cohesiveness and social integration

of participants (Hassmén et al., 2000). Greater PA level did not predict degrees of avoidance but did predict degree of dissociation. One possible explanation for these differential findings is that dissociation exists on a continuum of poor mental health with avoidance and psychosis following trauma (Moskowitz et al., 2019), and that avoidance is too mild a symptom to be captured as it relates to PA.

For the NH group, PA was important in predicting dissociation; although the interaction was only marginally significant, the magnitude of association was stronger between these constructs for the NH sample. This relationship could imply that for NHs, PA is a uniquely important activity in preventing dissociation. It may also mean that levels of dissociation already present in the NH group prevented them from engaging in PA. There is evidence to suggest that processes in posttraumatic experience are significantly associated with poor health-promoting behaviors such as PA (Ginzburg et al., 2010; Mills et al., 2006). This relationship may also be explained by one or several other variables that have contributed to dissociation and PA ratings. For example, given the high value placed on connection, relationships, attachment bonds to 'āina (land) (McCubbin et al., 2013; McGregor et al., 2003), and the post-colonial reality of these broken bonds, it may be that NHs are at unique risk for dissociation, which also affects engagement in embodied endeavors such as PA.

From a clinical perspective, analyzing the posttraumatic sequelae and aspects of wellbeing as separate constructs, rather than diagnoses (e.g., PTSD) presents several unique benefits. Although causality cannot be established from this study, PA may be important for patients who present with dissociation, and especially when working with a NH client. Conversely, since dissociation partially explains lower rates of health-promoting activities following trauma (Hall et al., 2015), reducing dissociation may improve participation in these activities, including exercise. Patients who do not meet full criteria for a diagnosis, stand to greatly benefit from research examining more process-based constructs such as avoidance or interpersonal difficulty (Hayes et al., 2019; Philippot et al., 2019). Finally, and perhaps most importantly, at-risk individuals (Forbes et al., 2014) and low-resourced communities to (Martin et al., 2018) have the most to gain from a transdiagnostic approach such as the one employed here.

Limitations and future directions

The present study should be considered with several limitations in mind. The current study was cross-sectional in nature and does not provide evidence of causality. Further, self-report methods for exploring trauma are somewhat limited by their retrospective nature. However, retrospective reports are often viewed as more valid when only asking for dichotomous occurrence (Hardt & Rutter, 2004) and appear reliable over time (Dube et al., 2003). Interpretation of the results as they relate to trauma should also be informed by the fact that the avoidance and dissociation items were administered in the same wave as the questions regarding trauma experience, which may have primed respondents to endorse more or less severe presentations of these processes. In terms of measures, the LTEQ had a low Cronbach's alpha. This measure was chosen for the present study as it is short (i.e., two questions) and would not contribute to participant burden of answering so many questionnaires—this likely explains the low alpha for this sample. Future research should attempt to replicate these findings with a longer measure. In addition, future studies might benefit from using a larger sample size to ensure optimal power for testing moderation effects. Finally, the number of respondents may have been impacted by the sensitive nature of the questions about psychological experiences following trauma questions, and other methods for asking these questions may be valuable in future research.

As this was a non-clinical study which made use of an existing data resource, research building on these findings would allow for a more nuanced view of interacting processes. Information regarding

trauma frequency, duration, interpersonal trauma type (e.g., sexual abuse, emotional neglect, witnessing interpersonal violence), intimacy level, and event centrality would be important data to gather regarding trauma experience. Further, some forms of ITCA may be more impactful specifically on dissociative processes than others. Emotional neglect (Dutra et al., 2009) and abuse (Braehler et al., 2013; Cecil et al., 2017) in childhood or adolescence appear to be types of ITCA most predictive of dissociation.

Given the extensive literature suggesting the cumulative impacts of intergenerational and historical trauma on Indigenous communities across mental and physical health outcomes (Brave Heart et al., 2011; Conching & Thayer, 2019; Evans-Campbell, 2008; Mohatt et al., 2014; Pokhrel & Herzog, 2014), future research with the NH community would benefit by including measures of these forms of trauma. Another potential future direction is to investigate the extent to which measures developed with other samples, like the ones employed here, apply or merit modification when working with NH groups. For instance, future work on NH wellbeing may benefit by considering constructs deemed important to the NH community, and in alignment with the Indigenous approach to psychology. For Indigenous communities around the world, culture, spirituality, and place attachment are inextricably intertwined with identity, and therefore, wellbeing (Durkalec et al., 2015). The NH worldview places *connection* at the core of values, beliefs, and behaviors and treats the individual, the family system, neighborhood, community, society, and the world as both *interdependent* and *relational* (McCubbin et al., 2013; McGregor et al., 2003).

