

Uplifting the voices of rural American Indian older adults to improve understanding of physical activity behavior

Maja Pedersen,¹ Kari Jo Harris,² Jordan Lewis,³ Mattea Grant,² Chelsea Kleinmeyer,⁴ Ashley Glass,⁴ Niki Graham,² Blakely Brown,² Diane King⁵

¹Stanford Prevention Research Center, Stanford University, Stanford, CA 94305, USA

²School of Public and Community Health Sciences, University of Montana, Missoula, MT 59812, USA

³Department of Family Medicine and Biobehavioral Health, University of Minnesota Duluth, MN 55812, USA

⁴Confederated Salish and Kootenai Tribal Health Department, MT 59865, USA

⁵Center for Behavioral Health Research and Services, University of Alaska Anchorage, AK 99508, USA

Correspondence to: M Pedersen, majaped@stanford.edu

Cite this as: *TBM* 2021;XX:XX–XX <https://doi.org/10.1093/tbm/ibab107>

© Society of Behavioral Medicine 2021. All rights reserved. For permissions, please e-mail: journals.permissions@oup.com.

Abstract

American Indian (AI) older adults experience pronounced health disparities and demonstrate one of the lowest levels of physical activity (PA) among racial and ethnic groups. Nearly half of AI older adults live in rural areas, indicating distinct challenges to participation in PA. Research to identify factors influencing PA in this population is missing from the literature, yet is critical to informing culturally relevant PA intervention development and implementation. The purpose was to identify barriers to and facilitators of PA among rural AI older adults using the ecological model and qualitative methods. A community-based approach was used to conduct semi-structured interviews with rural AI older adults. Interview questions were based on a multi-level ecological model. Content analysis was performed, using an iterative coding process to identify findings. The mean age of participants ($n = 21$) was 66 years. Barriers to and facilitators of PA were identified across ecological model levels. Barriers included factors such as caregiving and community responsibilities, lack of acceptable areas for walking, and overall lack of community-level support for older adult health. Facilitators included a personal connection to the land and ancestors through PA, multigenerational participation, and supportive tribal policies. This study addressed a gap in the literature by identifying barriers to and facilitators of PA among rural AI older adults, which can inform PA intervention development. With barriers and facilitators identified by AI older adults themselves, the voices of those directly affected are uplifted to shape efforts toward addressing longstanding health disparities through relevant public health interventions.

Keywords

American Indians/Native Americans, Physical activity, Exercise, Community-based participatory research, Qualitative methods

INTRODUCTION

An increase in physical activity (PA) levels among older adults is a public health goal [1, 2], given the numerous physical and mental health benefits that result from PA. Regular engagement in PA increases life expectancy and reduces risk for chronic diseases such as coronary artery disease, type 2 diabetes, and breast and colon cancer [1]. PA improves mood and enhances social well-being [1]. Moreover, PA can exert its positive impact even among previously sedentary older adults, those at high risk for mobility

Implications

Practice: Barriers to and facilitators of physical activity (PA) among American Indian (AI) older adults can guide local programming decisions and initiatives to better serve this population and reduce health disparities.

Policy: Policymakers who want to decrease chronic disease and disability among AI older adult populations should explore supportive social- and environmental-level interventions to address barriers and build upon facilitators to increase PA.

Research: Future research is needed to examine how factors related to PA behavior among AI older adults can inform the identification, adaptation, and implementation of interventions to increase PA among this population.

disability, and those with chronic disease [3]. For these reasons, increasing PA among older adults is an important public health strategy to reduce health disparities among aging populations that experience disproportionately high rates of chronic disease and disability [4].

American Indian and Alaska Native (AIAN) adults experience lower life expectancy than White peers, are more likely to develop chronic disease and disability, and demonstrate one of the lowest levels of PA among racial and ethnic groups in the USA. [5, 6]. Nearly half of AIAN older adults live in rural or non-metropolitan areas [7], suggesting environmental challenges to participation in PA [8]. Previous studies examining PA among AIAN older adults focused on predominantly younger [9], urban [10, 11], and female samples [12–14], and suggested unique influences on PA behavior, including a cultural and community connection to some forms of PA. Recent research among AIAN older adults reports themes of optimism and resilience, and the interconnectedness of participants' lived experiences, their own health, and the health

of future generations [15–18]. Yet, a recent systematic review found that none of the three published studies on PA interventions with this population included study practices to include the opinions of elders or other community members, such as participatory approaches [19] or incorporation of culturally relevant elements [20].

Formative research is critical to prevention science for intervention development, implementation, and dissemination among AIAN communities, as it emphasizes acceptability and relevance [21, 22]. Common strategies for improving cultural relevance of PA interventions among underrepresented groups include linking interventions to factors such as group values, socially and culturally acceptable forms of PA, and cultural beliefs and norms that may act as barriers to or enhancers of increased PA [23].

Research approach

Community-based approaches to research are recommended as best practices for prevention science and intervention development among AIAN communities [24, 25]. This approach builds on the knowledge and experiences of community members to encourage local participation, support social change, and lead sustainable health efforts [26]. Utilizing community-based approaches in research that engages AIAN elders has also been highlighted as important for guiding modern health promotion strategies [18], as AIAN elders are recognized as valued leaders, mentors, teachers, keepers of wisdom, and intergenerational transmitters of knowledge [27].

Theoretical framework

Ecological models examine people's interactions with their physical and sociocultural surroundings and are a useful framework for promotion of public health interventions, including PA [28, 29]. Levels of influence described in ecological models of health behavior are individual (biological and psychological), social/cultural (social support and norms), and environmental (institutional, built and natural factors, and policies) [28]. Although the ecological model is a Western-based framework, it has been used in health equity-focused, community-engaged research with AIAN communities, and has shown promise for its capacity to incorporate contextual variables that influence behavior, including Indigenous-based theories and knowledge [25].

