Indigenous Eco-Relational Engagement and mental wellbeing among American Indian and First Nation adults: Applying the Indigenous Traditional Ecological Knowledge framework

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Abstract

Addressing Indigenous determinants of health includes understanding the interconnectedness among Indigenous health and wellbeing, relationship to place and Mother Earth. Though persistent challenges exert a disproportionate burden on Indigenous communities, many experience an intersecting risk profile that includes a history of settler-colonial subjugation and historical loss, while navigating loss and damage due to climate change which further impinges on their mental health. Traditional, spiritual, and cultural activities operate as functional observations of Indigenous Traditional Ecological Knowledges (ITEK) and are increasingly recognized as necessary components of adaptation and mitigation to climate change and sustainability of otherwise delicate ecosystems. In addition, corresponding traditional and cultural activities have been associated with improved mental health. The present investigation utilizes land-based cultural and traditional activities, as well as indicators of language revitalization in a composite variable – Indigenous Eco-Relational Engagement (IERE) to determine the relationship to positive mental health among Anishinaabeg in the United States and Canada. The results suggest that IERE shares a positive relationship with positive mental health among Anishinaabeg adults. Results of the present investigation help us to reconcile the relationship between Indigenous and planetary health, such that both may be supplemented through the active observation of ITEKs vis-à-vis engagement in traditional cultural, spiritual activities and language revitalization efforts.

Indigenous Affiliations

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Introduction

Indigenous communities around the world have sustained ecosystems since time immemorial and continue to maintain Indigenous Traditional Ecological Knowledges (ITEK) systems that are culturally and spiritually connected to their traditional lands. ITEKs are representative of Indigenous epistemologies (i.e., systems of thinking and knowing) and ontologies (i.e., theory of the nature of reality) that are community-based, holistic, ancestral, orally transmitted, and share a deep relationship with land and place (Whyte, 2017; Redvers, 2023). Furthermore, ITEKs and corresponding cultural, traditional, and spiritual practices remain essential stewards and determinants of Indigenous health and planetary health, together (Redvers, 2023; Gray & Cote, 2019; Whyte, 2017).

Impacts of Colonialism on Indigenous Health

American Indian and Alaska Native (AI/AN) communities continue to contend with the disruption and enduring legacy of settler-colonialism that has culminated in a near total (98.9%) dispossession and loss of co-extensive lands, coupled with an average forced migration distance of 239 km to contemporary reservation lands (Farrell et al., 2021). The cumulative impacts of settler-colonialism and corresponding historical federal-Indian policy on social and health inequities of Indigenous communities are comprehensive and further challenged by inadequate, culturally misaligned, and chronically underfunded healthcare infrastructure (Warne and Frizzell, 2014). Historically, settler-colonialism can be traced according to federal-Indian policies that served as the architecture of land dispossession, forced assimilation, removal of AIAN people from traditional territories, genocide, and disenfranchisement that continue to profoundly impact individual, family, and community health (Gone & Trimble, 2012; Roubideaux et al., 2018; Indian Health Service (IHS), 2014; Sawchuck et al., 2016; Warne & Wescott, 2019). This awareness of Indigenous Peoples' interdependence and cultural and spiritual connection to traditional lands has led to an enhanced understanding of the collective burden on mental health many Indigenous communities experience in the context of disconnection of culture, spirituality and kinship to place, such as ecological grief and historical loss, both of which are uniquely attributed to the changes or forced removal from our traditional lands and ecosystems (Cunsolo et al., 2018; Walls et al., 2020).

Indigenous Traditional Ecological Knowledge and Indigenous Health

As a remedy to the devastating effects of historical loss and human-caused climate change consequences, ITEKs and associated traditional, cultural, and spiritual practices are

increasingly recognized as necessary components of Indigenous health and wellness, while also cited as critical to climate change adaptation and mitigation (Gone & Trimble, 2012; Gray & Cote, 2019; Snowshoe et al., 2017; Ford, 2012; Consulo, 2018; Ford et al., 2020). For example, the harvest of Manoomin (wild rice) among Great Lakes Anishinaabeg functions to both re-seed rice beds in the area's lakes and rivers, while also providing a sustainable and nutrient dense food-source for these Indigenous communities and local waterfowl. Equally important, Manoomin has a special place in Anishinaabeg ontologies or traditional creation and cultural stories that recognize this annual traditional and cultural activity as critical to community health. In summary, applying an ITEK lens requires us not to see plants and animals as "wild" or someone's "property", but to honor them as "sovereign persons" so that we follow more protective traditional harvesting practices. We receive these knowledges through stories passed down by traditional knowledge holders that are often told in our first language as Indigenous Peoples. These unwritten guidelines, or "original instructions", provide ethical and practical knowledge to govern our consumption by avoiding overexploitation and protecting the future of the plants and animals, including humans (Nelson & Schilling, 2018). The importance of Indigenous lifeways, cultural, and traditional spiritual activities in attenuating or decreasing the harmful effects of historical, intergenerational, and complex trauma, as well as associated symptomology are well documented in several areas of Indigenous health (i.e., substance use, distress, suicidal ideation, type 2 diabetes, etc.) (Gray & Cote, 2019; Gone & Calf Looking, 2011; Roubideaux et al., 2018).

