UNDERSTANDING HISTORICAL TRAUMA AMONG URBAN INDIGENOUS ADULTS AT RISK FOR DIABETES

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Abstract: Historical trauma has been posited as a key framework for conceptualizing and addressing health equity in Indigenous populations. Using a community-based participatory approach, this study aimed to examine historical trauma and key psycho-social correlates among urban Indigenous adults at risk for diabetes to inform diabetes and other chronic disease prevention strategies. Indigenous adult participants (n=207) were recruited from an urban area in California and were asked to identify whether their Indigenous heritage was from a group in the United States, Canada, or Latin America. Historical trauma was assessed using the Historical Loss (HLS) and Historical Loss Associated Symptoms (HLAS) scales. Nearly half (49%) of Indigenous participants from the United States or Canada endorsed thinking about one or more historical losses weekly, daily, or several times a day, compared to 32% for Indigenous participants from Mexico, Central America, and South America. Most participants (62%) reported experiencing one or more historical loss-associated symptoms, such as depression and anger, sometimes, often, or always. Ancestry from the United States or Canada, depression, and participation in cultural activities were associated with greater HLS and HLAS scores, indicating a greater number of losses and associated symptoms. Results suggest a need to consider historical trauma when designing diabetes prevention interventions and the need to further consider ancestry differences. As preventive efforts for Indigenous adults expand in urban environments, behavioral interventions must incorporate strategies that address community-identified barriers in order to succeed.

INTRODUCTION

American Indian, Alaska Native (AI/AN), and Indigenous communities have the highest prevalence of diabetes among all racial and ethnic groups in the United States (Centers for Disease

Control and Prevention [CDC], 2017). In 2018, the prevalence of type 2 diabetes was two times greater in AI/AN adults relative to non-Hispanic White adults (CDC, 2020). In addition to a higher prevalence, diabetes is the leading cause of blindness and lower-extremity amputation among AI/AN adults, for whom these complications appear at an earlier age (McLaughlin, 2010). Although interventions that encourage moderate weight loss and physical activity mitigate the onset of diabetes and are effective across multiple racial/ethnic groups (Knowler et al., 2002), including some reservation settings (Jiang et al., 2013), there remains a dearth of research demonstrating the successful translation of diabetes prevention efforts among Indigenous adults, including for those residing in urban areas. Thus, interventions and health promotion efforts that are specifically tailored for this population are crucial.

Genuine and bidirectional partnership with Indigenous community members and organizations is critical for understanding barriers to effective diabetes prevention and informing interventions. A community-university partnership, known as *Pathways to American Indian and Alaska Native Wellness*, came together to investigate successful models for diabetes prevention in a northern California urban Indigenous community. The community is an area where many Indigenous people relocated from reservation communities as a result of the 1950's Relocation Act (Ablon, 1964). Over years of planning and implementing their Diabetes Prevention Program (DPP) intervention, the community partner identified historical trauma as a key underlying challenge to successful diabetes prevention efforts and a construct requiring additional understanding in order to better implement DPP interventions within community and primary care settings (Rosas et al., 2016).

Historical trauma—the cumulative and transgenerational experience of group-wide trauma manifesting as emotional and psychosocial distress among Indigenous people (Brave Heart & DeBruyn, 1998; Whitbeck et al., 2004)—has been posited as a potential pathway explaining high prevalence of chronic conditions among Indigenous populations (Evans-Campbell, 2008; Walters, Beltran et al., 2011). Historical traumatic experiences—including starvation, disease, forced relocation and displacement, boarding school reeducation and assimilation, and culturally-restrictive policies—are hypothesized to be intergenerationally re-experienced as historical trauma and manifest as associated biopsychosocial symptoms such as post-traumatic stress (e.g., anger, numbing), depression, anxiety, sleep loss, and feelings of social isolation (Whitbeck et al., 2004; Whitbeck et al., 2009). Scholars have linked historical trauma to epigenic changes contributing to neurobiological changes, which along with proximal

stressors, place individuals at higher risk for cardiovascular diseases, immune response dysfunction, and other physical and mental health concerns (Walters, Beltran et al., 2011; Walters, Mohammed et al., 2011). Stress responses have also been linked to deleterious coping behaviors (e.g., eating, drinking, smoking) and lack of engagement in healthy behaviors (Pascoe & Smart Richman, 2009). The confluence of these factors may not only increase the risk of developing chronic conditions, including diabetes, but may also impact individuals' abilities to engage in prevention programs.

Little is known about how and to what degree urban Indigenous communities experience historical trauma. With approximately 70% of Indigenous individuals in the United States residing in urban areas (Indian Health Service, 2018), there exists an urgent need to understand how Indigenous adults at risk for diabetes may experience historical trauma. The objective of this study was therefore to examine experiences of historical trauma and key psycho-social correlates among urban Indigenous adults at risk for diabetes to inform diabetes and other chronic disease prevention strategies for this population.

METHODS

Study Design and Participants

Data for this analysis were collected from 2014 to 2016 using a baseline assessment conducted prior to participation in a randomized comparative effectiveness trial of a standard DPP and a culturally enhanced DPP for urban Indigenous adults in northern California. The trial design and outcomes have been previously described (Rosas et al., 2016; 2020). Study participants (n = 207) were recruited from Santa Clara County, CA. Sample size was determined based on having 80% power to detect significant differences in the primary outcome of body mass index (BMI) change between study groups of the trial. From the overall baseline sample (n = 207), two individuals were excluded due to concerns for staff safety. Another 12 participants did not complete questionnaires of interest for the present study (i.e., HLS, HLAS), culminating in a sample size of 193 participants. All study procedures were performed in accordance with the 1964 Helsinki declaration and its later amendments and approved by the Institutional Review Boards of Stanford University School of Medicine (IRB #30015). All participants provided written informed consent. Given the diversity among our participants in terms of ancestry, with a large proportion identifying as having Mexican, South, or Central American Indigenous descent, we chose

"Indigenous" rather than "AI/AN" as the main terminology for this manuscript. We continue to use AI/AN when citing specific findings from the literature to accurately depict the samples being described by other authors.

Eligibility Criteria

Inclusion criteria included a BMI between 30 and 55 kg/m^2, no type 2 diabetes diagnosis, and one or more criteria for metabolic syndrome (triglycerides >150 mg/dL, high-density lipoprotein cholesterol <40 mg/dL among men and <50 mg/dL among women, blood pressure >130/80 mmHg or current anti-hypertensive treatment, and fasting glucose 100–125 mg/dL). Participants self-reported their Indigenous ancestry. Multiple allowed responses included Indigenous to the United States or Canada; Indigenous to Mexico, South, or Central America (Latin America hereafter); and Indigenous ancestry from two or more of following regions: North or Latin America, Caribbean, and Pacific Islands. Exclusion criteria included taking atypical antipsychotics or multiple medications, certain comorbidities (e.g., heart failure, unstable metabolic disorders, and substance abuse), pregnancy, and plans to relocate during the study. Exclusions were in place for participants' safety (e.g., pregnancy and unstable medical conditions) and to ensure retention in the larger study (e.g., relocation).

Community Engagement

This study was led by a community-university partnership between Stanford University School of Medicine and Pathways to American Indian and Alaska Native Wellness. The American Indian Community Action Board served as the partnership governing body and consisted of leaders from the urban Indigenous community. The American Indian Community Action Board was involved in all phases of the research process, including study design; intervention development and delivery; and data collection, analysis, and interpretation.