In addition, when examining the iatrogenic effects of trauma with members of the NH community, as well as potentially protective factors, it is imperative to take stock of historical and intergenerational processes, spirituality constructs (e.g., 'āina attachment, *mana*), self-determination (i.e., *ea*), cultural activities, and mutually sustaining relationships (i.e., *pilina*), especially those in the family (i.e., 'ohana). In future research with NH participants, measures of resilience (e.g., Antonio et al., 2020) and relational wellbeing (e.g., McCubbin et al., 2013) may be valuable, as they have been specifically designed for and validated with this community. Wellbeing frameworks already developed by NH stakeholders in NH-serving organizations will likely also prove elucidating in future research with NH participants (e.g., Kamehameha Schools Strategic Planning and Implementation Division, 2014; Kūkulu Kumuhana Planning Committee, 2017; McGregor et al., 2003).

Finally, while the present study was designed to answer questions surrounding NH positive deviance in the face of ITCA, future research would benefit from the utilization of qualitative methodologies. Qualitative interviews with known positive deviants are most commonly used within the positive deviance framework—in this case, we suggest interviews with NH community members who are thriving despite contextual and individual factors that might have statistically suggested poor outcomes. How researchers might go about defining wellbeing or thriving for the NH community is addressed above.

When considering how to promote positive factors, such as PA, researchers in the NH community suggest interventions should be derived from participatory approaches (Kaholokula et al., 2018; Lee & Look, 2017; Mokuau, 2011; Oetzel et al., 2018), whereby researchers work with participants, adjusting aspects of the study based on their input and engagement. Additionally, PA programs for Pacific Islanders have benefitted from involving the community (i.e., family members, schools, and spiritual organizations) at all stages from design to evaluation (Dancause et al., 2013; Kaholokula et al., 2013; Kremer et al., 2011; McEligot et al., 2012). As a baseline, any PA program designed for the NH community should be culturally responsive (Kaholokula et al., 2018). A PA program for NHs would also benefit from positioning itself as *culturally sustaining* (Paris, 2012)—that is, seeking to specifically support the flourishing of the NH culture as it

is under threat of endangerment due to systemic inequalities. For a community which experienced large-scale post-colonial population decline (Pietruszewsky & Douglas, 1994), an illegal seizing of government (Kinzer, 2007; Kualapai, 2005), and a ban of its mother language (Warner, 1998; Wilson, 1998), cultural sustainability is vital. *Hula*, a Native Hawaiian spiritual dance, has been leveraged to improve hypertension control and cardiovascular disease risk, as examined by a recent randomized control trial (Kaholokula et al., 2017, 2021). Utilizing traditional forms of movement as the basis for a PA intervention program may result in more positive outcomes from both the individual and community levels of analysis.

Concluding remarks

These findings offer evidence in support of prior findings that PA predicts self-rated general health and satisfaction with life. It also provides novel evidence which suggests PA is uniquely important for NHs in predicting dissociation. These analyses explore three post-traumatic sequelae independent of diagnoses, lending further granularity to a process-based approach to research on ITCA. Importantly, the present study contributes to the body of research on understudied populations in Hawai'i (Lim et al., 2019), where mental and behavioral health is currently considered the most pressing public health concern in the state (Turnure & Pressler, 2017). Finally, given the limited variance in outcomes predicted by the current study constructs, future research should explore factors such as historical trauma, spirituality constructs (e.g., 'āina attachment, *mana*), self-determination (i.e., *ea*), cultural activities, and relational processes in determining positive deviance in the face of ITCA. If the Hawaiian proverb is indeed true, that the absence of some nourishing element may cause one to become ill, might there be other elements to support positive deviance? These findings, taken as a whole, are offered to shed light on the processes underlying *lamalama ka ola*, shining bright with wellbeing.

Declaration of Competing Interest

The authors of this paper have no conflicts of interest to declare.

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