HHS Public Access

Author manuscript

J Rural Health. Author manuscript; available in PMC 2024 March 01.

Published in final edited form as:

J Rural Health. 2023 March ; 39(2): 367–373. doi:10.1111/jrh.12673.

Historical Loss: Implications for Physical Activity Levels in American Indian Adults

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Abstract

Purpose: To investigate the relationship between daily thoughts about historical loss and daily levels of moderate to vigorous physical activity in American Indian (AI) adults residing on the Blackfeet reservation in Browning, Montana. Methods: The study was designed and conducted using a Community Based Participatory Research framework and Ecological Momentary Assessment. Over a period of one week, 100 AI adults (Mean age= 42.18, SD=14.92) reported how often they thought about historical loss at the end of each day. During this week-long period, all participants wore a wrist-accelerometer to passively and objectively measure levels of physical activity.

Findings: We found that Blackfeet AI adults who reported thinking about historical loss more frequently over the course of the week had lower average levels of moderate to vigorous physical activity (MVPA) over the course of the week compared to Blackfeet AI adults who reported thinking about historical loss less frequently (B = −10.22, 95% CI = −13.83, −6.60). We also found that on days when Blackfeet AI adults thought more about historical loss compared to their weekly average, they had fewer minutes of MVPA compared to their weekly average of minutes of MVPA (B = −0.87, 95% CI = −1.48, −0.27).

Conclusions: Our data indicate that thoughts about historical loss are linked to lower levels of MVPA. Given high incidence of chronic health conditions linked to physical inactivity in American Indians, more work is needed to identify the mechanisms through which thoughts about historical loss may inhibit physical activity in this population.

Keywords

Historical Loss; Physical Activity; American Indians; Physical Activity; Ecological Momentary Assessment; Actigraphy

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The authors have no conflicts of interest to disclose.

It is well known that engaging in physical activity can provide many health benefits, including the prevention of the onset of chronic diseases and the decelerated progression of existing chronic diseases.[1–2] More specifically, regular physical activity is associated with reduced morbidity and mortality from cardiovascular disease, diabetes, cancer, and obesity.[3–7] Physical activity can be health protective for all individuals, however it may have particularly pronounced implications for American Indians since they are disproportionately affected by these chronic conditions.[8–9]

While low levels of physical activity are observed across the United States, a systematic review of PA levels in American Indians revealed that approximately 37% are inactive.[10] Furthermore, previous work focused on physical activity in American Indian adults indicates that physical inactivity is observed at higher rates in American Indian adults compared to other minority groups.[11] For example, a cohort study of 2,604 American Indian adults showed that the majority of the sample were not meeting physical activity public health recommendations of 60 minutes of moderate-to-vigorous physical activity per day.[12] These findings warrant initiatives and efforts to increase physical activity in this at-risk group.

To date, very little is known about predictors of physical activity in American Indian adults. The Healthy Children Strong Families study found increasing age, television viewing, and computer use were predictors of decreased physical activity.[13] In other racial and ethnic groups, psychosocial factors linked to physical activity have included self-determination, social support, self-efficacy, and expectations about outcomes.[14–17] In American Indians, investigations into psychosocial factors which predict physical activity levels have focused on an individual's place in the stages-of-change model of behavior change as a predictor of physical activity levels.[18–20]

Historical Loss and Implications for Health Behaviors

American Indians have been subjected to violence, genocide, and colonization for the past 500 years. These traumatic group experiences have profound negative implications for the individuals who directly experienced these atrocities and are also passed from one generation to the next. The emotional and psychological injury associated with these traumatic group experiences is referred to as historical loss.[21] It is theorized that historical loss contributes to enduring mental and physical health disparities in American Indian communities.[22] A recent review summarized evidence in support of this theory with relationships documented between historical loss, mental health, psychological outcomes, and health behaviors.[23]

In our recent work, we have found that American Indian adults who report higher levels of thoughts about historical loss report experiencing more daily psychological stress, have higher ambulatory blood pressure, and higher levels of a marker of immune system inflammation.[24] Importantly, all of these outcomes are linked to increased risk for cardiovascular disease. Based on previous empirical research linking thoughts about historical loss to health behaviors,[23] it is possible that the degree to which American Indian adults think about historical loss in their daily lives relates to their daily levels of physical

activity. To our knowledge, this relationship has not been explored in American Indian adults.