Measures

Outcome Measures

Trained staff collected data using an interviewer-administered questionnaire. The Historical Loss Scale (HLS) and the Historical Loss Associated Symptoms Scale (HLAS) developed by Whitbeck et al. (2004) were used to assess historical trauma. These measures assess both losses due to historical trauma (e.g., loss of land, language, traditional ways, loss of family

ties because of boarding schools), as well as symptoms related to these losses (e.g., sadness, anger). Specific losses and symptoms were developed in collaboration with Indigenous elders and tribal advisory boards (Whitbeck et al., 2004). Participants who self-identified as Indigenous to the United States or First Nations of Canada were administered the standard HLS. Participants who self-identified as Indigenous to Latin America completed a modified version of the HLS developed by Brave Heart and colleagues (2011), which reflects differences in historical experiences. For example, for Indigenous participants from Latin America, loss of land was assessed with items indicating loss due to the Spanish colonization, immigration or migration, and/or due to being a refugee. The standard (13 items) and modified (21 items) HLS were scored on a scale of one to six ("never" = 1, "several times a day" = 6), and items on the HLAS (17 items) were scored on a scale of one to five ("never" = 1, "always" = 5). Mean HLS and HLAS scores were calculated by summing scores and dividing by the total number of items. Higher scores indicated participants thought more frequently about a given historical loss or more commonly experienced a symptom associated with historical loss.

Covariates

Socioeconomic variables included education (less than high school, high school graduate, some college, and college graduate or more) and income (0-200% Federal Poverty Level [FPL], 200-400% FPL, and >400% FPL). Healthy and unhealthy dietary scores were summed and divided into tertiles using a food frequency questionnaire (FFQ; Teufel-Shone et al., 2015). Greater scores corresponded to increased consumption. Physical activity was assessed via the Women's Health Initiative (WHI) physical activity scale (Meyer et al., 2009) and categorized as 500-1,000 MET-minutes/week, <500 MET-minutes/week, and >1,000 MET-minutes/week (Physical Activity Guidelines Advisory Committee, 2018). Items on this measure are gender neutral (e.g., "Think about the walking you do outside the home. How often do you walk outside the home for more than 10 minutes without stopping?"), and the measure allows for collecting physical activities according to intensity, which reduces time of completion and hence participant burden. Moreover, prior studies using the WHI physical activity scale have included Indigenous samples (McTiernan et al., 2003; Meyer et al., 2009; Stefanick et al., 2021). Participants were categorized as high-risk or normal-risk drinkers using the Alcohol Use Disorders Identification Test (AUDIT-C) scale (Bush et al., 1998). For smoking, participants were categorized as smokers or non-smokers using the question, "Do you smoke cigarettes every day, some days, or not at all?" (Nguyen & Zhu,

2009). Depressive symptoms were evaluated using the Center for Epidemiologic Studies Depression (CES-D) scale (Knight et al., 1997). Based on the measure recommended cut-off of 16 points, individuals were classified as having low or high risk of depression. Food security was evaluated using the Six-Item Short Form of the US Household Food Security Survey (Blumberg et al., 1999).

Participants self-reported participation in cultural (e.g., cooking traditional foods, attended powwow/gathering/big time, participated in talking/healing circle) and spiritual activities (e.g., participated in a sweat, ceremonial feasts, smudged, or saged) within the last 12 months (Peterson, 2006). A modified Multigroup Ethnic Identity Measure (MEIM) was used to assess individuals' sense of identification and belonging with their ethnic group (Phinney, 1992). Higher scores corresponded with a stronger sense of identification and belonging with Indigenous identity. Indigenous identity scores were classified into tertiles.

Statistical Analyses

Statistical analyses were performed using SAS Enterprise Guide 6.1. Sample characteristics were summarized using percentages, means, and standard deviations. Data were imputed when no more than 20% of the data necessary to score a scale were missing. HLS and HLAS responses were summarized using percentage frequencies, replicating the approach by Whitbeck and colleagues (2004). Responses to the HLS were grouped into categories based on the frequencies with which participants thought about each historical loss: (1) never, yearly, or only during special times; (2) monthly; and (3) weekly, daily, or several times a day. Correlations were examined between HLS and HLAS scores. Using conditional formatting features in Excel, heat maps were created to graphically depict correlations. Associations between participant characteristics and HLS and HLAS scale scores were examined using the Wilcoxon Rank Sum and Kruskal-Wallis tests. Predictors with statistically significant bivariate associations with HLS and HLAS scores were examined using multivariable logistic regression. Average HLS and HLAS scores were classified as >2 or ≤2. HLS scores >2 corresponded with thinking about historical losses monthly or more frequently, on average. HLAS scores >2 corresponded with experiencing historical loss associated symptoms sometimes, often, or always, on average.

RESULTS

Baseline Characteristics

Participants were predominantly middle-aged (53%), Indigenous to the United States or Canada (65%), and Hispanic/Latinx (57%; Table 1). Participants with a high school education or less comprised 35% of the sample. Approximately one-third of participants (33%) reported depressive symptoms consistent with risk for clinical depression. Most participants engaged in spiritual and cultural activities, with 81% and 52% reporting participation in one or more cultural or spiritual activities, respectively, in the last year.

Table 1
Participant sociodemographic characteristics by ancestry

	All *n* = 193	US/Canada *n* = 126	Latin America *n* = 67	*p* value
Demographic characteristics				
Age				0.43
18 - 39	20.7	18.2	25.4	
40 - 59	52.9	53.2	52.2	
60+	26.4	28.6	22.4	
Female	79.3	79.4	79.1	0.97
Household income[1]				0.20
0 - 200% FPL	59.4	56.1	65.6	
200% - 400% FPL	26.7	30.9	18.6	
400% +FPL	13.9	13.0	15.6	
Education				0.051
<High school	14.0	9.5	22.4	
High school graduate	20.7	19.1	23.9	
Some college	44.0	48.4	35.8	
College or more	21.2	23.0	17.9	
Ethnicity				<.001
Hispanic/Latino/x	56.5	34.1	98.5	
Non-Hispanic/Non-Latino/x	43.5	65.9	1.5	
Behavioral & psychosocial characteristics				
Alcohol				0.98
High-risk drinker	15.0	15.1	14.9	
Normal-risk drinker	85.0	84.9	85.1	
Smoking				0.10
Non-smoker	88.9	86.2	94.0	
Smoker	11.1	13.8	6.0	
Healthy food score[2]				0.30
First tertile (9-21)	34.7	37.3	29.9	
Second tertile (22-26)	43.0	43.7	41.8	
Third tertile (27-32)	22.3	19.0	28.4	

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Table 1 Continued
Participant sociodemographic characteristics by ancestry

	All *n* = 193	US/Canada *n* = 126	Latin America *n* = 67	*p* value
Unhealthy food score[2]				0.87
First tertile (14-31)	33.2	32.5	34.3	
Second tertile (32-39)	38.3	39.7	35.8	
Third tertile (40-58)	28.5	27.8	29.9	
Physical Activity[3]				0.70
<500 MET-minutes/week	28.6	27.5	30.6	
500 - 1000 MET-minutes/week	20.3	19.2	22.6	
>1000 MET-minutes/week	51.1	53.3	46.8	
Depression symptomatology (CES-D)				0.48
High depression risk	33.2	34.9	29.9	
Low depression risk	66.8	65.1	70.1	
Food Security				0.12
Very low security	16.6	18.8	10.4	
Low security	25.4	27.0	22.4	
High security	58.0	53.2	67.2	
Cultural activity participation (per year)				0.63
None	19.2	20.6	16.4	
One	16.1	17.5	13.4	
Two	18.6	19.0	17.9	
Three or more	46.1	42.9	52.2	
Spiritual activity participation (per year)				0.70
None	47.7	47.6	47.8	
One	16.6	15.1	19.4	
Two	14.0	15.9	10.5	
Three or more	21.8	21.4	22.4	
Indigenous identity score[4], mean (sd)	36.8 (6.0)	37.0 (5.9)	36.3 (6.0)	0.46
Historical loss score, mean (sd)	2.1 (1.0)	2.3 (1.1)	1.7 (0.7)	<.001
Historical loss symptoms score, mean (sd)	1.7 (0.7)	1.8 (0.7)	1.4 (0.5)	<.001

Note. Percentages are displayed unless otherwise specified.
[1]Household Income was classified using poverty level (FPL) guidelines. [2]The food frequency questionnaire incorporated culturally-relevant foods, and items were scored on a scale of 1 – 6, with 6 corresponding to greater consumption. "Healthy" foods are those recommended for increased intake (e.g., leafy greens), and "unhealthy" foods are those recommended for decreased intake (e.g., soft drinks). [3]Physical activity categories reflect recommendations by the Physical Activity Guidelines Advisory Committee. [4]The Multigroup Ethnic Identity Measure (MEIM) was modified to eleven items with five possible responses ranging from "strongly disagree" to "strongly agree."