Indigenous Eco-Relational Engagement

In the present investigation we recognize the implicit strength of language, as well as the unique contribution of place, in the active engagement of the ITEK framework (see Appendix A), while taking note of the inherent difficulty in measuring cultural identity within American Indian and Alaska Native samples (Whitesell et al., 2014; Walls et al., 2016a; Gonzalez et al., 2022). In efforts to examine the importance of traditional and spiritual practices as land-based practices, and traditional language use as a place-based determinant of health within an ITEK framework, the current study advances the concept of Indigenous Eco-Relational Engagement. Indigenous Eco-Relational Engagement (IERE) represents an opportunity to understand the health implications of active engagement in ITEKs by the following variables that are critical to such practices: land-based traditional cultural activities, land-based spiritual activities, and language dimensions. Consistent with this definition of IERE, language revitalization and engagement in land-based traditional and spiritual practices are place-based and central to concepts of wellness, health, and resilience within Indigenous communities (Gray & Cote, 2019; Gone & Trimble, 2012; Snowshoe et al., 2017).

Influences on Mental Health

Self-reported mental health has been positively associated with indicators of cultural connectedness (i.e., identity, traditions, and spirituality) (Gray & Cote, 2019). Similarly, Snowshoe and colleagues (2017) found that an abbreviated measure of cultural connectedness was associated with positive mental health in First Nations youth. Along similar lines, in a literature review on protective factors within American Indian communities, Henson et al. (2017) found cultural connectedness operated as a multi-level protective factor when represented by

three components: involvement in traditional activities, identification with American Indian culture, and involvement and importance of traditional spirituality (Henson et al., 2017).

In efforts to illustrate the importance of culture to concepts of wellness within Indigenous communities, Kading et al. (2019) measured the relationship of good health or "living in a good way" and cultural teachings within Anishinaabe young adults. Their analyses revealed that participants' multi-dimensional conceptions of positive well-being and good health reflected traditional and cultural values and teachings within the Anishinaabe youth sample (Kading et al., 2019). To date, few studies have investigated cultural and spiritual activity engagement and practices while re-centering concepts of wellness within Indigenous place-based knowledge systems. Previous literature exists on the protective role of cultural and traditional activities for wellness of American Indian and First Nations (AIFN) youth; however, discrimination and historical loss have been found to also affect well-being, perhaps even negating the protective effects of cultural engagement and spirituality (Walls et al., 2016a; MacDonald et al., 2013). Furthermore, Walls et al. (2016a) found in initial models that spirituality was associated with poor psychological health outcomes, particularly depression, anger, somatization, and interpersonal difficulties – which may lead to premature, inaccurate conclusions about relationships between culture and health without attending to considerations of trauma and loss associated with historical trauma, subjugation, and violence. Critically, however, these effects were attenuated (decreased) once historical loss and perceived discrimination were accounted for in statistical models (Walls et al., 2016a). Such findings guide the research community to account for variables that moderate relationships between culture and measures of wellness, especially in establishing spirituality and culture as protective in the wake of devastating collective and historical loss via settler-colonialism. Relatedly, Whitbeck et al. (2009) found that

adolescents thought daily about historical loss at similar rates to their adult caretakers. Reminders of cultural loss are salient and active in the realities of living life on reservations, especially as communities grapple with endangered tribal languages, health inequities, poverty, and a sense of persistent cultural erosion or cultural discontinuity (Whitbeck et al., 2009).

Considering the critical importance and relationship of Indigenous languages to land and place, we elected to utilize language use as a determinant of relationship to local ecosystems, in addition to cultural and spiritual activity engagement. Indigenous languages are often recognized as conduits of ITEKs, sharing an intimate relationship to place. In this respect, several studies attest to the importance of language maintenance and revitalization to Indigenous health and well-being (Gonzalez et al., 2017; Whalen et al., 2016). Accordingly, Indigenous languages, cultural and traditional spiritual activities are key facilitators of ITEKs in their capacity to assist in a harmonious and spiritual relationship to land and place.

Altogether, the present study contributes to existing literature on the relationship of culture, spirituality, and language to place and the natural environment within Indigenous communities, as well as well-being (Gonzalez et al., 2017; Kading et al., 2019; Lines et al., 2019). In particular, this study seeks to recognize how Indigenous eco-relational engagement (IERE) is related to Indigenous concepts of wellness. This aim is consistent with prevailing interests by Indigenous communities and stakeholders to explore the strengths-based contributions of culture, language, and traditional activities associated with Indigenous community health (O'Keefe et al., 2023). Our study proposed to measure the connection between IERE and positive mental health among AIFN adults with the goal of providing evidence to prioritize climate change-related mental health consequences. Importantly, we sought to further substantiate the health-related associations and collective importance of the eco-centric and

relational belief systems that are central to Indigenous ways of knowing within a sample of Anishinaabeg from both the United States and Canada. Therefore, we asked the following question: Is increased participation in land-based traditional and spirituality activities and place-based language use associated with positive mental health among AIFN adults? Finally, we expected to find that gender and socioeconomic status will impact these relationships between adjusted and unadjusted models (Wilson & Rosenberg, 2002; Bethune et al., 2019).

Methods

This study utilized data from the Healing Pathways (HP) Project, an ongoing longitudinal community-based participatory research (CBPR) study initiated in 2002 in the upper Midwest and Canada, conducted through partnerships across eight reservation (U.S.) and reserve (Canada) communities. The original longitudinal panel study began in 2002 and consisted of eight annual interviews with the adolescents and at least one caregiver (Waves 1–8). The second part of the study was a 3-year follow-up (Waves 9–11) with the original adolescent participants, now adults. Wave 9 occurred between 2017 and 2018 and collected data from 453 participants between the ages of 24 to 27 years. Additional study design details are published elsewhere (Walls et al., 2020; Whitbeck et al., 2014).

