Prevention Science
https://doi.org/10.1007/s11121-022-01342-y

Physical Activity Intervention Adaptation: Recommendations from Rural American Indian Older Adults

Maja Pedersen[1] · Kari Jo Harris[2] · Blakely Brown[2] · Mattea Grant[2] · Chelsea Kleinmeyer[3] · Ashley Glass[3] · Niki Graham[2] · Diane K. King[4]

Accepted: 11 January 2022

Abstract
Preventive interventions are critical to improving health equity among American Indian (AI) populations, yet interventions that promote physical activity (PA) among AI populations are scarce. This research addresses the research-to-practice gap by informing the adaption and implementation process of evidence-based interventions (EBIs) among rural AI older adults. We used a community-based approach and an Indigenous-focused adaptation theoretical framework. Qualitative, semi-structured interviews elicited detailed information on preferences for PA intervention among rural AI older adults. We applied a collaborative directed content analysis strategy, and established trustworthiness and relevance using an inter-rater reliability process and member checking. We conducted 21 interviews, all participants identified as AI, the mean age was 66 years (SD = 7.6), and 57% were female. Themes characterized contextual and cultural intervention considerations for adapting and implementing evidence-based PA interventions in rural AI older adults. Key findings included an emphasis on social and community interaction, strategies for targeted engagement, preference for group format, pairing PA sessions with shared meals, and inclusiveness in the PA intervention across ability levels and age groups. This study identified opportunities for adaptation of PA-focused EBIs among rural AI older adults. Findings can be applied to support the adaptation and implementation of effective and relevant PA-focused preventive interventions among this population which is at high risk for chronic disease and health disparities.

Keywords Physical activity · Exercise · Native American · Methods · Implementation Science

Introduction

In the USA, a significant portion of deaths among older adults is attributed to inadequate levels of physical activity (PA) (Carlson et al., 2018). Although PA is a modifiable risk factor known to decrease risk for all-cause mortality among older adults regardless of past PA levels and established risk factors (Mok et al., 2019), PA levels remain low among older adults (Watson et al., 2016). This is especially true among rural and racial/ethnic minority groups (Whitfield et al., 2019), including American Indian and Alaska Native populations (Bersamin et al., 2014; Storti et al., 2009).

Multiple evidence-based interventions (EBIs) targeting PA have demonstrated efficacy in increasing this behavior, and are publicly available for dissemination (Division of Cancer Control and Population Sciences, n.d.). Yet, translating research findings into practice continues to be a challenge for public health (Glasgow & Emmons, 2007). One primary issue is the lack of fit between characteristics of a selected EBI and the context of a target setting (Glasgow & Emmons, 2007). Implementation science uses strategies to "adopt and integrate EBIs into clinical and community settings to improve individual outcomes and benefit population health" (National Institutes of Health, 2019, p. 6). This effort is directly related to health equity, as the work

✉ Maja Pedersen
majaped@stanford.edu

1 Stanford Prevention Research Center, Stanford School of Medicine, Stanford University, Stanford, USA

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

3 Community Health Division, Confederated Salish and Kootenai Tribal Health Department, Saint Ignatius, Montana, USA

4 Center for Behavioral Health Research and Services, Institute of Social and Economic Research, University of Alaska Anchorage, Anchorage, USA

Published online: 29 January 2022

of effectively introducing EBIs into diverse settings seeks to allocate maximum benefit from scientific progress across all populations (Jernigan et al., 2020).

Recent studies have focused on applying implementation science principles to encourage adoption of EBIs among American Indian (AI) populations, contributing to a growing body of evidence aimed at addressing the research-to-practice gap observed in AI communities (Ivanich et al., 2020; Jernigan et al., 2020; Whitesell et al., 2018). Preventive interventions are critical to improving health equity among AIs, among whom life expectancy is lower by 5.5 years than all other races in the U.S. (73.0 years and 78.5, respectively) (Indian Health Service, 2019). In general, sufficient levels of PA among AIs are low (Storti et al., 2009). Furthermore, the two leading causes of death among AI adults are cancer and cardiovascular disease (Indian Health Service, 2019), two diseases that can be prevented or delayed by PA (Moore et al., 2016; Mora et al., 2007).

Efforts to identify effective approaches for prevention interventions among AI communities exist across a continuum, from non-adapted EBIs on one end of the spectrum, to culturally grounded intervention development and well-established EBIs on the other end (Okamoto et al., 2014). One approach along the continuum is cultural adaptation, which attempts to increase cultural sensitivity, that is, the fit and salience of a given EBI for a population other than the one(s) in which it has been tested (Resnicow et al., 1999). Cultural adaptation relies on the assumption that effectiveness will generalize so long as appropriate adaptions are integrated to align or "fit" the program with the target population-based context and culture (Ivanich et al., 2020).