Historical Loss and Historical Loss Associated Symptoms

The average HLS score was 2.1 (*SD* = 1.0), and the mean HLAS score was 1.7 (*SD* = 0.7), see Table 1. Full data on all items of the HLS and HLAS is provided in the Appendix. Among participants Indigenous to the United States or Canada, 49% thought about one or more historical losses weekly, daily, or several times a day. The top five historical losses Indigenous persons from

the United States or Canada thought about at least weekly were as follows: "The losses from the effects of drugs on our people" (31%), "The losses from the effects of alcoholism on our people" (29%), "Loss of respect by our children and grandchildren for elders" (29%), "Losing our culture" (24%), and "Loss of respect by our children for traditional ways" (23%).

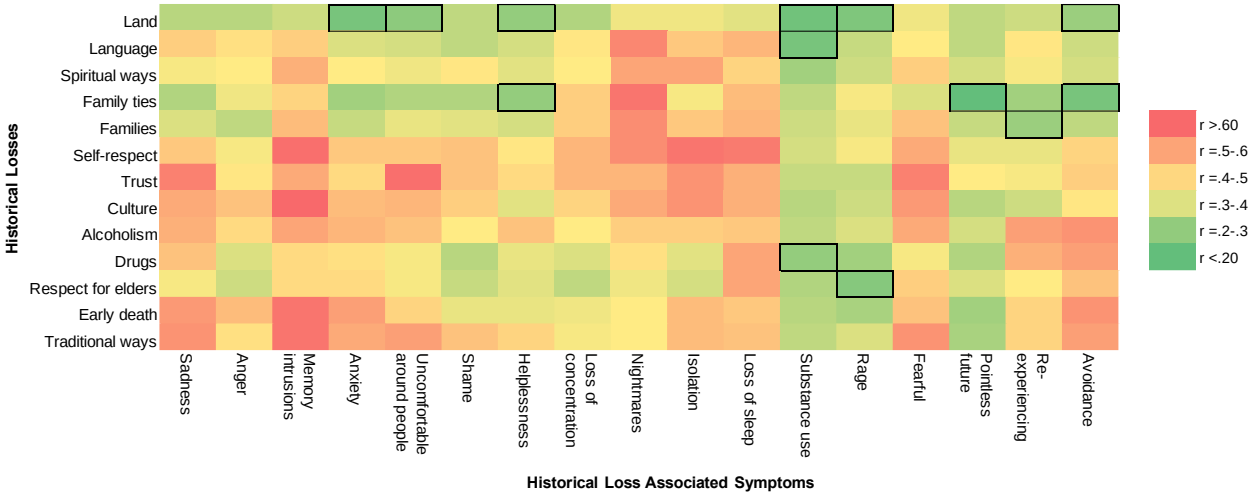
For Indigenous participants from Latin America, 32% thought about at least one historical loss weekly, daily, or several times a day. The top five historical losses thought about at least weekly included, "Loss of respect by our children and grandchildren for elders" (20%), "Loss of respect by our children for traditional ways" (19%), "The loss of our land due to the Spanish conquest or colonization" (14%), "The losses from the effects of alcoholism on our people" (12%), and "The losses from the effects of drugs on our people" (12%).

Most participants (62%) experienced one or more historical loss associated symptoms sometimes, often, or always. The most frequently experienced historical loss associated symptoms were "sadness or depression" (45%), "anger" (38%), "remembering these losses when you don't want to" (30%), "anxiety or nervousness" (29%), and "weakness or helplessness" (27%).

Figures 1 and 2 graphically depict correlations between HLS and HLAS scores for both ancestry groups. For the US/Canadian ancestry group (Figure 1), losses related to trust, self-respect, traditional ways, and the impacts of alcoholism had highest correlations with the HLAS. HLAS items most strongly associated with historical losses included memory intrusions, nightmares, loss of sleep, and feeling fearful. For participants with Latin American ancestry (Figure 2), losses related to trust, alcoholism, and self-respect (due to immigration or migration) had the highest correlations with HLAS items. Other items with high correlations include losses related to early death, drugs, and loss of culture. HLAS items most strongly associated with historical losses in this group included, in order of decreasing frequency, memory intrusions, feeling anger, and sadness.

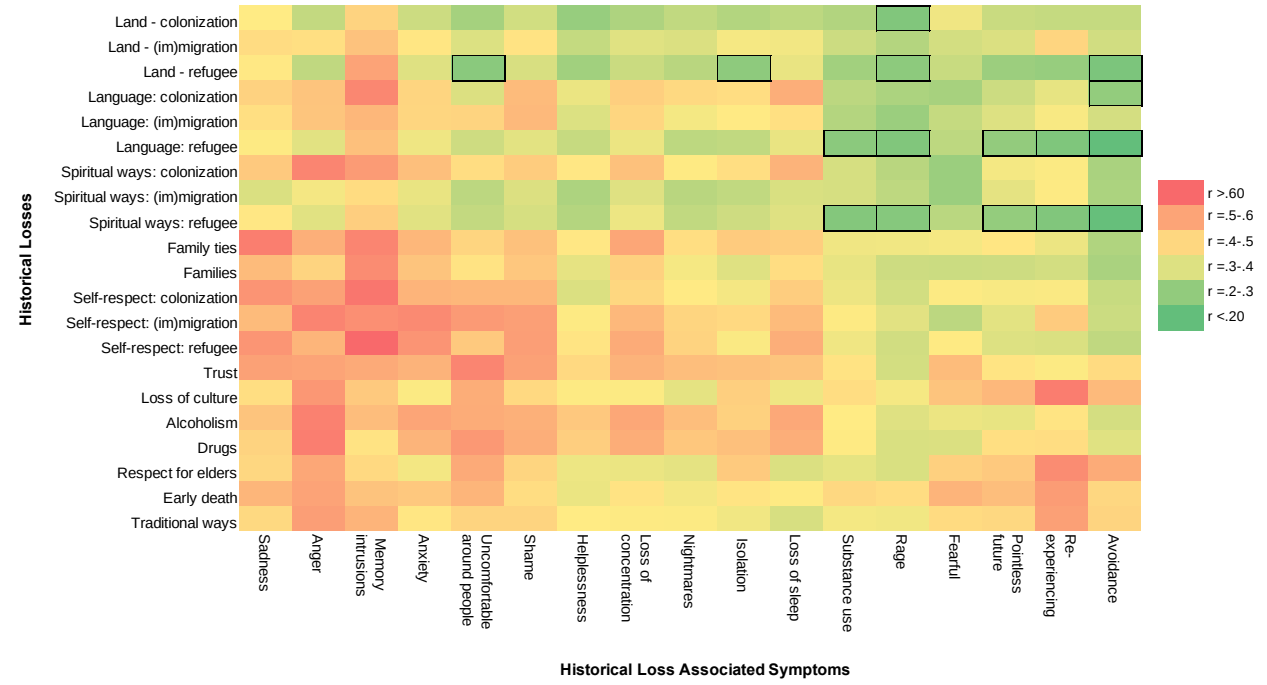
In bivariate analyses, Indigenous ancestry from the United States or Canada ($p < .001$), depression (< .001), greater participation in cultural ($p < .001$) and spiritual ($p < .01$) activities, and stronger identification with Indigenous identity ($p < 0.001$) were associated with greater average HLS scores (Table 2). An inverse association was observed between food security and average HLS ($p < .05$) and HLAS ($p < .01$) scores. Similarly, US or Canadian Indigenous ancestry ($p < .01$), depression ($p < .001$), greater participation in cultural ($p < .001$) and spiritual ($p < .05$) activities, and stronger Indigenous identity ($p < .01$) were associated with greater average HLAS scores.