Participants

All participants were American Indian or First Nations (AIFN) from four U.S. reservations/Nations and four Canadian First Nations that share common cultural values, language, beliefs, and traditions. Data was collected to examine culturally specific risk and protective factors for mental health among Indigenous youth/adolescents. Tribal resolutions were

sought prior to the study. Each community included co-researchers in the form of study-supported Community Research Councils (CRC). Members of CRC were involved in every stage of the study and provided feedback on earlier drafts of this manuscript, offered suggested revisions, and gave approval prior to submission for publication. The current analysis used Wave 9 data. Of the original 453 HP participants, 445 were included in these analyses. The participants had a mean age of 26, about three-quarters of participants reported a past year income less than $24,999, over half were female, about a third resided on a reserve or reservation, and about a quarter reported not finishing high school.

Measures

Exposure measure: Indigenous eco-relational engagement (IERE) is a fixed composite measure comprised of the following summed recoded binary ("Yes", "No") indicators of past year participation in: 1) Nine community-identified nature-based traditional activities (i.e., ricing, spear fishing, collected maple sugar or syrup, picked berries, hunting, gathered birch bark, gathered Ka-nik-a-nik or Asemaa (tobacco), snared rabbits, trapped, collected herbs or medicine); 2) two traditional spiritual activities (i.e., offered tobacco, participated in a sweat lodge); and 3) four language variables (i.e., understands some Anishinaabe language, easily understands spoken Anishinaabe, speaks some Anishinaabe, speaks Anishinaabe conversationally). We computed a standardized Cronbach's alpha to determine internal consistency among the 15 listed IERE items. Internal consistency of the IERE measure was $\alpha = 0.754$ (95% CI: 0.709, 0.795).

Outcome measure: The flourishing scale is composed of 8 likert-scale items ranging from 0 (strongly disagree) to 4 (strongly agree) that measure self-perceived success with a high score

representing that a person has many perceived psychological resources and strengths (Diener et al., 2009) (see Appendix B). The flourishing scale has been validated across age groups and applied cross-culturally in International Indigenous contexts (Hone et al., 2014; Ritchie et al., 2014). For this study, positive mental health was measured as the sum of the recoded versions of the 8 flourishing scale variables that ranged from 4 to 32.

Covariates: Income and gender were the demographic characteristics controlled for in this study. Income is a binary variable that consists of a person's total income either being above or below $24,999. Gender consisted of either being female or male.

Statistical analysis

We applied a linear regression with robust standard errors to estimate the association between IERE and positive mental health in both unadjusted and adjusted models. All statistical analyses were done in R version 4.1.3 (R Core Team, 2021).

Results

Increased participation across all three focal measures that comprise IERE occurred across higher agreement with positive mental health statements. Descriptive statistics and zero-order correlations are provided in Tables 1 and 2. Table 1 shows positive mental health organized into equally distributed low (4-22), medium (23-26), and high (27-32) levels to draw comparisons by either mean and standard deviation or count and percentage across each predictor variable, including focal variables that comprise IERE. The mean positive mental health score for all participants was 24 (max of 32). Just over half (58%) of the participants reported being female and nearly three-quarters reported having total combined annual incomes

below $24,999. Zero-order correlations indicated that only nature-based traditional activities and

the IERE composite measure were positively associated with positive mental health. All three

focal IERE variables were positively correlated with each other.

Table 1: Sample characteristics by levels of positive mental health among Healing
Pathways Wave 9 participants, 2017

| Characteristics | Full Sample No. (%) or Mean ±SD | Positive Mental Health | | | p^a |
		Low No. (%) or Mean ±SD	Medium No. (%) or Mean ±SD	High No. (%) or Mean ±SD	
All	445 (100.0)	127 (28.67)	207 (46.73)	109 (24.6)	…
IERE					
Nature-based traditional activities	1.74 ± 2.03	1.61 ± 2.094	1.71 ± 2.016	1.99 ± 1.993	0.049
Nature-based spiritual activities	0.90 ± 0.702	0.84 ± 0.717	0.92 ± 0.692	0.94 ± 0.711	0.268
Language	1.65 ± 1.146	1.62 ± 1.091	1.62 ± 1.130	1.76 ± 1.239	0.106
IERE composite	4.30 ± 2.963	4.07 ± 3.003	4.25 ± 2.950	4.69 ± 2.946	0.025
Demographics					
Gender: Female	250 (57.5)	59 (48.4)	128 (63.1)	61 (56.5)	0.849
Income: < $24,999	314 (71.4)	108 (85.7)	141 (69.1)	63 (58.3)	<0.001

IERE = Indigenous eco-relational engagement; b = Adjusted for gender and income; a = p values were
determined by analysis of variance (continuous) comparing positive mental health (flourishing) as a
continuous measure by each variable of interest.

Table 2: Zero-order Correlation Matrix

	1	2	3	4	5
1. Positive Mental Health	1				
2. Traditional activities	0.093*	1			
3. Spiritual activities	0.053	0.362***	1		
4. Language	0.077	0.260***	0.379***	1	
5. Indigenous Eco-relational Engagement	0.106*	0.872***	0.632***	0.654***	1

Both unadjusted and adjusted models in Table 3 demonstrated a significant positive association between increased participation in IERE and positive mental health (confirming the significant zero-order correlation observed in Table 2). Reporting lower income was the only significant covariate, which was found to be negatively associated with positive mental health.