This study addressed enduring health disparities as described by rural American Indian (AI) older adults. The study's objective was to identify barriers to and facilitators of PA behavior, in an effort to provide evidence that enhances PA intervention development and implementation within the AI older adult population.

METHODS

The study was approved by the designated Tribal Institutional Review Board. Additional entities providing oversight for the study were the Tribal Health Department (THD), Tribal Council, local culture and elder committees, and the project's community advisory board (CAB). All research activities—publication development and review, as well—aligned with protocols developed and formalized in a memorandum of understanding between University of Montana (UM) and THD partners.

Academic-community team

The academic-community partnership team (the team) was formed through a series of meetings attended by researchers at UM (two members), public health professionals at the THD (two members), and one tribal community research liaison. The team was composed of two members who identify as white and three members who identify as AI. Community inclusion was achieved through regular presentations and research updates at community events (e.g., THD events, culture committee meetings, and elder committee meetings), and by meetings with and participation of the CAB. The 11 member CAB was recruited at community events as described above and by word of mouth. The CAB demographics resembled those of the target research population; all members identified as AI, five were female, and ten were over the age of 50 years. The CAB, which met quarterly, for a total of four in-person meetings throughout the study period, participated in the development of project activities that aligned with community needs and priorities, and provided insight based on personal, professional, or cultural expertise. Team members collaboratively developed CAB meeting agendas and took turns facilitating the meetings. CAB meetings always included a shared meal prepared by a locally owned catering service, opening comments or prayer shared by a CAB member, and an “open discussion” opportunity to allow for additional agenda items to be added by CAB members.

Interviews

Participants and recruitment

Qualitative, semi-structured interviews were conducted with community-dwelling AI older adults. Interviews took place on a large, rural AI reservation in the northwest region of the USA with an estimated population of >7,000 AI residents and a relatively high proportion of older adults compared with the national average (18% and 14.9%, respectively) [30, 31]. Inclusion criteria were as follows: (a) age 50 years or older, (b) identify as AI, and (c) reside on the reservation. Participants were excluded if they lived in a residential facility for long-term care. Selecting the age of 50 years in this study of older adults aligns with exemplary research

which has reported a lower age criterion due to evidence that chronological pace of aging among AIs may exceed that of other racial/ethnic groups [32–34]. Recruitment occurred in November and December 2019 at community health fairs, at fitness centers, at culture and elder committees, and by word of mouth. A purposive sampling strategy was used to recruit an appropriate number of participants to reach data saturation [35, 36].

Procedures

A semi-structured interview guide was developed using an iterative team process. Interview questions explored ecological influences on PA, with an emphasis on barriers and facilitators (Table 1). The interview guide provided participants with a broad definition of PA, including a description and specific examples of relevant recreational, cultural, and outdoor physical activities, and exercise (e.g., hiking, dancing, hunting, cycling, and walking on a track or a treadmill). Walking was emphasized as a form of PA due to its popularity among AI older adults [9]. The interview guide was developed using a collaborative, iterative process. The team established an initial list of interview questions, informed by the theoretical framework. At an in-person meeting, the CAB reviewed, discussed, and modified the questions to produce the next draft. Three AI older adults piloted the guide and provided additional suggestions to improve question structure, content, and delivery. In accordance with culturally responsive methods for collecting qualitative data among AI adults, the interview guide conveyed culturally respectful, open-ended questions, and interviewers (author initials redacted for anonymity) were trained in qualitative and cultural methods [37].

A researcher (author initials redacted for anonymity) experienced in qualitative methods conducted team training on content analysis. The research team created an operations manual to establish high-quality, consistent standards in data collection and management.

Interviews were conducted in a quiet, comfortable location chosen by the participant (e.g., participant's home and local THD clinics). Each participant was offered a bottle of water, a healthy snack, and \$35 for participation. All participants received a written and verbal orientation to the informed consent

process and completed a demographics and health questionnaire. The written informed consent and verbally administered interview were designed with a Flesh-Kincaid score below seven for accessibility and comprehension across literacy levels [38, 39].

Data management and analysis

Interviews were digitally recorded and transcribed verbatim. Content analysis was applied to the transcripts using a priori categories [40, 41]. Categories were derived from the theoretical framework and were further divided into facilitators of or barriers to PA. All team members ($n = 5$) read the transcripts, taking notes on recurring themes and keeping a personal notebook for reflexivity. Notebook entries focused on identifying biases, on how personal experiences influenced interpretation [42], and on where an Indigenous worldview and/or cultural experiences influenced interpretation or reinforced a theme [43]. Strategies to incorporate Indigenous ways of knowing, as described by Simonds and Held (2013), were prioritized and applied throughout the study [43].

The coding frame was developed based on a priori categories and subcategories from the data, and two researchers (author initials redacted for anonymity) applied codes and sub-codes to all transcripts. QSR NVivo qualitative analysis software (QSR International, Burlington, MA) was employed for data organization and management. Trustworthiness of the coding process was based on the participatory process of coding frame development and through an interrater reliability test [44]. A random 10% sample of all coded text was selected, and a team member with expertise in qualitative research, who was masked to the initial coding process (author initials redacted for anonymity), applied the coding frame. Substantial agreement was achieved, with a Cohen's kappa of 0.80 [45]. Coding disagreements were resolved through group discussion and consensus. The CAB reviewed the results for member checking and community perspective on appropriateness, relevance, and interpretation of themes.