The main objective of the current investigation was to better understand whether daily thoughts about historical loss relate to daily physical activity in American Indian adults residing on the Blackfeet reservation. The Blackfeet reservation is located in Browning, Montana and has approximately 17,000 community members. The town of Browning has very few sidewalks and many people do not walk for various reasons (e.g. dogs, physical inability, weather). The wind gusts off the Rocky Mountains are upwards of 100 miles per hour and snow is usually found on the ground for seven to nine months out of the year. This makes it difficult for people to engage in outdoor activities including running, walking and biking. The town has two fitness facilities that close early in the evening, limiting access for those who work during the day and early evening hours. These factors make it hard for community members to maintain a physically active lifestyle.

We hypothesized that Blackfeet adults who thought more about historical loss over the course of one week, would on average, have lower levels of Moderate to Vigorous Physical Activity (MVPA). Furthermore, we hypothesized that there would be daily variability in thoughts about historical loss, and that on days when participants thought more about historical loss compared to other days in the week, they would have lower levels of MVPA compared to their average MVPA.

Methods

The current work utilized a Community Based Participatory Research (CBPR) framework which emphasizes an equitable partnership and involvement of both researchers and community stakeholders in all components of the research process.[25–26] The research design and methodologies were developed in consultation with a long-standing community advisory board comprised of 4 community members of the Blackfeet Community. In 2017, the Blackfeet Community completed a health assessment with the goal of identifying the pressing health concerns and issues for community members. The assessment found that cardiovascular disease was one of the top health concerns.[27] As such, the CAB believed it was urgent to better understand psychosocial factors which associate with physical activity, a health behavior which is known to reduce risk for cardiovascular disease. In this research, we utilized Ecological Momentary Assessment (EMA), a research approach which uses repeated sampling of individuals' experiences and behaviors as they unfold in real time in their real-life environments.[28] Participants reported how much they thought about historical loss on a daily basis over a week-long period. During this week, they also wore a wrist-accelerometer to objectively quantify moderate to vigorous physical activity. The study utilized staggering enrollment, with data collection taking place over a period of 70 days in the fall of 2018.

This study was approved by the Blackfeet Institutional Review Board and the Montana State University Institutional Review Board. As noted previously, the study used CBPR methods. In addition to helping with the development of the study design and selection of measures,

the CAB helped with the interpretation of these findings and decisions about how to best disseminate the findings to the community.

Participants for this research were recruited using advertisements on various Blackfeet social media sites, in the local newspaper, on the Blackfeet Community College campus, and in community centers. CAB members selected multiple advertisement sites which they believed would draw a representative sample of participants from across the community. We recruited a sample of 100 American Indian adults (55% female) ranging from 20 to 78 years of age (M=42.30, SD=15.08). A minimum sample size of 70 participants was needed to detect a medium effect size (F^2 = .15) based on past research.[23] To maximize precision, recruitment continued past the minimum sample size until project funds were expended. Participants had a median family income of $20,001-$40,000 (Inter-Quartile 1: below $20,000; Inter-Quartile 2 = $20,001-$40,000). Eligibility criteria included the following: 18 years or older, self-identification as American Indian, and current residence on the Blackfeet reservation. Exclusionary criteria for this research included a clinically diagnosed sleep disorder or chronic health condition. In addition, individuals taking any regular prescription medication were not eligible to participate.

Participants visited an office located on the Blackfeet Community College campus. They met with a project coordinator and provided written informed consent. After the informed consent process, participants completed a series of questionnaires including demographics, a measure of symptoms of depression and anxiety, and a measure of the frequency of thoughts about historical loss. The complete procedure and protocol for this study has been described previously.[24] The project coordinator showed participants how to use the Illumivu Ecological Momentary Assessment (EMA) application (www.lifedatacorp.com) on their mobile devices to answer daily surveys. The project coordinator used the Illumivu software to schedule alerts to be delivered to participants at the end of each day to report on the frequency with which they thought about historical loss during that day. The project coordinator also initialized a wrist accelerometer validated for assessment of physical activity and sleep (Actigraph, GT9X link, Penascola, FL). The accelerometers were initialized using ActiLife (version 6, Penascola, FL) in 60 second epochs. Participants wore the device continuously on their non-dominant hand for 7 days and 7 nights, after which they met with the project coordinator at Blackfeet Community College to return the device and download the data from the wrist accelerometer and the Illumivu EMA app. Participants were given $120 as an incentive for participation upon completion of the study and return of study equipment.