Figure 1. Associations between historical losses and historical loss associated symptoms for Indigenous participants with US/Canadian ancestry



Note. **Cells with a border indicate non-significant correlations. All other correlations were significant at least at the $p < .05$ level.**

Figure 2. Associations between historical losses and historical loss associated symptoms for Indigenous participants with Latin American ancestry



Note. **Cells with a border indicate non-significant correlations. All other correlations were significant at least at the $p < .05$ level.**

Table 2

Median average historical loss and historical loss associated symptom scores, associations with participant characteristics, and multivariable logistic regression results

	Historical Loss Scale				Historical Loss Associated Symptoms			
			Odds of HLS Score >2				Odds of HLAS Score >2	
	Median (IQR)	p[1,2]	OR	95% CI[2]	Median (IQR)	p	OR	95% CI[2]
Demographic characteristics								
Gender		0.89	N/A			0.48	N/A	
Female	2.0 (1.6)				1.5 (0.9)			
Male	2.0 (1.6)				1.4 (0.9)			
Age		0.39	N/A			0.70	N/A	
18 - 39	2.1 (1.5)				1.5 (1.0)			
40 - 59	2.1 (1.5)				1.5 (0.9)			
60+	1.9 (1.3)				1.4 (1.1)			
Household income[3]		0.62	N/A			0.79	N/A	
0 - 200% FPL	2.1 (1.7)				1.4 (0.9)			
200% - 400% FPL	2.0 (1.0)				1.6 (0.9)			
400%+FPL	2.0 (1.3)				1.6 (0.9)			
Education		0.49	N/A			0.73	N/A	
<High school	1.7 (1.9)				1.4 (0.7)			
High school graduate	1.9 (1.5)				1.5 (1.0)			
Some college	2.1 (1.5)				1.5 (1.0)			
College or more	2.0 (1.5)				1.6 (0.9)			
Ancestry		<0.001				0.002		
US, Canada	2.2 (1.5)		2.88	(1.40 – 5.95)	1.6 (1.1)		3.82	(1.43 – 12.9)
MX, CA, SA	1.4 (1.1)		Ref		1.4 (1.0)		Ref	
Behavioral & psychosocial characteristics								
Alcohol		0.95	N/A			0.52	N/A	
High-risk drinker	2.2 (1.5)				1.7 (1.1)			
Normal-risk drinker	2.0 (1.5)				1.5 (0.9)			
Smoking		0.12	N/A			0.65	N/A	
Non-smoker	2.0 (1.5)				1.5 (1.0)			
Smoker	2.3 (1.6)				1.3 (1.6)			
Physical activity (MET-minutes/week)		0.14	N/A			0.39	N/A	
<500	1.8 (1.3)				1.4 (0.9)			
500 - 1000	1.8 (1.1)				1.3 (1.1)			
>1000	2.1 (1.6)				1.6 (0.9)			
Healthy food score		0.35	N/A			0.06		
First tertile (9-21)	1.9 (1.6)				1.5 (0.9)			
Second tertile (22-26)	2.1 (1.6)				1.6 (1.0)			
Third tertile (27-32)	1.8 (1.1)				1.4 (0.9)			
Unhealthy food score		0.15	N/A			0.28		
First Tertile (14-31)	1.7 (1.4)				1.4 (0.9)			
Second Tertile (32-39)	2.0 (1.7)				1.5 (1.0)			
Third Tertile (40-58)	2.1 (1.3)				1.6 (0.9)			

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Table 2 Continued
Median average historical loss and historical loss associated symptom scores, associations with participant characteristics, and multivariable logistic regression results

	Historical Loss Scale				Historical Loss Associated Symptoms			
			Odds of HLS Score >2				Odds of HLAS Score >2	
	Median (IQR)	p[1,2]	OR	95% CI[2]	Median (IQR)	p	OR	95% CI[2]
Depression (CES-D)		<0.001				<0.001		
Low depression risk	1.8 (1.2)		Ref		1.4 (0.8)		Ref	
High depression risk	2.5 (1.2)		3.77	(1.71 – 8.32)	2.0 (1.2)		8.86	(3.69 – 21.3)
Food security		0.013				0.003		
High security	1.8 (1.5)		Ref		1.4 (0.9)		Ref	
Low security	2.1 (1.4)		1.17	(0.51 – 2.69)	1.5 (0.9)		0.72	(0.27 – 1.95)
Very low security	2.4 (1.9)		0.77	(0.28 – 2.08)	2.0 (1.3)		0.79	(0.27 – 2.35)
Indigenous identity score		<0.001				0.002		
First tertile (15-33)	1.3 (1.3)		Ref		1.2 (1.0)		Ref	
Second tertile (34-39)	1.9 (1.3)		1.25	(0.55 – 2.86)	1.5 (0.8)		1.02	(0.36 – 2.85)
Third tertile (40-49)	2.3 (1.1)		2.13	(0.88 – 5.18)	1.7 (1.0)		1.47	(0.52 – 4.20)
Cultural activity participation (per year)		<0.001				<0.001		
None	1.3 (1.2)		Ref		1.1 (0.6)		Ref	
One	1.3 (1.2)		1.25	(0.39 – 3.99)	1.1 (0.9)		2.51	(0.57 – 11.0)
Two	1.9 (1.4)		2.09	(0.67 – 6.48)	1.5 (0.9)		2.98	(0.69 – 12.8)
Three or more	2.3 (1.1)		6.20	(1.96 – 19.6)	1.8 (0.9)		4.13	(0.99 – 17.2)
Spiritual activity participation (per year)		0.003				0.02		
None	1.8 (1.2)		Ref		1.4 (0.9)		Ref	
One	1.6 (1.6)		0.31	(0.11 – 0.89)	1.4 (0.9)		0.66	(0.19 – 2.24)
Two	2.5 (1.8)		0.95	(0.33 – 2.72)	1.8 (1.0)		1.91	(0.59 – 6.17)
Three or more	2.2 (1.1)		0.75	(0.26 – 2.22)	1.7 (0.9)		0.90	(0.25 – 3.21)

[1]p-value for the Wilcoxon Rank Sum Test for categorical variables with two levels and the Kruskal-Wallis Test for variables with three or more levels. [2]Boldface indicates statistical significance, $p<0.05$. [3]Household income was classified using poverty level (FPL) guidelines.

In the multivariable analysis, Indigenous ancestry, depression, and engagement in cultural activities were significantly associated with HLS scores, after controlling for all other variables with significant associations in the bivariate analysis. The odds of reporting a HLS score >2 were more than two times greater for Indigenous persons from the United States or Canada compared to Indigenous adults from Latin America (Odds Ratio [OR] = 2.88; 95% Confidence Interval [CI]: 1.71, 8.32). The odds of reporting an HLS score >2 were almost four times greater for participants endorsing symptoms consistent with high risk of depression compared to participants with low depression risk (OR = 3.77, 95% CI: 1.71, 8.32) and more than six times greater for participants who engaged in cultural activities three or more times during the last year compared to participants who did not participate in any cultural activities (OR = 6.20, 95% CI: 1.96, 19.6).

Similarly, the odds of reporting a HLAS score >2 were over three times greater for Indigenous persons from the United States or Canada compared to Indigenous adults from Latin America (OR = 3.82; 95% CI: 1.43, 12.9), and more than eight times greater in participants endorsing symptoms consistent with high risk of depression compared to participants with low depression risk (OR = 8.86, 95% CI: 3.69, 21.3).

DISCUSSION

To our knowledge, this is the first study to describe historical losses and their associated symptoms in an urban population of Indigenous adults at risk for diabetes. Nearly half (49%) of participants with Indigenous ancestry from the United States or Canada and a third (32%) of participants with Indigenous ancestry from Latin America thought about one or more historical losses at least weekly. In addition, 62% of all participants experienced at least one symptom associated with historical losses sometimes, often, or always. These findings illustrate that historical trauma, as measured by the HLS and HLAS scales, was frequently experienced in this sample of Indigenous adults living in an urban area.

In 2004, Whitbeck et al. reported HLS and HLAS data for 143 Indigenous adults recruited from two reservations in the American Midwest. Weekly or more often, over half of these adults thought about various losses, and some items from the HLAS were endorsed by over 60% of respondents. Indigenous adults in our sample, recruited from an urban area, experienced similar historical losses and associated symptoms as their reservation-based counterparts but at slightly lower levels. It is possible that individuals residing in tribal reservations face additional stressors such as deep poverty, unemployment, and other socioeconomic barriers (Krogstad, 2014), which may exacerbate symptoms associated with historical trauma.