RESULTS

Twenty-one AI older adults participated in semi-structured interviews. Participant demographics

Table 1 | Interview questions

1. Tell me about the role of physical activity or walking for health and wellbeing in your life.
2. When you were growing up, how did elders stay physically active?
3. In your life now, what physical activities do you participate in?
4. How do people around you (family, friends, or healthcare providers) – influence how much you walk?
5. Where do you like to go walking?
6. What gets in the way of walking more often / being more physically active?
7. What would help you to go walking more often / be physically active more often?

and selected health characteristics are presented in Table 2. Ninety-five percent of participants reported comorbidity (two or more chronic conditions). The most common chronic conditions were high blood pressure (62%), back pain (62%), type 2 diabetes (52%), depression/anxiety (52%), and arthritis (52%). Participants resided in seven communities situated on the reservation and represented three tribal nations. Interviews took place at local THD clinics ($n = 15$), community centers ($n = 1$), or private homes or offices ($n = 4$). Interview duration averaged 54 min (range 15 to 131 min).

Themes

Themes on PA were organized by barriers and facilitators across ecological levels (Table 3), and participant quotes are included throughout the results section. For the purposes of this study, barriers were defined as constraints that could limit an individual's ability or motivation to participate in PA, such as physical or mental limitations, time or conflicting demands, access to opportunities, or individual interest or satisfaction [46]. Facilitators were defined as motivating or supportive factors that enhanced PA participation [13]. Data on types of PA are drawn solely from information shared by participants in the interviews.

Barriers and facilitators

Individual

Barriers. Physical health was frequently described as a barrier to PA. Specific examples of health as a barrier included health transitions such as the onset

Table 2 | Participant characteristics ($n = 21$)

| Demographics | Mean (SD) or % |
|-----------------------------------------------------|----------------|
| Age (years) | 66 (7.6) |
| Age range (years) | 50–82 |
| Female | 57% |
| Married | 48% |
| Retired/not working | 62% |
| Completed some college or vocational training | 86% |
| Children under 18 years living in the home | 29% |
| Health characteristics | Mean (SD) or % |
| Body mass index ≥ 30 kg/m ² | 52% |
| Comorbidities | 7.2 (3.3) |
| High blood pressure | 62% |
| Back pain | 62% |
| Type 2 diabetes | 52% |
| Depression/anxiety | 52% |
| Arthritis | 52% |
| Walk for exercise ≥ 3 times per week | 48% |
| Health rated as “good,” “very good,” or “excellent” | 76% |

of a chronic disease or a broken bone caused by a fall; pain associated with existing conditions such as arthritis, chronic back pain, and neuropathy that decreases motivation to be physically active; and fear of worsening health due to injuries that may be associated with PA such as falling or overexertion. These occurrences were described as barriers to PA.

Mental health was also described as a barrier. Participants reported periods of depression as getting in the way of a PA routine or PA opportunities. One participant said, “When I’m depressed and I’m sleeping, it takes a lot to get me up and moving if I’m not willing...It takes a lot for my kids or anybody to get me up to do anything.” Another participant described barriers in this way: “I guess for me it would be the physical pain and the weather, but other than that the only other thing would be depression, and that’s it.”

Facilitators. Maintaining physical health to retain independence was described as a facilitator of PA, as was utilizing PA to rehabilitate, regain, and maintain physical health following a health transition.

Participants also referenced mental health as a facilitator of PA; many described using PA to improve and maintain mental health along with physical and spiritual health. The concept of “balance” was often mentioned to explain how PA can be used as a strategy to attain equilibrium during periods of mental distress due to depression, anxiety, grief, and discrimination. One participant said,

You have physical, emotional, spiritual, and mental. Those four, you’ve got to keep them in balance. Individuals got to make up their choice. The physical component, this is what I’m going to do. This is what I’ll do.

Walking outdoors was a facilitator to PA, described as an enjoyable way to attain meaningful personal connections to the land and ancestors. One participant described it this way:

Physical activity is important to me...I used to love to hike because I felt like I could connect with my ancestors. I always thought about my ancestors and how they navigated and went over mountain passes and all that, long time ago...I prefer being outside and connected to mother earth.

Walking outside evoked connections with previous generations. Examples named were walking old hunting trails, walking to areas for harvesting seasonal plants and berries, or walking to locations of historical/cultural meaning.

Social

Barriers. Participants described the lack of social support in the form of a walking partner or walking group as a barrier, inhibiting their ability to participate in PA, even inhibiting their interest. Some

Table 3 | List of barriers and facilitators for physical activity

| Barriers | Facilitators |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Individual level factors | |
| <ul style="list-style-type: none"> • Physical health • Mental health • Unmotivated • Too Busy | <ul style="list-style-type: none"> • Active in the past, still active now • Enjoyment • Physical health • Mental health • Personal connection to land, ancestors^a |
| Social level factors | |
| <ul style="list-style-type: none"> • No walking partner(s) • Physical inactivity is a social norm • Family/community responsibilities • Decreased support for elders in the community^a | <ul style="list-style-type: none"> • Stay active to contribute to family and community^a • Observed others become ill, want to avoid it • Community traditions linked to PA^a • Social connectedness • Social event or group goal to work towards • Multigenerational PA^a |
| Environment level factors | |
| <ul style="list-style-type: none"> • Cold/winter • Lack of acceptable walking areas • Safety • Lack of ongoing programming for older adults • Investment by leadership in development in recreation opportunities^a • Historical changes/policies^a | <ul style="list-style-type: none"> • Seasonal activities to connect with the outdoors/earth^a • Existing paths, trails in communities • Tribal policies and community programming |

^aThemes identified as specific to sample population.

participants reported concern about not seeing others being active. One participant described it this way: “Most of the time, I never see anybody my age walking around.” This observation was not solely applied to older adults, however. Participants reported that community members of all ages seem less likely to participate in PA these days compared with years ago, when participants were growing up, particularly PA involving active community traditions (examples of these activities described below under “facilitators” section). Participants expressed concern over modern social norms that are mostly sedentary activities and barriers to PA.