Table 3: Linear regression of the association between IERE and positive mental health.

	Unadjusted (n=443)				Adjusted (n=428)			
	β	std. Error	CI	p	β	std. Error	95% CI	p
(Intercept)	23.30	0.41	22.49, 24.10	**<0.001**	25.22	0.48	24.28, 26.15	**<0.001**
IERE	0.16	0.07	0.02, 0.31	**0.023**	0.15	0.07	0.02, 0.29	**0.030**
Gender: Male					-0.20	0.43	-1.06, 0.65	0.645
Income: below $24,999					-2.50	0.43	-3.34, -1.67	**<0.001**
IERE = Indigenous eco-relational engagement; b = Adjusted for gender and income.								
R2 / R2 adjusted	0.011 / 0.009				0.073 / 0.066			

Discussion

This study explored the connection between nature-based traditional and spiritual activity participation, the use of traditional language that comprises Indigenous health and Indigenous Eco-Relational Engagement (IERE), and positive mental health. Our findings demonstrated that IERE participation is significantly associated with positive mental health in both adjusted and unadjusted models. These findings are consistent with previous literature on the important role of cultural and traditional activities, language facility, and cultural connectedness as key factors to Indigenous mental health and well-being (Gray & Cote, 2019; Snowshoe et al., 2016; Gonzalez et al., 2021; Kading et al., 2019; Lines et al., 2019). Importantly, endorsement of annual income less than $24,999 was negatively associated with positive mental health (i.e., the relationship between income and mental health is negative) is similar in scope to previous findings (Wilson

& Rosenburg, 2002). Again, such findings are indicative of the inherent complexity of measuring culture as a protective factor within Indigenous communities (Walls et al., 2016b).

This study contributes to the gap in literature by examining the relationship between land, place-based cultural engagement, and positive mental health as it pertains to Indigenous-based determinants of health, particularly as an integral determinant of planetary health (Redvers et al., 2023). Furthermore, the current findings begin to explore how engagement in land and place-based cultural and traditional activities share associations with positive mental health. Such results might help guide research at the intersection of ecology and Indigenous health, particularly considering that there is an absence of studies on eco-anxiety from an Indigenous perspective, or with an Indigenous sample (Coffey et al., 2021). We introduced the novel concept of IERE, which inherently relies on a foundation of ITEKs as a central framework - a deep and embedded land-based relationship between humans and nature, by measuring engagement of Indigenous traditional cultural and spiritual activities, as well as language use.

In many ways, this study is an important recognition of the dynamic interplay between traditional cultural, spiritual activities and language as facilitators of ITEKs and the ways in which Indigenous ontologies (knowledge ways of being or existence) import critical ecological pedagogies based on sustainability and relationship to land (Hayes et al., 2019; Consulo, 2018; Ford, 2012). Our study is but one attempt to reclaim Indigenous concepts of health and wellness and explore the interdependence on our cultural and spiritual relationship to land and place, which has suffered a profound disruption, owing to a history of human and civil rights violations via-a-vis settler-colonialism (Vecchio et al., 2022; Gone & Trimble, 2012). Critical investigations have provided clear evidence that historical loss is tied to poor mental health among Indigenous Peoples (Whitbeck et al., 2004; 2009; Walls et al., 2016a). Therefore, it is

only natural to shift to measuring promising protective factors that buffer against poor mental health outcomes among Indigenous populations. Like other strengths-based studies, we also found positive connections between traditional and spiritual practices, traditional language use, and mental wellbeing (Gonzalez et al., 2022), with the added nature-based component. Further substantiating the remedial role of engagement in cultural, spiritual activities and language revitalization is important for tribal and urban community health, particularly in efforts to ameliorate health inequities and redress the legacy of settler-colonialism (Gone & Trimble, 2012; Brockie et al., 2015; Warne & Wescott, 2019). Many Indigenous groups, as is outlined within the United Nations Declaration on the Rights of Indigenous Peoples (United Nations, 2007) recognize the concept of relationship and connectedness to the land as a principal component of health, wellness, and sovereignty. Based on the findings herein, as well as existing literature on cultural connectedness and health, it is important for institutions and governments alike to assist in efforts to restore ITEKs at individual, family, and community levels for Indigenous and planetary health. In this case, the return to culture, traditions, spirituality, and language are recognized as foundational elements in the efforts to understand and ameliorate the corresponding effects of settler colonialism, as well as historical loss, while moving toward individual and collective healing and cultural continuity (Gone & Trimble, 2012; Nelson & Wilson, 2017; Walls et al., 2012; Warne & Wescott, 2019; Bethune et al., 2019).

Limitations

This investigation is not without its limitations. The positive mental health measure has limited variability which may have hindered our ability to detect differences. Due to the heterogeneity between the 574 federally recognized tribes and more than 600 First Nations

groups in Canada, these findings represent only the communities sampled, limiting generalizability to other Indigenous groups. Given that this is a cross-sectional study design, we cannot infer causation, however, this study provides a unique exploration of the utility of culture, language and spirituality as a "proxy" of ITEK, and how the engagement of ITEK, which is primarily translated through stories and first-person observations, can share a robust relationship with positive mental health. Finally, language as a variable associated with place is unique for Indigenous communities, as many Indigenous languages are endangered in the United States and Canada (Whalen et al., 2016). Efforts to introduce language as a place-based indicator or health or well-being is aspirational in its ability to capture the places where these languages are taught, spoken and learned. Critically, much of this work is ongoing, however, existing literature on language as a place-based determinant of health within American Indian/Alaska Native and First Nations communities is promising (Whalen et al., 2016; Gonzalez et al., 2017).