Culturally adapted interventions for health promotion, including those focused on PA, have consistently demonstrated increased relevance and effectiveness (Barrera et al., 2013; Conn et al., 2014). This strategy may be an efficient use of research resources, as it promotes the use of a broad and well-developed evidence base of health promotion interventions with demonstrated efficacy, while integrating critical components of a target population's context and culture. Careful attention to cultural adaptation may be especially relevant among AI populations due to historical and present forms of oppression and cultural colonization (McKinley et al., 2019). Previous studies have identified that implementing non-adapted interventions may perpetuate existing disparities (Dixon et al., 2007; Gone & Trimble, 2012).

Interventions to promote PA behavior among AI populations are scarce, with PA-focused EBIs that have established effectiveness among AI older adults extremely limited (Division of Cancer Control and Population Sciences, n.d.). The Special Diabetes Program for Indians (SDPI), which implemented the National Diabetes Prevention Program across AI and Alaska Native communities and utilized lifestyle behavior change (including PA increase) to reduce incidence of diabetes, listed several general strategies used by some (but not all) sites to contextually and culturally adapt intervention components (Jiang et al., 2013). Strategies included translation of educational concepts and curriculum into the local tribal language, modification of delivery format to align with culturally appropriate communication dynamics, and integration of local foods and customs into intervention sessions (Jiang et al., 2013). Across the SDPI, participant characteristics such as lower household income, low family support, chronic pain, transportation issues, and caregiving responsibilities were associated with participant retention failure (Jiang et al., 2015). These data indicate unique needs and potential for innovative strategies to support intervention relevance and participation among this population.

Intergenerational PA, where members from two different generations participate in PA together (Buonsenso et al., 2021), may be highly relevant to Indigenous populations, as teachings and interaction between older adult leaders, often referred to as Elders, and youth are an important source of cultural transmission across generations (Lewis, 2013). Elders have historically provided an important community role in teaching and modeling cultural practices, language, beliefs, and expectations, including on topics such as healthful ways of being and living (Varcoe et al., 2010; Walters et al., 2020).

Given the relevance of cultural adaptation in improving implementation of PA-focused EBIs among AI populations, this study sought to address the research question: *What are the contextual and cultural factors that influence PA intervention implementation among a rural AI older adult population?* The intent of this study was to identify specific information that can be used to inform selection and adaptation of PA-focused EBIs to enhance upstream efforts at reducing health disparities among this AI population.

Methods

All methods were approved by the designated Tribal Institutional Review Board (IRB). The information presented in this paper is one part of a broader project to examine PA behavior among rural AI older adults (Pedersen et al., 2021). The present study used a community-based approach, theoretical foundations rooted in implementation science, and a qualitative description design to improve understanding of contextual and cultural factors that influence PA-focused intervention implementation among a rural AI older adult population.

Community-Based Approach

Recommendations for intervention and implementation research with AI communities include the use of a community-based

participatory research (CBPR) approach to prioritize the inclusion of Indigenous voices and the goal of health equity throughout the research (Dickerson et al., 2020; Jernigan et al., 2020; Whitesell et al., 2018). This approach emphasizes an equitable partnership between academic and community entities, action-oriented research, and a commitment to building on community strengths and resources (Israel et al., 2012).

Our study took place within the context of a committed CBPR partnership between a university and a Tribal Health Department (THD) located on a rural AI reservation. The overall study focused on an issue identified by the community, which was the limited availability of resources and targeted programming for AI older adults residing in the community.

The research team consisted of five members and included three AI women (an MPH student, a Research Associate, and the THD Program Manager, all residents of the tribal community) and two non-AI women (the principal investigator who was a PhD candidate and a THD Division Director). Aside from the MPH student, all team members held a master's degree in a health-related discipline at the time of the study.

The study was approved by tribal community entities (i.e., Culture Committee and Elder Advisory Board), the THD Director, the Tribal Council, and the Tribal IRB. A community advisory board (CAB) was assembled to provide critical study oversight and community insight. The CAB consisted of 11 AI community residents who met quarterly to develop and review research procedures and materials at all stages of the study (i.e., research questions, study design and methods, recruitment procedures, data collection instrument and interview procedures, data analysis process, study findings). The CAB also participated in dissemination activities, including review of materials used to communicate project findings to AI reservation stakeholders, and review of scientific communications, such as the review of this publication.