Family responsibilities, such as taking care of grandchildren, a spouse, or an aging family member were described as barriers. Caretaking responsibilities were daily priorities that take precedence over a walking or PA routine. Many participants were full-time caregivers of grandchildren, which reduced time available for PA. Social responsibilities, such as visiting community members in need of help or participating in funerals or other valued community events, were described as barriers because of the time-consuming and unpredictable nature of such events.

Facilitators. Grandchildren were also described as motivational in staying physically active. Participants described their wish to stay healthy and active as their grandchildren grow older—to serve as role models. One participant said, “Because the grandkids, they like to walk, and I like to show them that I can still walk.”

Participation in family activities or community traditions that centered around PA, such as wood cutting, harvesting berries and roots, hunting, and tanning hides, was often mentioned as facilitators. The land-based feature and seasonal nature of such activities were emphasized. One participant described it this way:

We go camping, huckleberry picking. We do a lot of walking there. We go get our berries, which brings us to the mountains and walk. We go get our roots...Then in the fall we do our hunting, which we use the bones for things. We use our meat, we use the hides. That creates activity.

Many participants described how traditional activities were routine when they were growing up. They also described watching their adult family members and elders participate in these traditional activities.

Participants frequently spoke of their own upbringing and the importance of multiple generations participating in activities together. As well, participants described their wish to remain active and healthy so that they could continue to contribute meaningfully to their community into the future. This was described by one participant as “community wellness,” emphasizing the importance of people getting together, being active and healthy. Community participation was mentioned by other participants, one who said, “I think everybody should do it. I don’t care what size, what age, what anything...” and “...We’re all somehow connected, and if it means just walking with your grandma

down to get the mail or whatever that is together, I think it's really good."

Environmental Barriers.

Common environmental barriers mentioned were weather and safety. Many participants described a decrease or cessation of PA during winter months due to dislike of cold temperatures, the decrease in daylight, and the lack of safe places to walk because of snow and ice, fearing a fall. Comments about cold weather were often paired with comments regarding the lack of suitable walking areas, for example, the lack of an indoor walking facility. Many described a lack of accessible, local walking paths, stating that walking in their neighborhood was not an option due to concerns about personal safety.

Context-specific safety issues included concern over interaction with loose dogs and wildlife such as bears and mountain lions while participating in PA outside. Among women, the fear of violence or getting "picked up" or "stolen" was emphasized. One participant said, "That's what I think about the danger of walking by yourself. Somebody trying to pick you up..."

Another barrier focused on historical events of U.S. government policies enacted to displace and disempower AI populations. Confinement policies refer to a set of U.S. policies intended to reduce access to and use of ancestral lands of AI people. One result of these policies, as described by participants, has been limitation of access to traditional hunting areas. Reduced access to land was reported to incrementally reduce opportunity and interest in active pastimes, such as hunting, over time. One participant said, "In the reservation at one time, if you recall, you had to get a permit to go hunt your buffalo, which was a natural thing to do in the past. But now, the government has confined that ... So, that affects everybody in some stages of mentality: 'Forget about it, I ain't going to go this year.' That kind of a thing." The impact of these restrictive land use policies was reported to also negatively influence factors across individual and social ecological levels, such as substance use and an overall trajectory toward a social norm of what several participants described as "laziness." Additional policies facilitated by the U.S. government, such as the food distribution programs, were described as negatively impacting the overall health of community members. One participant described it this way: "They [the U.S. government] adjusted our eating habits, our dietary things. We ended up with good sugarized things that's coming down the pike. That kept growing. The young, strong, physical people that move started to become confined and idle, didn't move."

Participants perceived a lack of investment by leadership structures in developing recreational

opportunities for health, such as the absence of programming targeted toward older adults. One participant said, "So I think we're doing a disservice to our elders by not offering structured classes or even walking groups, to get together." Investment in recreational infrastructure was described as a remedy to this issue; specific suggestions were additional established safe outdoor paths and indoor walking facilities, with time designated for older adults.

Facilitators. Some existing physical resources were described as facilitators for PA, including designated walking paths located at some of the THD fitness centers, other open spaces for walking (like pow wow grounds), and local hiking or walking trails near lakes or mountains.

Supportive local tribal policies and existing community programming were identified as facilitators that enhance PA opportunities. One example of a supportive policy was a workplace policy enacted by local tribes for employees to apply for "physical activity leave." If granted this benefit, employees could spend a designated amount of paid time per week participating in PA. This suggestion was described as helpful in encouraging coworkers to be active together and in creating time for PA amidst busy days. Existing community programming, such as the local diabetes program and an annual community-wide walking challenge, was reported by some participants as helpful in engaging individuals in PA.

DISCUSSION

This study used a community-based approach and qualitative research methods to identify key influences on walking and PA among rural AI older adults. Health equity efforts seek to improve cultural relevance of behavioral interventions among AI populations [25]. Our findings provide information that links intervention components with barriers to and facilitators of PA such as socially and culturally acceptable forms of PA, cultural beliefs, social norms, and values [23]. By examining these factors across ecological levels, this study identified original findings that inform the identification, development, and adaptation of culturally relevant PA interventions within the rural AI older adult population.

Several themes overlapped with existing literature on barriers and facilitators to PA among older adults, regardless of race, ethnicity, or setting. Factors such as the impact of health transitions and enjoyment of PA at the individual level; the importance of social support and connection at the social level; and competing demands, weather, safety, and access at the environmental level [10, 47–49] reinforce the potential to adapt existing PA interventions so that they align with, and are relevant to, the specific needs and concerns of rural AI older adults.