The literature comparing historical trauma and associated symptoms among Indigenous groups with diverse ancestry is scarce (Brave Heart et al., 2011). Findings from the present study further the extant literature on differences in experiences and magnitude of historical loss and trauma by ancestry. We found that a higher proportion of participants with Indigenous ancestry from the United States or Canada endorsed thinking about one or more historical losses weekly, daily, or several times a day, compared to their counterparts with Latin American ancestry. This was also shown in our multivariate analysis where participants who were Indigenous to the United States or Canada had higher scores in the HLS and HLAS, even after controlling for other covariates. Observed differences may reflect group differences in historical experiences with

colonization, assimilation, and acculturation. Such differences may reflect the importance of place in contextualizing historical trauma, in particularly histories and experiences of displacement and land loss (Walters, Beltran et al., 2011). Indigenous participants of Latin American descent could also be experiencing other, and perhaps more, salient discrimination events related to assumptions of foreign-born status and current anti-immigrant sentiment across the country. Given the diversity of Indigenous populations, it may be important to consider ancestry differences in HLS and HLAS when designing and delivering interventions in this context.

The finding that participants who more frequently engaged in cultural practices may be particularly vulnerable to experiences of historical trauma is a complex finding requiring further exploration. It is important to emphasize that, in general, the literature supports a buffering effect of engagement in traditional cultural and spiritual practices in combating negative impacts of environmental insults and are generally recommended for diabetes programs (Brave Heart et al., 2011; Mitchell, 2012; Shaw et al., 2013). It is possible that participation in cultural and religious practices may have increased awareness of historical trauma and its sequelae. This experience may result in an increased need for support and opportunities to process. Interventions could provide support and opportunities to heal and develop culturally congruent and appropriate coping or cultural revitalization strategies. This may be particularly relevant for urban communities that may lack or have more intermittent cultural sources of support and racial socialization available to them. It is also possible that the positive association of participation in cultural activities and historical losses does not account for other important variables. Prior research has shown that stronger ethnic identification and less comfort in mainstream society were associated with increased thoughts of historical loss among AI college students (Tucker et al., 2016). Additionally, systematic reviews have identified engagement in traditional Indigenous ways of life to be associated with lower adherence to self-management recommendations, in part due to mistrust in providers (Scarton & de Groot, 2016). These studies point to the potential role of additional variables—such as discrimination and mistrust—in explaining findings. Thus, findings not accounting for these additional variables should be interpreted with caution.

Positive bivariate associations observed in this study between depression and food insecurity with HLS and HLAS scores may elucidate how historical trauma could compromise diabetes prevention efforts, in particular by negatively influencing health behaviors. For example, previous studies have shown that depression and food insecurity are negatively associated with physical activity (Cueva et al., 2020; Delahanty et al., 2006; To et al., 2014), positively associated

with obesity (Luppino et al., 2010; Pan et al., 2012), and independently associated with an increased risk of diabetes (Kahl et al., 2015; Gucciardi et al., 2014). Thus, incorporating interventions that address depression and food insecurity may be important adjunctive strategies for successful diabetes prevention in the context of historical trauma. Indeed, food is integrally connected to culture and traditional knowledge and practices (Alonso et al., 2019; DeBruyn et al., 2020; Satterfield et al., 2016). Discussions around traditional foods have been implemented as a way of discussing culture and history and promoting conversations around health and diabetes prevention in Indigenous communities (DeBruyn et al., 2020). These conversations and activities involve growing and preparing foods, storytelling, and talking circles. Moreover, the food sovereignty movement has received recent attention, particularly among tribes (DeBruyn et al., 2020), as a way to restore the local food environment, while incorporating elders and intergenerational knowledge sharing. An example of this traditional food movement can be found in Phoenix, AZ, where an urban garden ties sustainable food access with education, capacity building programs, and storytelling to connect food with health and well-being for urban Indigenous communities (Wesner, 2015).

Other urban Indigenous programs are also using holistic approaches to improve diabetes prevention and control. The Sogorea Te' Land Trust program[1] in Northern California incorporates food access and nutrition activities (urban gardens, cooking of culturally appropriate recipes, food distribution), mental health (activities aimed at increasing socialization and involving elders as role models), language revitalization programs, spirituality (via ceremonies), and promotion of physical activity (in part via working in the land). Other aspects involve leadership opportunities, creating a space to share and return to, and conducting advocacy around land rights and historical trauma. Additional research is needed to assess the efficacy of these types of programs as a different strategy for addressing diabetes and other chronic diseases in Indigenous communities.

Despite these promising efforts, a few limitations exist. First, the majority of research has been conducted in tribal communities (Alonso et al., 2019; DeBruyn et al., 2020; Satterfield et al., 2014), highlighting the need for similar programs in urban areas. Second, while traditional components of DPP interventions involve discussion and content around healthy eating and nutrition, our findings suggest a need to address food security as well. For example, programs adapted for urban medically underserved communities, including Indigenous ones, concentrate on promoting healthy food choices (Benyshek et al., 2013; Seidel et al., 2008); however, it is less

[1] https://sogoreate-landtrust.org

evident whether they discuss or address potentially underlying food insecurity. In fact, scholars have pointed to a lack of efforts to address underlying socioeconomic factors (including food insecurity, poverty) that can facilitate long lasting and systemic prevention of diabetes, obesity, and other comorbid conditions (Spencer et al., 2016). Finally, while DPP interventions include discussions around stress management and problem solving, discussions around depression or historical trauma associated symptoms (e.g., anxiety) are not typically included. Storytelling and talking circles appear to be the most common strategies used to incorporate historical trauma and incorporate cultural and traditional values into Indigenous diabetes programs (Rosas et al., 2016; Satterfield et al., 2014).

Research and Clinical Implications

A dearth of empirical research exists addressing the health of urban Indigenous communities in the context of diabetes and historical trauma. While limited research and interventions exist for urban Indigenous populations, some studies have successfully implemented culturally congruent strategies including talking circles, storytelling, and photovoice to engage Indigenous participants in a DDP (Rosas et al., 2016). Additional research providing data for different groups (e.g., urban vs. tribal communities, different ancestry groups), exploring nuances in cultural and demographic characteristics and their impact on chronic conditions, as well as exploring potential interventions is crucial.

Clinically, our results can increase awareness among primary care providers and other health care professionals of the prevalence of historical loss and associated symptoms among Indigenous adults at risk for diabetes. Clinical interventions such as the Historical Trauma and Unresolved Grief Intervention (Brave Heart, 1998) could potentially be integrated with diabetes prevention. The positive association observed between depression and historical loss and associated symptoms underscores the importance of integrating support for mental wellness. As such, culturally centered depression interventions may be important for effective diabetes prevention. Primary-care based brief low-intensity depression interventions have been shown to be effective with diverse populations (Lopez-Montoyo et al., 2019). Additionally, incorporating traditional medicine could be a potential strategy for ameliorating the impacts of trauma (Marsh et al., 2016) and positively influence health (Mainguy et al., 2013).

Given the complexity of historical trauma and its associated symptoms, which can include symptoms of anxiety, depression, substance use, and post-traumatic stress (Sotero, 2006), holistic

approaches to addressing mental health are needed. Moreover, providers must be educated on the multiple ways in which historical trauma can be experienced by current generations. For example, via experiences as children (e.g., exposure to relatives who were direct victims of trauma and subjugation), behavioral and social problems in the community (e.g., suicides, substance use), collective memory and oral traditions (e.g., accounts of trauma shared via storytelling), and through direct experiences of ongoing trauma and marginalization (e.g., deep poverty and deprivation, discrimination, social inequities) over the individuals' lifetime (Sotero, 2006). This complexity also calls for new paradigms and programs (Duran et al., 1998; 2019) and the need to connect the past with the present in the case conceptualization and in treatment planning.