Future Directions

Consistent with the findings of the connection between IERE and positive mental health, there are several implications for the impact of engagement in nature-based traditional and spiritual activities and practices at the individual, family, and community levels. Of course, the findings herein further reinforce calls for cultural, spiritual, and language initiatives as place-based determinants of Indigenous health, and important for climate adaptation/mitigation programs, more broadly. As an asset-based approach to inform health policies, Indigenous and non-Indigenous policymakers are encouraged to advocate for adequate resources and support for the sovereignty of Indigenous communities to actively engage spiritual, cultural, and language practices on their lands. Importantly, these findings support recognition of the importance of

Indigenous Traditional Ecological Knowledge(s) to climate adaptation and mitigation programs, particularly as Indigenous communities grapple with the concept of loss and damage that underscores environmental policy development. For example, environmental and climate policies may well include directing local, federal, and state funding streams toward AIAN community health care reform, practices, and programming that utilize IERE as adjunctive preventative treatments to any combination of mental and/or physical health maladies or comorbidities. Such efforts would also broaden the scope of climate adaptation programs and open avenues for evaluation of Indigenous-led sustainability practices and land-based pedagogies.

Future investigations and community-based research can apply ITEK by incorporating stories and first-person observations using a mixed-method study design to determine long-term health impacts of land and language-based traditional and spiritual activities, particularly when ecological determinants are studied together (i.e., water access/quality, access to greenspace, access to land where traditional activities take place). With respect to the findings that those who identify as low-income reported a negative relationship with flourishing, this is an area of significant concern as Indigenous communities report lower incomes, on average, than non-Indigenous counterparts (Bethune et al., 2019; IHS, 2014; Warne, 2019; Public Health Agency of Canada, 2018; National Collaborating Centre for Aboriginal Health, 2013). Finally, integrating, framing assessment, and treatment planning with IERE practices holds promising practice implications as well as development of IERE and culturally relevant climate adaptation toolkits for Indigenous communities in healthcare and public health programming, with particular attention to managed care organizations and third-party payors.

In closing, an important indicator of Indigenous health is the health of Mother Earth, and the health of Mother Earth is an important indicator of Indigenous health. Such intimate and ancestral interdependence and shared relationship is the bedrock of Indigenous Peoples' recognition of place. As such, climate change and associated environmental impacts, a key determinant of health for all, are among the most pressing public health challenges for Indigenous communities (Watts et al., 2019; Consulo, 2018; Ford, 2012; Intergovernmental Panel on Climate Change (IPCC), 2019). High-heat days, drought, lower ice coverage and melting sea ice, ocean acidification, loss of ecosystems and habitats, increases in vector-borne illness (e.g., malaria), and food and water insecurity are substantially greater in communities that rely on their immediate environments and ecosystems for their livelihoods (Ford et al., 2020; Romanello et al., 2022). Furthermore, these climate-related negative consequences affect to an even greater degree communities that experience social and health inequities, systems of structural oppression, racism, and legacies of colonialism (IPCC, 2019; Romanello et al., 2022; Whyte, 2017). For these reasons, Indigenous communities are at particular risk for loss and damage from climate change due to floods, wildfires, melting sea ice, drought, and more that directly impact their lifeways and sense of being associated with Mother Earth and sense of place (Romanello et al., 2022; Whyte, 2017; Consulo & Ellis, 2018). Indigenous Eco-Relational Engagement stands as an important conceptual framework that will contribute important scientific findings to the global community on the convergence of human health and planetary health, a relationship that we all share.

Conclusion

Indigenous Peoples are caretakers of 80% of the world's biodiversity, while only representing 5% of the global population, and inhabiting only 20% of the earth's surface (Redvers, 2022; World Bank, 2008). Although the urgency and scope of this global environmental health crisis is difficult to comprehend on a community level, we know that Indigenous communities are particularly vulnerable to the health impacts of climate change due to the cumulative and disproportionate burden of health inequities, enduring social and ecological determinants, as well as a deep relationship and dependence on land and place that define culture and lifeways (Ford, 2012; Hayes, 2018; Consulo, 2018). Yet, the results of the present investigation help us to reconcile the relationship between Indigenous mental health and planetary health, such that both may be achieved through the observation of ITEKs vis-à-vis engagement in traditional cultural, spiritual activities and language revitalization efforts (Whalen et al., 2016; Ford et al., 2020; Redvers, 2023; Gonzalez et al., 2017).

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References

Bethune, R., Absher, N., Obiagwu, M., Qarmout, T., Steeves, M., Yaghoubi, M., Tikoo, R., Szafron, M., Dell, C., & Farag, M. (2019). Social determinants of self-reported health for Canada's indigenous peoples: a public health approach. *Public health*, *176*, 172–180. https://doi.org/10.1016/j.puhe.2018.03.00

Brockie, T.N., Dana-Sacco, G., Wallen, G.R., Wilcox, H.C., & Campbell, J.C. (2015). The Relationship of Adverse Childhood Experiences to PTSD, Depression, Poly-Drug Use and Suicide Attempt in Reservation-Based Native American Adolescents and Young Adults. *American Journal of Community Psychology, 55*(3-4), 411-21. https://doi.org/10.1007/s10464-015-9721-3