For example, while safety from falling, loose dogs, and/or crime are commonly raised as barriers to PA [10, 47–49], specific concerns for AI older adults regarding wildlife may represent a unique rural attribute. The concern mentioned by several female participants of getting “picked up” or “stolen” explicitly relates to the ongoing crisis of violence against Indigenous women. According to U.S. surveillance data, AIAN women experience disproportionately high rates of homicide (4.3 per 100,000) when compared with non-Hispanic white women (1.2 per 100,000) [50]. These safety issues emphasize specific considerations of this population, with implications for intervention development and implementation. These unique safety concerns may be reflected in the recommendation to establish group walking programs and designated indoor walking spaces in rural communities.

When compared with existing literature on AI older adult samples, our findings agree with the recognized prominence of walking for PA in this population [9–14]. Walking is a popular, accessible, and impactful form of PA and is considered a critical tool in addressing health disparities among older adults [4]. A unique motivational factor for walking among participants in this study was the description of the link between PA and valued cultural activities. Participants described the value of walking outdoors to connect with ancestors and the land and to participate in community traditions such as harvesting plants for medicine and food. This perspective echoes themes from qualitative studies involving urban and rural older adult AIAN women [13, 51]. For example, a study of mostly rural AI women (mean age: 56.6 years) found walking to be described as part of their culture—walking outside in the morning being a time for prayer, walking in the mountains serving as an opportunity to teach younger AI women about medicinal plants, and walking outdoors providing an opportunity to connect with the earth [13].

Our study emphasized that walking is not perceived solely as an individual behavior performed for the sake of health, but as a link to valued historical and traditional forms of activity. Additionally, spiritual aspects of walking were described, such as the experience of connection to ancestors and the land. The potential of walking to advance community health was discussed, including opportunities to share knowledge with younger generations during walk-based activities. From an ecological theory perspective, these themes highlight how walking for PA is an individual behavior that is facilitated at the social and environmental levels, involving connection to valued social relationships (ancestors and youth) and a respected relationship with the land (i.e., nature, plants, animals, and landmarks) [52–54]. Identifying these potential facilitators of PA behavior may provide important guidance for customizing PA

intervention as well as leveraging important cultural strengths and values to encourage participation. For example, content messaging and education within an intervention context may highlight historical information specific to the community on traditional walking-based practices and place-based activities. Other examples of how this information may be applied in an intervention could include opportunities for multigenerational interaction, activities, and knowledge exchange. Leveraging land-based opportunities for PA, that is, sharing stories and information about historical trails and landmarks, educating youth on local wildlife and plants, and engaging in traditional outdoor activities and games, are examples of ways to connect PA to the physical and social environment.

Another important theme was utilizing PA as a strategy to balance well-being amidst periods of health transitions and mental distress. Previous qualitative findings with urban and rural AI older adults have emphasized the role of health—both physical and mental—as an individual-level factor that can represent a barrier to and a facilitator of PA participation [10, 11, 13]. Our findings align with existing evidence, indicating how individual experiences of health and comorbidities may play a central role in PA-focused behavioral interventions. Findings from this study underscore the role of mental health, and more specifically the experience, management, and prevention of depression, as both a barrier to and a facilitator of PA behavior. Participants described using PA to create balance during times of distress, such as periods of grief following the death of a loved one, periods of depression, or when having experienced racial discrimination. These findings align with foundational concepts of Indigenous well-being, which emphasize interrelatedness and balance across the four elements of life: physical, emotional, mental, and spiritual [52]. It is widely recognized that deep roots of mental distress associated with rapid cultural change, marginalization, and assimilation among Indigenous populations are reflected in current rates of anxiety and depression [52]. Our findings highlight ways that AI older adults engage in PA, such as walking, to pursue or maintain balance when encountering mental and physical health challenges. As voices of AI older adults and elders are brought to the forefront of public health research, longstanding beliefs related to sources of healing, balance, and well-being can inform the content of PA intervention and other health promotion efforts [17, 55].

One quarter of this study’s participants were primary caregivers of grandchildren, and they cited caretaking as both a barrier to and a facilitator of PA. Previous research has identified caretaking responsibilities as a top barrier to PA among AI older adult women [10, 14], while staying active to serve as a good role model for grandchildren has been

found to be a motivator for PA [10]. AIAN grandparents are more likely to be the primary caregivers of their grandchildren than peers from other racial and ethnic groups [56]. This reveals important individual and social-level considerations for PA programming. For example, the transition into older adulthood may align with a return to caregiving duties, impacting time, energy, and resources for PA behavior. Thus, childcare may be a consideration for PA intervention programming, as many inclusive multigenerational activities that involve age-appropriate PA for grandparents and grandchildren.

Participants also expressed dissatisfaction in perceived overall support for older adult health promotion from within the community and from tribal leadership, both of which were reported as barriers to PA participation. A poignant example of this is when one participant, following the interview, expressed appreciation in being asked about older adult health concerns, saying “I thought they just forgot about us.” These themes link directly to the perceived lack of community resources for age-appropriate health promotion and a lack of ongoing PA programming for the older adult population through local health promotion programs and agencies. Social support is a well-established influence on PA among older adults [57], while Active Living research, developed by Sallis and colleagues [58], emphasizes ways in which environmental factors and policies are recognized as immensely influential to PA behavior. Further exploration into Active Living domains, such as transportation systems and recreational, workplace, and household environments, may bring further insight into how local settings and policies impact, and can increase, PA behavior [58].