Study Limitations and Future Directions

The present study has limitations to consider. First, experiences of historical loss and trauma captured in this study may not be generalizable to Indigenous populations living on reservations or in other urban areas. In addition, the cross-sectional design of this study limits the ability to ascertain causal relationships between historical loss and trauma and participant characteristics. Future studies using longitudinal designs should examine direction of associations and test whether intervening in certain psycho-social variables (e.g., depression) can reduce the endorsement and impacts of historical trauma-associated symptoms. Longitudinal research is also needed for understanding complex relationships between historical losses, associated symptoms, and health behaviors. Moreover, we employed HLS and HLAS as our primary measures of historical trauma, which conceptualize a complex phenomenon mostly within the spectrum of emotional distress. Although we adapted some of the content for our population, it is possible that other measures might be better able to capture specific stressors faced by urban Indigenous populations. Additionally, it is possible that participants and community members may have different conceptualizations of and reactions to historical trauma compared to those measures by Whitbeck and others. As the empirical literature surrounding historical trauma continues to grow, psychometric refinement of measures and population specific data is needed. We hope our data contributes to this effort and can be used by future metanalysis or other cross-study synthesis efforts. Finally, future studies should consider other factors that also contribute to diabetes and other chronic conditions. For instance, exposure to pollutants (e.g., polychlorinated biphenyls, pesticides) has been associated with diabetes and obesity in Indigenous communities (Aminov &

Carpenter, 2020; Codru et al., 2007). Thus, future studies should assess key environmental and social factors that can further illuminate risk and areas for additional intervention.

The results of this study suggest that historical trauma and associated symptoms are prevalent among urban Indigenous adults at risk for diabetes, particularly Indigenous adults from the United States and Canada. Strategies that address these challenges may improve engagement and success in prevention programs for Indigenous individuals in urban areas. Additionally, observed associations between HLS and HLAS with frequent participation in cultural activities deserves more attention to understand how this cultural asset could be leveraged to improve diabetes prevention for this population.

CONCLUSION

The prevalence of diabetes in the United States calls for reinvigorated efforts to attenuate this public health crisis. The results of this study highlight the needs of urban Indigenous adults, which are distinct from the significant public health efforts needed on U.S. reservations. These findings suggest that as preventive efforts serving Indigenous adults expand in urban environments, behavioral interventions must incorporate strategies that address community-identified barriers to success. For our community partner and in this study, historical trauma was identified as a challenge that manifested as comorbid depression and low food security, which could decrease the likelihood of successful diabetes prevention efforts. Identifying and addressing the unique challenges specific to distinct communities and unique to urban settings has the greatest potential for successful program implementation and diabetes prevention.

List of Abbreviations

AI/AN: American Indian, Alaska Native; DPP: Diabetes Prevention Program; HLS: Historical Loss Scale; HLAS: Historical Loss Associated Symptom Scale.

REFERENCES

Ablon, J. (1964). Relocated American Indians in the San Francisco Bay Area: Social interaction and Indian identity. *Human Organization*, *23*(4), 296-304. http://www.jstor.org/stable/44125165

Aminov, Z., & Carpenter, D. O. (2020). Serum concentrations of persistent organic pollutants and the metabolic syndrome in Akwesasne Mohawks, a Native American community. *Environmental Pollution*, *260*, 114004. https://doi.org/10.1016/j.envpol.2020.114004

Alonso, L., Decora, L., & Bauer, U. E. (2019). Obesity and diabetes in the Winnebago Tribe of Nebraska: From community engagement to action, 2014-2019. *Preventing Chronic Disease*, *16*(8), 190181. https://doi.org/10.5888/pcd16.190181

Benyshek, D. C., Chino, M., Dodge-Francis, C., Begay, T. O., Jin, H., & Giordano, C. (2013). Prevention of type 2 diabetes in urban American Indian/Alaskan Native communities: The Life in BALANCE pilot study. *Journal of Diabetes Mellitus*, *3*(4), 184–191. https://doi.org/10.4236/jdm.2013.34028

Blumberg, S. J., Bialostosky, K., Hamilton, W. L., & Briefel, R. R. (1999). The effectiveness of a short form of the Household Food Security Scale. *American Journal of Public Health*, *89*(8), 1231–1234. https://doi.org/10.2105/ajph.89.8.1231

Brave Heart, M. Y. (1998). The return to the sacred path: Healing the historical trauma and historical unresolved grief response among the Lakota through a psychoeducational group intervention. *Smith College Studies in Social Work, 68*(3), 287-305. https://doi.org/10.1080/00377319809517532

Brave Heart, M. Y., Chase, J., Elkins, J., & Altschul, D. B. (2011). Historical trauma among Indigenous Peoples of the Americas: Concepts, research, and clinical considerations. *Journal of Psychoactive Drugs*, *43*(4), 282–290. https://doi.org/10.1080/02791072.2011.628913

Brave Heart, M. Y., & DeBruyn, L. M. (1998). The American Indian Holocaust: Healing historical unresolved grief. *American Indian and Alaska Native Mental Health Research*, *8*(2), 56–78. https://doi.org/10.5820/aian.0802.1998.60

Bush, K., Kivlahan, D. R., McDonell, M. B., Fihn, S. D., & Bradley, K. A. (1998). The AUDIT alcohol consumption questions (AUDIT-C): an effective brief screening test for problem drinking. Ambulatory Care Quality Improvement Project (ACQUIP). Alcohol Use Disorders Identification Test. *Archives of Internal Medicine*, *158*(16), 1789–1795. https://doi.org/10.1001/archinte.158.16.1789

Centers for Disease Control and Prevention (CDC). (2017). *National diabetes statistics report, 2017*. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services. https://www.cdc.gov/diabetes/data/statistics/statistics-report.html

Centers for Disease Control and Prevention (CDC). (2020). *National diabetes statistics report 2020: Estimates of diabetes and its burden in the United States*. Atlanta, GA: Centers for Disease Control and Prevention, U.S. Dept of Health and Human Services. https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf

Codru, N., Schymura, M.J., & Negoita, S., (2007). Diabetes in relation to serum levels of polychlorinated biphenyls and chlorinated pesticides in adult Native Americans. E*nvironmental Health Perspectives*, *115*(10), 1442-1447. https://doi.org/10.1289/ehp.10315

Cueva, K., Lovato, V., Carroll, D., Richards, J., Speakman, K., Neault, N., & Barlow, A. (2020). A qualitative evaluation of a community based, culturally relevant intervention to promote healthy food access in American Indian Communities. *Journal of Community Health*, *45*(3), 458-464. https://doi.org/10.1007/s10900-019-00760-4

DeBruyn, L., Frank, M., Fullerton, L., & Satterfield, D. (2020). Integrating culture and history to promote health and help prevent type 2 diabetes in American Indian/Alaska Native communities: Traditional foods have become a way to talk about health. *Preventing Chronic Disease*, *17*, 1–14. https://doi.org/10.5888/pcd17.190213

Delahanty, L. M., Conroy, M. B., Nathan, D. M., & Diabetes Prevention Program Research Group (2006). Psychological predictors of physical activity in the diabetes prevention program. *Journal of the American Dietetic Association*, *106*(5), 698–705. https://doi.org/10.1016/j.jada.2006.02.011

Duran, E. (2019). *Healing the soul wound: Trauma-informed counseling for Indigenous communities* (2nd ed.). Teachers College Press.

Duran, E., Duran, B., Brave Heart, M. Y., & Yellow Horse-Davis, S. (1998). Healing the American Indian soul wound. In: Danieli Y. (Eds), *International Handbook of Multigenerational Legacies of Trauma* (pp.341-354). Springer, Boston, MA.