Measures

Daily thoughts about Historical Loss.—As a measure of daily frequency of thoughts about historical loss, participants were asked the following question on their mobile devices at the end of each day before going to bed, “Over the course of the day, how much have you thought about American Indian loss?” Participants responded using the following scale, 1 (*not at all*), 2 (*somewhat rarely*), 3 (*quite frequently*), and 4 (*all the time*).

Actigraphy measured physical activity.—The sleep period was excluded and moderate to vigorous physical activity (MVPA) was defined according to the cut-off points outlined by Freedson and colleagues.[29] Activity greater than or equal to 1952 counts per minute was defined as MVPA.[30] Participants were excluded from analyses if the accelerometers were not worn for a least 10 hours per day (excluding the sleep period) for at least 5 days (n=2). For each day, we obtained a measure of the number of minutes each participant was engaged in MVPA.

Covariates

Age, biological sex, annual income, Body Mass Index (BMI) and symptoms of depression and anxiety were utilized as covariates in all analyses given known relationships between these variables and each of our outcomes.[31–35]

Demographic Variables.—Participants self-reported their biological sex, age, and their annual income. Annual income was measured on a scale from 1 (below US $20,000), 2 (US $20,001-$40,000), 3 (US $40,001-$60,000), 4 (US $60,0001-$80,000), 5 (US$80,001-$100,000) and 6 (US$100,001 and above).[36]

Body Mass Index.—The project coordinator measured participant weight using a scale and participant height using a stadiometer in order to calculate Body Mass Index (BMI).

Symptoms of Depression and Anxiety.—We used the Hospital Anxiety and Depression Scale (HADS) as a measure of current symptoms of depression and anxiety during the initial office visit.[37] The HADS has 14 items, 7 items comprise ad depression subscale, and 7 items comprise an anxiety subscale. Respondents answered each item using a four-point response category (0–3), with possible scores ranging from 0–21 for depression, and 0–21 for anxiety. Cronbach's alpha was 0.85 for the anxiety subscale and 0.88 for the depression subscale.

Analytic Technique

Hypotheses were tested using linear mixed-effect modeling and the lme4 package in R.[38] All models included a random effect for subject and fixed effects for other predictors. The primary independent variable was historical loss, which was measured at Level-1 and between and within-person effects calculated separately. Within-person effects for historical loss were estimated by calculating the deviation of each person's observed historical loss for a given day from that person's average historical loss across the week. Between-person effects were estimated by calculating the deviation of each person's average historical loss across the week from the grand mean for historical loss.

Level-2 covariates included age, gender, income, anxiety symptoms, depressive symptoms, and BMI. To account for possible linear changes in MVPA across the week, measurement time point was included as a Level-1 covariate[1]. The primary dependent variable was MVPA

[1]An exploratory HLM was used to examine whether there was a quadradic effect of time on MVPA. The quadratic effect was non-significant in this model. Thus, only the linear effect of time was estimated.

measured at Level-1. Intra-class correlation coefficients (ICCs) were estimated to quantify the within and between-person variances in thoughts about historical loss and MVPA.

Results

Four participants were missing data on either physical activity or historical loss and were removed from analyses. All remaining participants had complete data. Table 1 displays the means and standard deviations and Table 2 displays the bivariate correlations for all study variables. Greater average depressive symptoms across the week were correlated with lower MVPA. As expected, BMI was inversely related to average MVPA. However, in this sample, age, gender, and income were not significantly related to MVPA.

Figure 1 displays spaghetti plots to visualize variability in MVPA and thoughts about historical loss over the week-long monitoring period. ICCs indicate that 72% of the variability in MVPA was attributed to between-person effects and 28% of the variance was attributed to within-person effects. Additionally, 27% of the variability in daily thoughts about historical loss was attributed to between-person effects and 73% of the variance was attributed to within-person effects.

Thoughts about Historical Loss and Physical Activity

A linear mixed model was used to estimate within and between associations between historical loss and MVPA after accounting for demographic characteristics, anxiety symptoms, and depressive symptoms. Table 3 displays the model estimates. There was a linear effect of time, with MVPA becoming significantly lower across the week.