Future research may use the information revealed in this study to identify appropriate evidence-based PA interventions, emphasizing strategies such as social support, family, leadership/stakeholder engagement, land use, and environmental design. Examples of resources that may be used to identify available evidence-based interventions for adaptation are the Center for Disease Control and Prevention’s Guide to Community Preventive Services [59] and the National Cancer Institute’s Evidence-Based Cancer Control Programs database [60]. These resources feature filters to identify specific interventions by program type, age group, and setting, among other indicators. In addition, an iterative process for a community-based approach to intervention selection, adaptation, and implementation among Indigenous communities [61] can be used as a step-by-step guide in development. Potential settings to maximize participation and sustainability may include THDs, where elder services programming can offer PA programming through existing infrastructure or in partnership with other entities embedded in community such as tribal senior centers or congregate meal sites.

Existing examples of evidence-based interventions that have been tested across older adult populations provide further guidance on next steps to transform this critical formative research into public health action. Walk with Ease, a walking-focused intervention developed by the Arthritis Foundation to reduce pain and fatigue, has been successfully scaled up and implemented across community-based settings including health departments and rural and urban locations [62, 63]. However, this intervention has yet to be tested among diverse older adults. The flexible nature of Walk with Ease (i.e., it can be delivered in-person, hybrid, or online) and ease of access for training local facilitators may provide a suitable foundation for contextual and cultural adaptation to rural AI older adults. The Walk Your Heart to Health intervention, which emphasizes group cohesion and social behavioral theories to increase group neighborhood walking among older adults, has been tested among urban non-Hispanic Black and Hispanic older adults [64]. These features are promising for alignment with factors identified in this study that influence PA behavior among AI older adults. The availability of existing evidence-based interventions to increase PA among older adults, the absence of existing interventions tailored for AI older adults [20], and the ongoing health disparities within this population support careful attention and action in this area.

Limitations

This research identified new information to advance the field of PA promotion for health equity among rural AI older adult populations. However, this study has limitations. The scope of this research focused on one rural AI reservation in the USA, limiting generalizability. Broad heterogeneity exists among and across AI tribes and communities, and characteristics of rural areas also vary by geography, built infrastructure, physical climate, and socio-cultural conditions. Given the emphasis by participants on the importance of land and the natural environment as well as limited opportunities for indoor activity, additional exploration of the four domains of Active Living may help us to further inform intervention design [58]. Inherent in the qualitative in-depth interview methodology is a small sample ($n = 21$) size. Planned recruitment techniques acquired in-depth perspectives across genders and age groups to enhance breadth of information obtained, while aligning with recommended practices and standards for sampling in qualitative research. Finally, as the research focused on a rural AI reservation, themes identified may not be applicable to the large number of AI older adults living in urban areas.

CONCLUSION

This study builds on what is known about older adult perspectives on walking and other forms

of PA by contributing new information on multi-level ecological barriers and facilitators relevant to rural AI older adults. Participatory qualitative methods were employed to engage and uplift the voices of rural AI older adults on their knowledge, beliefs, and attitudes regarding PA behavior. Our study results emphasize relevant cultural, environmental, historical, and policy factors, as well as multi-faceted aspects of health and how PA can be used to promote balance across the physical, emotional, mental, and spiritual aspects of health and well-being. Findings from this study can be utilized by community-based entities, including the THD involved in this research partnership, in ongoing efforts to develop age-specific health promotion programming, and supportive policies to improve longevity and health equity among this population.

Acknowledgments The authors would like to express gratitude for the support and assistance of members of the Community Advisory Board throughout the research and writing process. They would also like to thank the tribal communities and leadership that supported this research project, and the participants who shared their perspectives and experiences for this study. The research reported in this publication was supported by the National Institute of General Medical Sciences of the National Institutes of Health under Award Number U54GM115371. M. Pedersen was supported by a National Cancer Institute predoctoral fellowship under Award Number F99CA253761. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Compliance with Ethical Standards

Conflict of Interest: None declared.

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Salish Kootenai College Institutional Review Board Approval # 2019_6_Pederson. This article does not contain any studies with animals performed by any of the authors.

Informed Consent: Informed consent was obtained from all individual participants included in the study.

Transparency Statements

This study was not formally registered. The analysis plan was not formally pre-registered. De-identified data from this study are not available in a public archive. De-identified data from this study will be made available (as allowable according to institutional IRB standards and pending tribal leadership approval) by emailing the corresponding author. There is not analytic code associated with this study. Materials used to conduct the study are not publicly available.

References

- Nelson ME, Rejeski WJ, Blair SN, et al.; American College of Sports Medicine; American Heart Association. Physical activity and public health in older adults: recommendation from the American College of Sports Medicine and the American Heart Association. *Circulation*. 2007;116(9):1094–1105.
- World Health Organization. Global recommendations on physical activity for health. Geneva, Switzerland. 2010. Available at <https://www.who.int/publications/item/9789241599979>. Accessed September 15, 2020.