Coffey, Y., Bhullar, N., Durkin, J., Islam, M. S., & Usher, K. (2021). Understanding eco-anxiety: A systematic scoping review of current literature and identified knowledge gaps. *The Journal of Climate Change and Health, 3*, 100047. https://doi.org/10.1016/j.joclim.2021.100047

Diener, E., Wirtz, D., Tov, W., Kim-Prieto, C., Choi, D., Oishi, S., Biswas-Diener, R. (2009). New Well-being Measures: Short Scales to Assess Flourishing and Positive and Negative Feelings. *Social Indicators Research, 97*, 143–156. https://doi.org/10.1007/s11205-009-9493-y

Consulo, A., & Ellis, N. R. (2018). Ecological Grief as a Mental Health Response to Climate Change-Related Loss. *Nature Climate Change, 8*, 275-281. https://doi.org/10.1038/s41558-018-0092-2

Farrell, J., Burow, P.B., McConnell, K., Bayham, J., Whyte, K., & Koss, G. (2021). Effects of land dispossession and forced migration on Indigenous peoples in North America. *Science, 374*(6567), eabe4943. https://doi.org/10.1126/science.abe4943

Ford, J. D. (2012). Indigenous Health and Climate Change. *American Journal of Public Health, 102*(7), 1260-1266. https://doi.org/10.2105/AJPH.2012.300752

Ford, J. D., King, N., Galappaththi, E. K., Pearce, T., McDowell, G., & Harper, S. L. (2020). The Resilience of Indigenous Peoples to Environmental Change. *One Earth*, *2*(6), 532-543. https://doi.org/10.1016/j.oneear.2020.05.014

Gone, J. P., & Calf Looking, P. E. (2011). American Indian culture as substance abuse treatment: Pursuing evidence for a local intervention. *Journal of Psychoactive Drugs, 43*(4), 291–296. https://doi.org/10.1080/02791072.2011.628915

Gone, J. P. & Trimble, J. E., (2012). American Indian and Alaska Native Mental Health: Diverse Perspectives on Enduring Disparities. *Annual Review of Clinical Psychology, 8*, 131-160. https://doi.org/10.1146/annurev-clinpsy-032511-143127

Gonzalez, M. B., Sittner, K. J., Saniguq Ullrich, J., & Walls, M. L. (2021). Spiritual connectedness through prayer as a mediator of the relationship between Indigenous language use and positive mental health. *Cultural diversity & ethnic minority psychology*, *27*(4), 746–757. https://doi.org/10.1037/cdp0000466

Gonzalez, M., Aronson, B., Kellar, S., Walls, M., Greenfield, B. (2017). Language as a Facilitator of Cultural Connection. *ab-Original, 1*(2): 176-194. https://doi.org/10.5325/aboriginal.1.2.0176

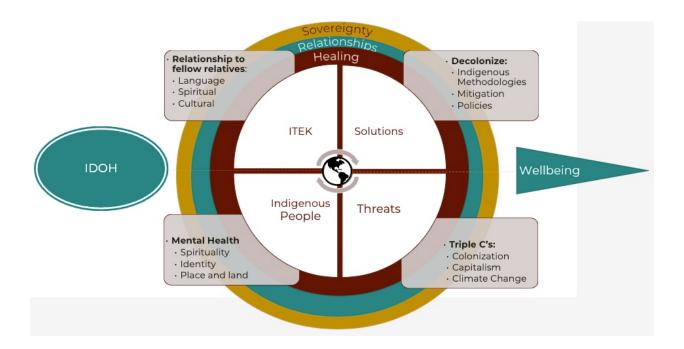Gonzalez, M. B., Sittner, K. J., & Walls, M. L. (2022). Cultural efficacy as a novel component of

understanding linkages between culture and mental health in Indigenous communities. *American Journal of Community Psychology*, *70*, 191-201. https://doi.org/10.1002/ajcp.12594

Gray, A. P., & Cote, W. (2019). Cultural connectedness protects mental health against the effect of historical trauma among anishinabe young adults. *Public Health, 176*, 77-81. https://doi.org/10.1016/j.puhe.2018.12.003

Hayes, S., Desha, C., Burke, M., Gibbs, M., & Chester, M. (2019). Leveraging socio-ecological resilience theory to build climate resilience in transport infrastructure. *Transport Reviews*, *39*(5), 677–699. https://doi.org/10.1080/01441647.2019.1612480

Hayes, K., & Poland, B. (2018). Addressing Mental Health in a Changing Climate: Incorporating Mental Health Indicators into Climate Change and Health Vulnerability and Adaptation Assessments. *International Journal of Environmental Research and Public Health*, *15*(9), 1806. https://doi.org/10.3390/ijerph15091806

Henson, M., Sabo, S., Trujillo, A., & Teufel-Shone, N. (2017). Identifying Protective Factors to Promote Health in American Indian and Alaska Native Adolescents: A Literature Review. *The Journal of Primary Prevention*, *38*(1-2), 5–26. https://doi.org/10.1007/s10935-016-0455-2

Hone, L., Jarden, A., & Schofield, G. (2014). Psychometric properties of the Flourishing Scale in a New Zealand sample. *Social Indicators Research, 119*(2), 1031–1045. https://doi.org/10.1007/s11205-013-0501-x

Indian Health Service. (2015). *Trends in Indian health: 2014 Edition.* https://www.ihs.gov/sites/dps/themes/responsive2017/display_objects/documents/Trends 2014Book508.pdf

Intergovernmental Panel on Climate Change. (2019).*Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems* [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (Eds.)]. https://www.ipcc.ch/site/assets/uploads/2019/11/SRCCL-Full-Report-Compiled-191128.pdf