Between-subject effects indicate that those who on average thought about historical loss more over the course of the week had lower MVPA over the course of the week relative to those who thought less frequently about historical loss over the course of the week. Specifically, a one-unit increase in thinking about historical loss corresponded to 10.22 fewer minutes of average MVPA. Within-subject effects indicate that when participants thought about historical loss more on a given day relative to their own weekly average, they had lower MVPA that day relative to their own weekly average of MVPA. Specifically, a one-unit increase in daily thinking about historical loss corresponded to 0.87 fewer minutes of daily MVPA.

Discussion

To our knowledge, this study represents the first work focused on the relationship between historical loss and physical activity in a sample of American Indian adults. The findings make an important contribution to the literature as physical activity is a modifiable behavior which is linked to risk for cardiovascular disease.[39] The current data provide important insight into the potential impact of historical loss on physical activity levels in a population that is at disproportionate risk for health conditions linked to physical inactivity. First, the findings indicate that there is day to day variability in the frequency with which American Indian adults in this sample think about historical loss. Second, the findings show that on average, those who thought about historical loss more over the course of the week-

long monitoring period had lower levels of MVPA compared to those who thought about historical loss less often. Further, on days when individuals thought more about historical loss compared to their own weekly average of frequency of thoughts about historical loss, they had lower MVPA compared to their weekly average of MVPA.

These findings suggest that thoughts about historical loss may act as a barrier to physical activity. However, these results do not identify mechanisms through which thinking about historical loss may impede physical activity. It is possible that the cognitive toll of thinking about loss consumes vital energy which reduces the likelihood of engaging in physical activity. It is also possible that ruminating on historical loss promotes health compromising behaviors which may interfere with one's ability to engage in physical activity. In future work, we hope to better understand temporal associations between thoughts about historical loss and subsequent behavioral choices. We also hope to improve our understanding of the contexts and situations which prompt thoughts about historical loss. It is possible that thinking about historical loss may have differential effects on health behaviors including physical activity depending on the social context.

Strengths and Limitations

An important limitation of the current work is that we did not collect data on perceived barriers to engaging in physical activity. This would provide a more nuanced understanding of potential mechanisms which could account for the observed relationship between historical loss and daily physical activity. For example, thoughts about historical loss may affect motivation to exercise or may affect perceptions about the value of physical activity for health. While there are limitations of this work, it is worth noting that the current research makes an important contribution to a limited body of work on physical activity in American Indians. A strength of this research is one of few studies to utilize actigraphy to objectively measure physical activity in American Indian adults. Given the implications of physical inactivity in the chronic conditions which disproportionately affect tribal communities, it is critical to understand factors that contribute to physical activity engagement.

These relationships were observed in American Indian adults residing on the Blackfeet reservation. The findings cannot be generalized to other tribal communities or to urban American Indian populations. In other racial and ethnic groups, individuals living in rural environments tend to be more physically inactive compared to their urban counterparts.[40] In contrast, American Indians residing in rural communities were significantly more likely to engage in physical activity compared to those in urban environments.[41] Further, in past work, historical loss was observed at higher rates in a sample of urban American Indians compared to American Indians living on a tribal reservation.[42] Based on these findings, it is possible that the relationship between historical loss and physical activity would be distinct or more or less evident for urban American Indians, however this should be investigated in future research projects.

Conclusions

In this study, we investigated the relationship between thinking about historical loss and objective physical activity levels in American Indian adults. We found that the more participants thought about historical loss, the less MVPA they engaged in. The findings from this work provide further evidence in support of the growing theoretical and empirical literature which posits that historical loss and its sequelae, should be addressed in effective health interventions for American Indian populations.[22–23,43–45] By addressing historical loss, such interventions could promote higher levels of physical activity in American Indians, thus reducing risk for chronic disease. As such, our future CBPR work, guided by the existing CAB, will focus on the development of culturally appropriate interventions which focus on effective strategies for reducing the the potentially negative consequences of historical loss for community members. Such interventions could focus on restoration of Blackfeet culture, language and traditions in order to alleviate the psychological burden of historical loss and promote positive health behaviors such as physical activity.