Evans-Campbell, T. (2008). Historical trauma in American Indian/Native Alaska communities: A multilevel framework for exploring impacts on individuals, families, and communities. *Journal of Interpersonal Violence*, *23*(3), 316–338. https://doi.org/10.1177/0886260507312290

Gucciardi, E., Vahabi, M., Norris, N., Del Monte, J. P., & Farnum, C. (2014). The intersection between food insecurity and diabetes: A review. *Current Nutrition Reports*, *3*(4), 324–332. https://doi.org/10.1007/s13668-014-0104-4

Indian Health Service. (2018). *Urban Indian health program*. Fact sheets. Indian Health Service, Rockville, MD. https://www.ihs.gov/newsroom/factsheets/uihp/

Jiang, L., Manson, S. M., Beals, J., Henderson, W. G., Huang, H., Acton, K. J., Roubideaux, Y., & Special Diabetes Program for Indians Diabetes Prevention Demonstration Project (2013). Translating the Diabetes Prevention Program into American Indian and Alaska Native communities: Results from the Special Diabetes Program for Indians Diabetes Prevention demonstration project. *Diabetes Care*, *36*(7), 2027–2034. https://doi.org/10.2337/dc12-1250

Kahl, K. G., Schweiger, U., Correll, C., Müller, C., Busch, M. L., Bauer, M., & Schwarz, P. (2015). Depression, anxiety disorders, and metabolic syndrome in a population at risk for type 2 diabetes mellitus. *Brain and Behavior*, *5*(3), e00306. https://doi.org/10.1002/brb3.306

Knight, R. G., Williams, S., McGee, R., & Olaman, S. (1997). Psychometric properties of the Centre for Epidemiologic Studies Depression Scale (CES-D) in a sample of women in middle life. *Behaviour Research and Therapy*, *35*(4), 373–380. https://doi.org/10.1016/s0005-7967(96)00107-6

Knowler, W. C., Barrett-Connor, E., Fowler, S. E., Hamman, R. F., Lachin, J. M., Walker, E. A., Nathan, D. M., & Diabetes Prevention Program Research Group. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *The New England Journal of Medicine, 346*(6), 393–403. https://doi.org/10.1056/NEJMoa012512

Krogstad, J. M. (2014). *One-in-four Native Americans and Alaska Natives are living in poverty*. Pew Research Center. https://www.pewresearch.org/fact-tank/2014/06/13/1-in-4-native-americans-and-alaska-natives-are-living-in-poverty/

Lopez-Montoyo, A., Quero, S., Montero-Marin, J., Barcelo-Soler, A., Beltran, M., Campos, D., & Garcia-Campayo, J. (2019). Effectiveness of a brief psychological mindfulness-based intervention for the treatment of depression in primary care: Study protocol for a randomized controlled clinical trial. *BMC Psychiatry, 19*(301). https://doi.org/10.1186/s12888-019-2298-x

Luppino, F. S., de Wit, L. M., Bouvy, P. F., Stijnen, T., Cuijpers, P., Penninx, B. W., & Zitman, F. G. (2010). Overweight, obesity, and depression: A systematic review and meta-analysis of longitudinal studies. *Archives of General Psychiatry*, *67*(3), 220–229. https://doi.org/10.1001/archgenpsychiatry.2010.2

Mainguy, B., Valenti Pickren, M., & Mehl-Madrona, L. (2013). Relationships between level of spiritual transformation and medical outcome. *Advances in Mind-Body Medicine, 27*(1), 4–11. https://www.researchgate.net/publication/235363777_Relationships_between_level_of_spiritual_transformation_and_medical_outcome

Marsh, T.N., Young, N. L., Meek, S. C., Najavits, L. M., & Toulouse, P. (2016). Impact of Indigenous healing and seeking safety on intergenerational trauma and substance use in an Aboriginal sample. *Journal of Addiction Research & Therapy*, *7*(3), 284. https://doi.org/10.4172/2155-6105.1000284

McLaughlin, S. (2010). Traditions and diabetes prevention: A healthy path for Native Americans. *Diabetes Spectrum*, *23*(4), 272-277. https://spectrum.diabetesjournals.org/content/23/4/272

Meyer, A. M., Evenson, K. R., Morimoto, L., Siscovick, D., & White, E. (2009). Test-retest reliability of the Women's Health Initiative physical activity questionnaire. *Medicine and Science in Sports and Exercise*, *41*(3), 530–538. https://doi.org/10.1249/MSS.0b013e31818ace55

Mitchell F. (2012). Reframing diabetes in American Indian communities: A social determinants of health perspective. *Health & Social Work, 37*(2),71–79. https://doi.org/10.1093/hsw/hls013

McTiernan, A., Kooperberg, C., White, E., Wilcox, S., Coates, R., Adams-Campbell, L. L., Woods, N., & Ockene, J. (2003). Recreational physical activity and the risk of breast cancer in postmenopausal women: The Women's health initiative cohort study. *JAMA, 290*(10), 1331–1336. https://doi.org/10.1001/jama.290.10.1331

Nguyen, Q. B., & Zhu, S. H. (2009). Intermittent smokers who used to smoke daily: A preliminary study on smoking situations. *Nicotine & Tobacco Research*, *11*(2), 164–170. https://doi.org/10.1093/ntr/ntp012

Pan, L., Sherry, B., Njai, R., & Blanck, H. M. (2012). Food insecurity is associated with obesity among US adults in 12 states. *Journal of the Academy of Nutrition and Dietetics*, *112*(9), 1403–1409. https://doi.org/10.1016/j.jand.2012.06.011

Pascoe, E. A., & Smart Richman, L. (2009). Perceived discrimination and health: A meta-analytic review. *Psychological Bulletin*, *135*(4), 531–554. https://doi.org/10.1037/a0016059

Peterson, N. (2006). Culture. In Hunter B. (Ed.), *Assessing the evidence on Indigenous socioeconomic outcomes: A focus on the 2002 NATSISS* (pp. 269-278). ANU Press. http://www.jstor.org/stable/j.ctt2jbj3f.28

Phinney, J. S. (1992). The multigroup ethnic identity measure: A new scale for use with diverse groups. *Journal of Adolescent Research*, *7*(2), 156–176. https://doi.org/10.1177/074355489272003

Physical Activity Guidelines Advisory Committee. (2018). *2018 physical activity guidelines advisory committee scientific report.* To the Secretary of Health and Human Services, Part A: Executive summary. https://health.gov/sites/default/files/2019-09/02_A_Executive_Summary.pdf

Rosas, L. G., Vasquez, J. J., Hedlin, H. K., Qin, F. F., Lv, N., Xiao, L., Kendrick, A., Atencio, D., & Stafford, R. S. (2020). Comparing enhanced versus standard Diabetes Prevention Program among Indigenous adults in an urban setting: A randomized controlled trial. *BMC Public Health, 20*(139). https://doi.org/10.1186/s12889-020-8250-7

Rosas, L. G., Vasquez, J. J., Naderi, R., Jeffery, N., Hedlin, H., Qin, F., LaFromboise, T., Megginson, N., Pasqua, C., Flores, O., McClinton-Brown, R., Evans, J., & Stafford, R. S. (2016). Development and evaluation of an enhanced Diabetes Prevention Program with psychosocial support for urban American Indians and Alaska Natives: A randomized controlled trial. *Contemporary Clinical Trials*, *50*, 28–36. https://doi.org/10.1016/j.cct.2016.06.015

Satterfield, D., DeBruyn, L., Santos, M., Alonso, L., & Frank, M. (2016). Health promotion and diabetes prevention in American Indian and Alaska Native communities--Traditional Foods Project, 2008-2014. *MMWR Supplements*, *65*(1), 4–10. https://doi.org/10.15585/mmwr.su6501a3

Scarton, L., & de Groot, M. (2016). Emotional and behavioral aspects of diabetes in American Indians/Alaska Natives: A systematic literature review. *Health Education & Behavior, 44*(1), 70-82. https://doi.org/10.1177/1090198116639289

Seidel, M. C., Powell, R. O., Zgibor, J. C., Siminerio, L. M., & Piatt, G. A. (2008). Translating the Diabetes Prevention Program into an urban medically underserved community: A nonrandomized prospective intervention study. *Diabetes Care*, *31*(4), 684–689. https://doi.org/10.2337/dc07-1869

Shaw, J., Brown, J., Khan, B., Mau, M., & Dillard, D. (2013). Resources, roadblocks and turning points: A qualitative study of American Indian/Alaska Native adults with type 2 diabetes. *Journal of Community Health, 38*(1), 86–94. https://doi.org/10.1007/s10900-012-9585-5

Sotero, M. M. (2006). A conceptual model of historical trauma: Implications for public health practice and research. *Journal of Health Disparities Research and Practice, 1*(1), 93-108.