Kading, M. L., Gonzalez, M. B., Herman, K. A., Gonzalez, J., & Walls, M. L. (2019). Living a good way of life: Perspectives from American Indian and First Nation young adults. *American Journal of Community Psychology, 64*(1-2), 21-33. https://doi.org/10.1002/ajcp.12372

Lines, L. A., Yellowknives Dene First Nation Wellness Division, & Jardine, C. G. (2019). Connection to the land as a youth-identified social determinant of Indigenous Peoples' health. *BMC Public Health, 19*(1), 176. https://doi.org/10.1186/s12889-018-6383-8

MacDonald, J. P., Ford, J. D., Willox, A. C., & Ross, N. A. (2013). A review of protective factors and causal mechanisms that enhance the mental health of indigenous circumpolar youth. *International Journal of Circumpolar Health, 72*, 21775. https://doi.org/10.3402/ijch.v72i0.21775

National Collaborating Centre for Aboriginal Health (2013). *Setting the Context: An Overview of Aboriginal Health in Canada*. https://www.ccnsa-nccah.ca/docs/context/FS-OverviewAbororiginalHealth-EN.pdf

Nelson, M. K., & Shilling, D. (Eds.). (2018). *Traditional ecological knowledge: Learning from*

Indigenous practices for environmental sustainability. Cambridge University Press.

Nelson, S. E., & Wilson, K. (2017). The mental health of Indigenous peoples in Canada: A critical review of research. *Social Science & Medicine, 176*, 93-112. https://doi.org/10.1016/j.socscimed.2017.01.021

O'Keefe, V. M., Maudrie, T. L., Cole, A. B., Ullrich, J. S., Fish, J., Hill, K. X., White, L. A., Redvers, N., Jernigan, V. B. B., Lewis, J. P., West, A. E., Apok, C. A., White, E. J., Ivanich, J. D., Schultz, K., Lewis, M. E., Sarche, M. C., Gonzalez, M. B., Parker, M., Neuner Weinstein, S. E., … Walls, M. L. (2023). Conceptualizing Indigenous strengths-based health and wellness research using group concept mapping. *Archives of Public Health, 81*(1), 71. https://doi.org/10.1186/s13690-023-01066-7

R Core Team. (2021). *R: A language and environment for statistical computing.* R Foundation for Statistical Computing. https://www.R-project.org

Redvers, N., Aubrey, P., Celidwen, Y., & Hill, K. X. (2023). Indigenous Peoples: Traditional knowledges, climate change, and health. *PLOS Global Public Health, 3*(10), e0002474. https://doi.org/10.1371/journal.pgph.0002474

Redvers, N., Celidwen, Y., Schultz, C., Horn, O., Githaiga, C., Vera, M., Perdrisat, M., Mad Plume, L., Kobei, D., Kain, M. C., Poelina, A., Rojas, J. N., & Blondin, B. (2022). The determinants of planetary health: an Indigenous consensus perspective. *The Lancet. Planetary health*, *6*(2), e156–e163. https://doi.org/10.1016/S2542-5196(21)00354-5

Ritchie, S. D., Wabano, M. J., Russell, K., Enosse, L., & Young, N. L. (2014). Promoting resilience and wellbeing through an outdoor intervention designed for aboriginal adolescents. *Rural and Remote Health, 14*(2523), 1–19.

Romanello, M., Di Napoli, C., Drummond, P., Green, C., Kennard, H., Lampard, P., Scamman, D., Arnell, N., Ayeb-Karlsson, S., Ford, L. B., Belesova, K., Bowen, K., Cai, W., Callaghan, M., Campbell-Lendrum, D., Chambers, J., van Daalen, K. R., Dalin, C., Dasandi, N., Dasgupta, S., … Costello, A. (2022). The 2022 report of the Lancet Countdown on health and climate change: health at the mercy of fossil fuels. *Lancet, 400*(10363), 1619–1654. https://doi.org/10.1016/S0140-6736(22)01540-9

Roubideaux, Y., Lewis, M., Hill, K., Pytalski, S., & Around Him, D. (2018). *Diabetes and Behavioral Health Comorbidity: Advancing the Tribal Behavioral Health Agenda*. NCAI Policy Research Center https://www.researchgate.net/publication/326519161_diabetes_and_behavioral_health_comorbidity_advancing_the_tribal_behavioral_health_agenda

Public Health Agency of Canada. (2018). *Key Health Inequities in Canada: A National Portrait, Executive Summary*. https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/science-research/key-health-inequalities-canada-national-portrait-executive-summary/hir-executive-summary-eng.pdf

Sawchuk, W. (2016). Riding the divide – balancing resource extraction and conservation in the Muskwa-Kechika region of northern British Columbia, Canada. *Journal of Ecotourism*, *15*(3), 285–293. https://doi.org/10.1080/14724049.2016.1189557

Snowshoe, A., Crooks, C. V., Tremblay, P. F., & Hinson, R. E. (2017). Cultural connectedness and its relation to mental wellness for first nations youth. *The Journal of Primary Prevention, 38*(1-2), 67-86. https://doi.org/10.1007/s10935-016-0454-3

Snowshoe, A., & Starblanket, N. V. (2016). Eyininiw mistatimwak: The role of the Lac La Croix Indigenous pony for First Nations youth mental wellness. *Journal of Indigenous Wellbeing*, *1*(2), 60-76.