- Chodzko-Zajko WJ, Proctor DN, Singh MAF, Minson CT, Nigg CR, Salem GJ, Skinner JS. Exercise and physical activity for older adults. *Med Sci Sports Exerc*. 2009;41(7):1510–1530.
- Lee IM, Buchner DM. The importance of walking to public health. *Med Sci Sports Exerc*. 2008;40(7 Suppl):S512–S518.
- Office of Minority Health. Profile: American Indian / Alaska Native. U.S. Department of Health and Human Services. 2018. Available at <https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=3&lvlid=62>. Accessed November 6, 2020.
- Centers for Disease Control and Prevention. *National Center for Health Statistics. Summary Health Statistics: Health Behaviors of Adults: United States, 2011–2014 Table PA_1a*. 2018. Available at <https://www.cdc.gov/nchs/nhis/shs/tables.htm>. Accessed July 2, 2019.
- Deweese S, Marks B. *Twice Invisible: Understanding Rural Native America*. Albuquerque, NM: First Nations Development Institute; 2017.
- Hansen AY, Hartley D. *Promoting Active Living in Rural Communities*. San Diego, CA: Active Living Research; 2015.
- Redwood D, Schumacher MC, Lanier AP, et al. Physical activity patterns of American Indian and Alaskan Native people living in Alaska and the Southwestern United States. *Am J Health Promot*. 2009;23(6):388–395.
- Belza B, Walwick J, Shui-Thornton S, Schwartz S, Taylor M, LeGerfo J. Older adult perspectives on physical activity and exercise: voices from multiple cultures. 2004. Available at <http://www.ncbi.nlm.nih.gov/pubmed/15670441>. Accessed April 17, 2017.
- Sawchuk CN, Russo JE, Bogart A, et al. Barriers and facilitators to walking and physical activity among American Indian elders. *Prev Chronic Dis*. 2011;8(3):A63.
- Henderson KA, Ainsworth BE. A synthesis of perceptions about physical activity among older African American and American Indian women. *Am J Public Health*. 2003;93(2):313–317.
- Henderson KA, Ainsworth BE. Enablers and constraints to walking for older African American and American Indian women: the Cultural Activity Participation Study. *Res Q Exerc Sport*. 2000;71(4):313–321.
- King AC, Castro C, Wilcox S, Eyster AA, Sallis JF, Brownson RC. Personal and environmental factors associated with physical inactivity among different racial-ethnic groups of U.S. middle-aged and older-aged women. *Health Psychol*. 2000;19(4):354–364.
- Varcoe C, Botorff JL, Carey J, Sullivan D, Williams W. Wisdom and influence of elders: Possibilities for health promotion and decreasing tobacco exposure in First Nations communities. *Can J Public Health*. 2010;101(2):154–158.
- Lewis JP. The importance of optimism in maintaining healthy aging in rural Alaska. *Qual Health Res*. 2013;23(11):1521–1527.
- Braun KL, Browne CV, Ka'opua LS, Kim BJ, Mokuau N. Research on indigenous elders: From positivistic to decolonizing methodologies. *Gerontologist*. 2014;54(1):117–126.
- Whitewater S, Reinschmidt KM, Kahn C, Attakai A, Teufel-Shone NI. Flexible roles for American Indian elders in community-based participatory research. *Prev Chronic Dis*. 2016;13:E72.
- Israel BA, Eng E, Schulz AJ, Parker EA. *Methods in Community-Based Participatory Research for Health*. 2nd Edition. San Francisco, CA: Jossey-Bass; 2012.
- Pedersen M, Harris KJ, Brown B, Anderson K, Lewis JP. A systematic review of interventions to increase physical activity among American Indian and Alaska Native older adults. *The Gerontologist*. 2021. doi:10.1093/geront/gnab020.
- Czajkowski SM, Powell LH, Adler N, et al. From ideas to efficacy: the ORBIT model for developing behavioral treatments for chronic diseases. *Health Psychol*. 2015;34(10):971–982.
- Jernigan VBB, D'Amico EJ, Kaholokula JKA. Prevention research with indigenous communities to expedite dissemination and implementation efforts. *Prevention Science*. 2020;21(1):74–82.
- Conn VS, Chan K, Banks J, Ruppert TM, Scharff J. Cultural relevance of physical activity intervention research with underrepresented populations. *Int J Community Health Educ*. 2013;34(4):391–414.
- Whitesell NR, Sarche M, Keane E, Mousseau AC, Kaufman CE. Advancing scientific methods in community and cultural context to promote health equity: Lessons from intervention outcomes research with American Indian and Alaska Native Communities. *Am J Eval*. 2018;39(1):42–57.
- Dickerson D, Baldwin JA, Belcourt A, et al. Encompassing cultural contexts within scientific research methodologies in the development of health promotion interventions. *Prev Sci*. 2020;21(Suppl 1):33–42.
- Horowitz CR, Robinson M, Seifer S. Community-based participatory research from the margin to the mainstream: Are researchers prepared? *Circulation*. 2009;119(19):2633–2642.
- Garrett MT, Parrish M, Williams C, et al. Invited commentary: Fostering resilience among Native American youth through therapeutic intervention. *J Youth Adolesc*. 2014;43(3):470–490.
- McLeroy KR, Bibeau D, Steckler A, Glanz K. An ecological perspective on health promotion programs. *Health Educ Q*. 1988;15(4):351–377.
- Sallis JF, Owen N, Fisher E. Ecological models of health behavior. *Health Behav*. 2015;5(43–64):51.