Spencer Bonilla, G., Rodriguez-Gutierrez, R., & M. Montori, V. (2016). What we don't talk about when we talk about preventing type 2 diabetes—Addressing socioeconomic disadvantage. *JAMA Internal Medicine, 176*(8), 1053–1054. https://doi.org/10.1001/jamainternmed.2016.2952

Stefanick, M. L., King, A. C., Mackey, S., Tinker, L. F., Hlatky, M. A., LaMonte, M. J., Bellettiere, J., Larson, J. C., Anderson, G., Kooperberg, C. L., & LaCroix, A. Z. (2021). Women's health initiative strong and healthy pragmatic physical activity intervention trial for cardiovascular disease prevention: Design and baseline characteristics. *The Journals of Gerontology: Series A, 76*(4), 725-734. https://doi.org/10.1093/gerona/glaa325

Teufel-Shone, N. I., Jiang, L., Beals, J., Henderson, W. G., Zhang, L., Acton, K. J., Roubideaux, Y., & Manson, S. M. (2015). Demographic characteristics and food choices of participants in the Special Diabetes Program for American Indians Diabetes Prevention Demonstration Project. *Ethnicity & Health*, *20*(4), 327–340. https://doi.org/10.1080/13557858.2014.921890

To, Q. G., Frongillo, E. A., Gallegos, D., & Moore, J. B. (2014). Household food insecurity is associated with less physical activity among children and adults in the U.S. population. *The Journal of Nutrition*, *144*(11), 1797–1802. https://doi.org/10.3945/jn.114.198184

Tucker, R. P., Wingate, L. R., & O'Keefe, V. M. (2016). Historical loss thinking and symptoms of depression are influenced by ethnic experience in American Indian college students. *Cultural Diversity & Ethnic Minority Psychology*, *22*(3), 350–358. https://doi.org/10.1037/cdp0000055

Walters, K. L., Beltran, R., Huh, D., & Evans-Campbell, T. (2011) Dis-placement and Dis-ease: Land, place, and health among American Indians and Alaska Natives. In L. Burton, S. Matthews, M. Leung, S. Kemp, & D. Takeuchi (Eds.), *Communities, Neighborhoods, and Health* (vol 1, pp. 163-199). Springer, New York: NY. https://doi-org/10.1007/978-1-4419-7482-2_10

Walters, K. L., Mohammed, S. A., Evans-Campbell, T., Beltrán, R. E., Chae, D. H., & Duran, B. (2011). Bodies don't just tell stories, they tell histories: Embodiment of historical trauma among American Indians and Alaska Natives. *Du Bois Review: Social Science Research on Race*, 8(01), 179-189. http://dx.doi.org/10.1017/S1742058X1100018X

Wesner, C. (2015). Part IV: Traditional foods in Native America: A compendium of stories from the indigenous food sovereignty movement in American Indian and Alaska Native Communities. *Native Diabetes Wellness Program, Centers for Disease Control and Prevention*. Retrieved from https://www.cdc.gov/diabetes/ndwp/traditional-foods/index.html

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. https://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*, *16*(3), 16–41. https://doi.org/10.5820/aian.1603.2009.16

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CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest.

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APPENDIX

Table A1

Frequencies of historical losses among Indigenous persons from the US and Canada (n = 126)

	Never, Yearly, Only special times (%)	Monthly (%)	Weekly, Daily, Several times a day (%)
The loss of our land	66.7	13.3	20.0
The loss of our Indigenous language	67.5	15.5	17.0
Losing our traditional spiritual ways	59.4	19.5	21.1
The loss of our family ties because of boarding or residential schools	73.0	13.9	13.1
The loss of families from the reservation to government relocation	76.9	10.7	12.4
The loss of self-respect from poor treatment by government officials	71.5	11.4	17.1
The loss of trust in whites from broken treaties	68.6	12.4	19.0
Losing our culture	60.7	15.5	23.8
The losses from the effects of alcoholism on our people	53.7	17.1	29.2
The losses from the effects of drugs on our people	54.6	14.0	31.4
Loss of respect by our children and grandchildren for elders	54.0	17.0	29.0
Loss of our Indigenous people through early death	62.3	15.6	22.1
Loss of respect by our children for traditional ways	58.2	18.8	23.0

Table A2
Frequencies of Historical Losses Among Indigenous Persons from Mexico and Central and South America (n = 67)

	Never, Yearly, Only special times (%)	Monthly (%)	Weekly, Daily, Several times a day (%)
The loss of our land due to the Spanish conquest or colonization	79.5	6.9	13.7
The loss of our land due to immigration or migration to the US	78.7	9.3	12.0
The loss of our land due to being a refugee	91.7	5.6	2.8
The loss of our Indigenous language due to the Spanish conquest or colonization	82.2	11.0	6.8
The loss of our Indigenous language due to immigration or migration to the US	83.6	6.9	9.6
The loss of our Indigenous language due to being a refugee	94.3	4.3	1.4
Losing our traditional spiritual ways due to the Spanish conquest or colonization	82.4	9.5	8.1
Losing our traditional spiritual ways due to immigration or migration to the US	87.8	6.8	5.4
Losing our traditional spiritual ways due to being a refugee	92.9	5.7	1.4
The loss of our family ties because of boarding or residential schools	87.3	7.0	5.6
The loss of families from the reservation to government relocation	91.4	5.7	2.9
The loss of self-respect from poor treatment by government officials due to the Spanish conquest or colonization	86.0	7.0	7.0
The loss of self-respect from poor treatment by government officials due to immigration or migration to the US	88.7	7.0	4.2
The loss of self-respect from poor treatment by government officials due to being a refugee	92.9	5.7	1.4
The loss of trust in whites from broken treaties	86.3	11.0	2.7
Losing our culture	70.7	18.7	10.7
The losses from the effects of alcoholism on our people	78.4	9.5	12.2
The losses from the effects of drugs on our people	77.0	10.8	12.2
Loss of respect by our children and grandchildren for elders	60.5	19.7	19.7
Loss of our Indigenous people through early death	73.7	14.5	11.8
Loss of respect by our children for traditional ways	69.3	12.0	18.7

Table A3
Frequencies of emotional responses to historical losses (n = 205)[1]

	Never (%)	Seldom (%)	Sometimes (%)	Often (%)	Always (%)
How often do you feel sadness or depression?	31.9	22.9	34.6	7.9	2.7
How often do you feel anger?	37.6	24.3	26.9	7.9	3.2
How often do you feel like you are remembering these losses when you don't want to?	44.1	25.8	20.9	4.3	4.8
How often do you feel anxiety or nervousness?	54.7	16.3	23.2	3.7	2.1
How often do you feel uncomfortable around white people when you think about these losses?	56.6	20.6	15.3	4.8	2.7
How often do you feel shame when you think of these losses?	66.7	15.9	10.6	4.8	2.1
How often do you feel a sense of weakness or helplessness?	58.7	14.8	19.6	4.2	2.7
How often do you feel a loss of concentration?	64.6	17.5	12.2	5.3	0.5
How often do you have bad dreams or nightmares?	66.7	17.5	12.7	3.2	0.0
How often do you feel isolated or distant from other people when you think of these losses?	62.8	16.5	14.4	3.7	2.7
How often do you have a loss of sleep?	62.6	18.4	14.2	4.2	0.5
How often do you feel the need to drink or take drugs when you think of these losses?	87.4	8.4	3.1	1.1	0.0
How often do you feel rage?	78.0	11.0	8.4	2.6	0.0
How often do you feel fearful or distrustful of the intentions of white people?	62.9	13.8	16.9	3.7	2.7
How often do you feel there is no point in thinking about the future?	74.7	14.7	7.4	1.6	1.6
How often do you feel like it is happening again?	63.5	15.3	17.5	2.7	1.1
How often do you feel like avoiding places or people that remind you of these losses?	69.8	13.8	7.9	5.8	2.7

[1] Some participants completed this questionnaire, but not the HLS scale reported in Tables A1 and A2. Both Indigenous participants to the US or Canada or to Mexico, South, or Central America completed the same HLAS scale reported here.