United Nations. (2007). *United Nations Declaration on the Rights of Indigenous peoples*. https://www.un.org/development/desa/indigenouspeoples/wp-content/uploads/sites/19/2018/11/UNDRIP_E_web.pdf

Vecchio, E. A., Dickson, M., & Zhang, Y. (2022). Indigenous Mental Health and Climate Change: A Systematic Literature Review. *The Journal of Climate Change and Health, 6*, 1-8. https://doi.org/10.1016/j.joclim.2022.100121

Walls, M. L., Whitbeck, L., & Armenta, B. (2016a). A cautionary tale: Examining the interplay of culturally specific risk and resilience factors in indigenous communities. *Clinical Psychological Science : A Journal of the Association for Psychological Science, 4*(4), 732-743. https://doi.org/10.1177/2167702616645795

Walls, M., Pearson, C., Kading, M., & Teyra, C. (2016b). Psychological wellbeing in the face of adversity among merican indians: Preliminary evidence of a new population health paradox? *Annals of Public Health and Research, 3*(1), 1034. https://pubmed.ncbi.nlm.nih.gov/28553671/

Walls, M., Sittner, K. J., Whitbeck, L. B., Herman, K., Gonzalez, M., Elm, J. H. L., Hautala, D., Dertinger, M., & Hoyt, D. R. (2020). Prevalence of mental disorders from adolescence through early adulthood in American Indian and first nations communities. *International Journal of Mental Health and Addiction, 19*, 2116–2130. https://doi.org/10.1007/s11469-020-00304-1

Walls, M. L., & Whitbeck, L. B. (2012). The Intergenerational Effects of Relocation Policies on Indigenous Families. *Journal of Family Issues*, *33*(9), 1272-1293. https://doi.org/10.1177/0192513X12447178

Warne, D., & Frizzell, L. B. (2014). American Indian health policy: historical trends and contemporary issues. *American journal of public health*, *104*(Suppl 3), S263–S267. https://doi.org/10.2105/AJPH.2013.301682

Warne, D., & Wescott, S. (2019). Social Determinants of American Indian Nutritional Health. *Current developments in nutrition*, *3*(Suppl 2), 12–18. https://doi.org/10.1093/cdn/nzz054

Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Belesova, K., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Capstick, S., Chambers, J., Dalin, C., Daly, M., Dasandi, N., Davies, M., Drummond, P., Dubrow, R., Ebi, K. L., Eckelman, M., Ekins, P., … Montgomery, H. (2019). The 2019 report of The Lancet Countdown on health and climate change: ensuring that the health of a child born today is not defined by a changing climate. *Lancet, 394*(10211), 1836–1878. https://doi.org/10.1016/S0140-6736(19)32596-6

Whalen, D. H., Moss, M., & Baldwin, D. (2016). *Healing Through Language: Positive Physical Health Effects of Indigenous Language Use.* CUNY Academic Works.

Whitbeck, L.B., Walls, M., & Hartshorn, K. (2014). *Indigenous Adolescent Development: Psychological, Social and Historical Contexts* (1st ed.). Psychology Press. https://doi.org/10.4324/9781315880211

Whitbeck, L. B., Adams, G. W., Hoyt, D. R., & Chen, X. (2004). Conceptualizing and measuring historical trauma among American Indian people. *American Journal of Community Psychology, 33*(3–4), 119–130. http://doi.org/10.1023/B:AJCP.0000027000.77357.31

Whitbeck, L. B., Walls, M. L., Johnson, K. D., Morrisseau, A. D., & McDougall, C. M. (2009).

Depressed affect and historical loss among north american indigenous adolescents. *American Indian and Alaska Native Mental Health Research (Online), 16*(3), 16-41. 10.5820/aian.1603.2009.16

Whitesell, N. R., Asdigian, N. L., Kaufman, C. E., Big Crow, C., Shangreau, C., Keane, E. M., Mousseau, A. C., & Mitchell, C. M. (2014). Trajectories of substance use among young American Indian adolescents: patterns and predictors. *Journal of youth and adolescence*, *43*(3), 437–453. https://doi.org/10.1007/s10964-013-0026-2

Wilson, K., & Rosenberg, M. W. (2002). Exploring the determinants of health for First Nations peoples in Canada: Can Existing Frameworks Accommodate Traditional Activities? *Social Science and Medicine, 55*, 2017-2031. https://doi.org/10.1016/S0277-9536(01)00342-2

Whyte, K., (2017). Indigenous Climate Change Studies: Indigenizing Futures, Decolonizing the Anthropocene. *English Language Notes, 55*,1-2. 10.1215/00138282-55.1-2.153

The World Bank (2008). *The Role of Indigenous Peoples in Biodiversity Conservation: The Natural but Often Forgotten Partners*. https://documents1.worldbank.org/curated/en/995271468177530126/pdf/443000WP0BOX321onservation01PUBLIC1.pdf

Appendix A
ITEK Framework

Appendix B
Brief Screening Instruments

Flourishing Scale

Source: adapted Diener et al. 2009

- 1. Strongly disagree
- 2. Disagree
- 3. Neither agree nor disagree
- 4. Agree
- 5. Strongly agree
- 99. DK/REF

WxM5a ....I lead a purposeful and meaningful life
WxM5b ....My social relationships are supportive and rewarding
WxM5c ....I am engaged and interested in my daily activities
WxM5d ....I actively contribute to the happiness and well-being of others
WxM5e ....I am competent and capable in the activities that are important to me
WxM5f...........I am a good person and live a good life
WxM5g ....I am optimistic about my future
WxM5h ....People respect me