Funding:

Research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Numbers P20GM104417, P20GM103474, and U54GM115371. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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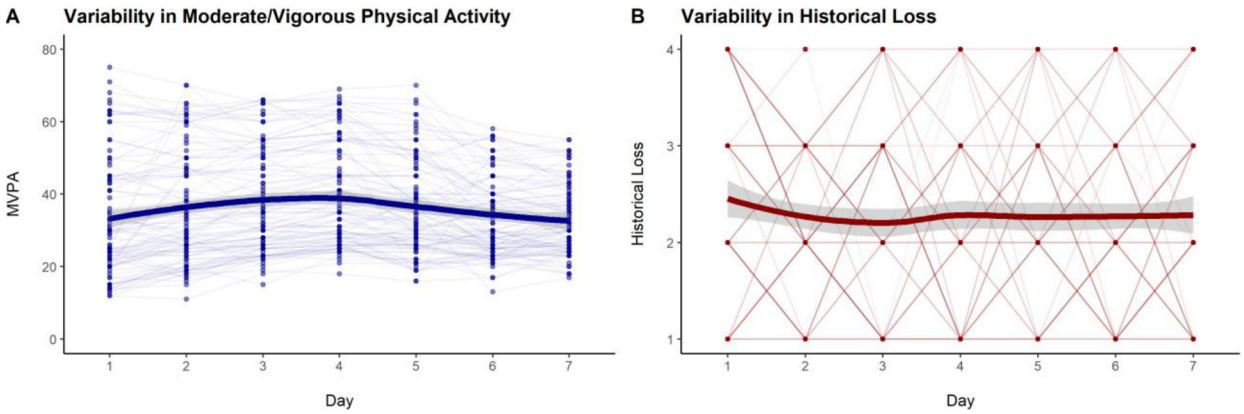

Figure 1.
Variability in MVPA and thoughts about historical loss over the week-long monitoring period.

Table 1
Descriptive statistics for all study variables

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Variable	*M* (N)	*SD* (%)
Age	42.18	14.92
Gender: Female	(55)	
Income		
below $20,000	(44)	(44.44)
$20,001–$40,000	(39)	(39.39)
$40,001–$60,000	(10)	(10.10)
$60,0001–$80,000	(1)	(1.01)
$80,001–$100,000	(3)	(3.03)
$100,001 and above	(2)	(2.02)
Anxiety Symptoms	9.68	3.52
Depression Symptoms	9.67	4.50
BMI	27.88	5.34
Average Historical Loss	40.26	16.12
Average MVPA	36.60	13.75

Notes: BMI = Body-Mass Index; MVPA = Moderate to Vigorous Physical Activity

Table 2

Bivariate correlations among study variables

.

Variable	1	2	3	4	5	6	7
1. Age							
2. Gender: Female	.12						
3. Income	.01	−.15					
4. Anxiety Symptoms	.12	.04	.07				
5. Depression Symptoms	−.00	.14	.13	.59**			
6. BMI	−.15	−.03	−.03	−.10	−.02		
7. Average Historical Loss	.06	.09	.01	.05	.11	.15	
8. Average MVPA	.04	−.17	−.02	−.13	−.22*	−.13	−.56**

Note.

* indicates $p < .05$.

** indicates $p < .01$.

Gender was coded as Male=0, Female =1; BMI = Body-Mass Index; MVPA = Moderate to Vigorous Physical Activity.

J Rural Health. Author manuscript; available in PMC 2024 March 01.

Table 3
Associations between Historical Loss and Physical Activity.

	Physical Activity		
	B	***SE***	***95% CI***
Age	0.06	0.07	−0.09 – 0.20
Gender: Female	−1.97	2.19	−6.26 − 2.33
Income	−0.71	1.00	−2.67 − 1.25
Anxiety Symptoms	−0.14	0.38	−0.88 − 0.60
Depressive Symptoms	0.09	0.31	−0.52 – 0.70
BMI	−0.32	0.20	−0.71 − 0.07
Linear Time	**−0.34**	**0.13**	**−0.59 − −0.10**
Historical Loss (Within)	**−0.87**	**0.31**	**−1.48 − −0.27**
Historical Loss (Between)	**−10.22**	**1.85**	**−13.83 − −6.60**
Random Effects			
σ^2	41.92		
τ_{00}	102.37		
ICC	0.72		
Marginal R^2 / Conditional R^2	0.252 / 0.783		

Notes: Bolded values are significant at $p < .01$