30. Montana State University Extension. Flathead Reservation, Montana poverty report card. 2017. Available at <https://www.montana.edu/extensionecon/reservationdata/flatheadreservation.pdf>. Accessed November 6, 2020.
31. United States Census Bureau. Facts for features: Older Americans month: May 2017. 2017. Available at <https://www.census.gov/newsroom/facts-for-features/2017/cb17-ff08.html>. Accessed April 18, 2018.
32. Goins RT, Pilkerton CS. Comorbidity among older American Indians: The native elder care study. *J Cross Cult Gerontol*. 2010;25(4):343–354.
33. Graves K, Rosich R, McBride M, Charles G, Branch PK. *Health and Healthcare of Alaska Native Older Adults*. Periyakoil VS, eds. Stanford CA: eCampus-Geriatrics; 2010. Available at <https://geriatrics.stanford.edu/ethnomed/alaskan.html>.
34. Hayward MD, Heron M. Racial inequality in active life among adult Americans. *Demography*. 1999;36(1):77–91.
35. Luborsky MR, Rubinstein RL. Sampling in qualitative research: Rationale, issues, and methods. *Res Aging*. 1995;17(1):89–113.
36. Patton MQ. *Qualitative Research & Evaluation Methods: Integrating Theory and Practice*. Thousand Oaks, CA: Sage Publications; 2014.
37. Lewis JP. *Conducting Qualitative Research in Rural Alaska Communities: Engaging Elders to Ensure Cultural Relevance and Sensitivity*. Thousand Oaks, CA: SAGE Publications Ltd; 2017.
38. Simonds VW, Buchwald D. Too dense and too detailed: Evaluation of the health literacy attributes of an informed consent document. *J Racial Ethn Health Disparities*. 2020;7(2):327–335.
39. Division of Communication Services. Simply put: a guide for creating easy-to-understand materials. Division of Communication Services. 2009. Available at https://www.cdc.gov/healthliteracy/pdf/simply_put.pdf. Accessed November 2, 2020.
40. Elo S, Kyngäs H. The qualitative content analysis process. *J Adv Nurs*. 2008;62(1):107–115.
41. Hsieh HF, Shannon SE. Three approaches to qualitative content analysis. *Qual Health Res*. 2005;15(9):1277–1288.
42. Guba EG, Lincoln YS. Epistemological and methodological bases of naturalistic inquiry. *ECTJ*. 1982;30(4):233–252.
43. Simonds VW, Christopher S. Adapting Western research methods to indigenous ways of knowing. *Am J Public Health*. 2013;103(12):2185–2192.
44. Morse JM. Critical analysis of strategies for determining rigor in qualitative inquiry. *Qual Health Res*. 2015;25(9):1212–1222.
45. McHugh ML. Interrater reliability: The kappa statistic. *Biochem Med (Zagreb)*. 2012;22(3):276–282.
46. Jackson EL. Leisure constraints: A survey of past research. *Leisure Sciences*. 1988;10(3):203–215.
47. Gallagher NA, Clarke PJ, Ronis DL, Cherry CL, Nyquist L, Gretebeck KA. Influences on neighborhood walking in older adults. *Res Gerontol Nurs*. 2012;5(4):238–250.
48. Marquez DX, Aguiñaga S, Campa J, Pinsker EC, Bustamante EE, Hernandez R. A qualitative exploration of factors associated with walking and physical activity in community-dwelling older latino adults. *J Appl Gerontol*. 2016;35(6):664–677.
49. Schmidt L, Rempel G, Murray TC, McHugh TL, Vallance JK. Exploring beliefs around physical activity among older adults in rural Canada. *Int J Qual Stud Health Well-Being*. 2016;11:32914.
50. Petrosky E, Blair JM, Betz CJ, Fowler KA, Jack SPD, Lyons BH. Racial and ethnic differences in homicides of adult women and the role of intimate partner violence - United States, 2003–2014. *MMWR Morb Mortal Wkly Rep*. 2017;66(28):741–746.
51. Hopkins SE, Kwachka P, Lardon C, Mohatt GV. Keeping busy: A Yup'ik/Cup'ik perspective on health and aging. *Int J Circumpolar Health*. 2007;66(1):42–50.
52. King M, Smith A, Gracey M. Indigenous health part 2: The underlying causes of the health gap. *Lancet*. 2009;374(9683):76–85.
53. Brown HJ, McPherson G, Peterson R, Newman V, Cranmer B. Our land, our language: Connecting dispossession and health equity in an indigenous context. *Can J Nurs Res*. 2012;44(2):44–63.
54. Lines LA, Jardine CG; Yellowknives Dene First Nation Wellness Division. Connection to the land as a youth-identified social determinant of Indigenous Peoples' health. *BMC Public Health*. 2019;19(1):176.
55. Lewis JP, Allen J. Alaska native elders in recovery: Linkages between indigenous cultural generativity and sobriety to promote successful aging. *J Cross Cult Gerontol*. 2017;32(2):209–222.
56. U.S. Census Bureau. Grandparents and grandchildren. 2016. Available at <https://www.census.gov/newsroom/blogs/random-samplings/2016/09/grandparents-and-grandchildren.html>. Accessed April 12, 2020.
57. Lindsay Smith G, Banting L, Eime R, O'Sullivan G, van Uffelen JGZ. The association between social support and physical activity in older adults: A systematic review. *Int J Behav Nutr Phys Act*. 2017;14(1):56.
58. Sallis JF, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. *Annu Rev Public Health*. 2006;27:297–322.
59. Centers for Disease Control and Prevention. The guide to community preventive services. n.d. Available at <https://www.thecommunityguide.org/topic/physical-activity>. Accessed 2/20/2019.
60. National Cancer Institute. Evidence-based cancer control programs. n.d. Available at <https://ebccp.cancercontrol.cancer.gov/searchResults.do>. Accessed 5/17/2021.
61. Ivanich JD, Mousseau AC, Walls M, Whitbeck L, Whitesell NR. Pathways of adaptation: Two case studies with one evidence-based substance use prevention program tailored for indigenous youth. *Prev Sci*. 2020;21(Suppl 1):43–53.
62. Conte KP, Odden MC, Linton NM, Harvey SM. Effectiveness of a scaled-up arthritis self-management program in Oregon: Walk with ease. *Am J Public Health*. 2016;106(12):2227–2230.
63. Silverstein RP, VanderVos M, Welch H, Long A, Kaboré CD, Hootman JM. Self-directed walk with ease workplace wellness program—Montana, 2015–2017. *Morbidity and Mortality Weekly Report*. 2018;67(46):1295.
64. Schulz AJ, Israel BA, Mentz GB, et al. Effectiveness of a walking group intervention to promote physical activity and cardiovascular health in predominantly non-Hispanic black and Hispanic urban neighborhoods: Findings from the walk your heart to health intervention. *Health Educ Behav*. 2015;42(3):380–392.