The research team identified the THD, which maintains multiple health clinics and fitness centers across the reservation, as the service setting for a future PA-focused intervention. This decision was based on the interest level of THD program leadership to commit to a future PA-focused intervention for the older adult population, and the availability of staff and existing infrastructure such as facilities, walking tracks, and paths. The alignment of (1) existing community infrastructure and (2) evidence of the popularity, accessibility, and positive impact of walking among AIs and older adults (Storti et al., 2009; Tudor-Locke et al., 2010) prompted the research team to focus study questions on *walking* as the form of PA. Thus, the research team prioritized identifying contextual and cultural factors that may influence a walking-focused EBI, which could then be adapted and evaluated in a future community-based implementation study.

Theoretical Foundations

The theoretical foundations of this study were provided by the Iterative Adaptation Process (IAP) (Ivanich et al., 2020) and the domains of intervention adaptation (Chambers & Norton, 2016). The IAP is a framework designed to guide implementation research among Indigenous populations. The IAP emphasizes the integration of community-based methods, prioritization of Indigenous voices, and the use of an iterative, collaborative process. The IAP consists of two stages intended to guide community research partnerships to select and adapt EBIs for use among Indigenous populations. The stages uphold principles of CBPR by integrating community initiative, considerations of cultural knowledge and practice, and community-level review as key steps throughout (Ivanich et al., 2020). This study used the IAP as a guide to orient information gathering; data collection strategies focused on yielding information to inform selection of an appropriate EBI, adaptation based on contextual and cultural factors, and feasibility considerations for future implementation.

Information gathering was organized by sources of intervention adaptation (Chambers & Norton, 2016), focusing on four key adaptation domains: service setting, target audience, mode of delivery, and culture. For this study, the future service setting was identified to be the THD, so we gathered information on the latter three adaptations only.

Qualitative Description Design

Qualitative description design is a method of inquiry that seeks to understand activities and processes experienced by the study population (Sandelowski, 2000), and can be effectively used to assess, develop, and refine interventions among populations that experience health disparities (Sullivan-Bolyai et al., 2005). This design has been applied among Indigenous-focused studies to improve cultural sensitivity in research (Burnette et al., 2014). In keeping with this design, we conducted qualitative, semi-structured interviews to elicit detailed, pragmatic information on contextual and cultural factors that influence PA-focused intervention implementation among rural AI older adults.

Participants and Recruitment

Interviews took place on the large, rural AI reservation located in the northwest region of the USA with a population of > 7000 AI residents and a relatively high proportion of adults over the age of 50 years (U.S. Census Bureau, 2019). Inclusion criteria were as follows: (1) age of 50 years or above, (2) self-identify as AI, and (3) reside on the reservation. Individuals were excluded if they lived in a residential facility for long-term care. Recruitment occurred in November–December of 2019 at community

events that AI older adults were likely to attend, such as THD-sponsored health fairs, flu shot clinics, and local gatherings for elders. Purposive sampling and snowball sampling strategies were used to recruit an appropriate number of participants expected to reach theme saturation (Luborsky & Rubinstein, 1995; Patton, 2014).

Data Collection Procedures

The semi-structured interview guide focused on contextual and cultural factors influencing PA-focused EBI implementation among rural AI older adults. Our interviews started with broad, open-ended questions about PA participation and behavior, such as, "What is the role of physical activity for health and wellbeing in your life," and "what gets in the way of walking more often?" and "what would help you to go walking more often?" The interview guide then moved into a set of questions grouped under the introduction, "If we developed a walking program for older adults / elders in your community …" and focused on the three selected domains of intervention adaptation: target audience (e.g., "what would motivate you to participate?"), mode of delivery (e.g., "where should it be located?"), and cultural adaptation (e.g., "if young people were involved in the walking program, what topics would you like to share with them?"). Several questions explored a community-identified, culture-focused interest in intergenerational health promotion programming (e.g., "what are some benefits to young people participating in the PA program alongside older adults? Concerns?"). The guide was developed through a collaborative, iterative process that included the research team, the CAB, and three pilot interviews with community members representative of the target population.

Two research team members, one non-AI (MP) and one AI (MG), both trained in qualitative methods (i.e., had both completed graduate-level qualitative methods coursework and had previous experience conducting qualitative research studies with rural AI populations) and culturally appropriate interview strategies (Lewis, 2017), conducted all interviews. The interviewers followed a study operation manual to maintain high-quality, consistent standards for data collection and management. All interviews were conducted on the AI reservation. Locations were selected that would be quiet, convenient, and comfortable for the participant. All participants were verbally oriented to a written informed consent, collected prior to data collection, and each participant completed a demographics and health questionnaire. All participants were offered a bottle of water and a snack, and $35 for participation.

Data Analysis

Interviews were digitally recorded and transcribed verbatim. Content analysis, which is an appropriate analysis strategy with qualitative description design (Sullivan-Bolyai et al., 2005), was applied to the transcript text. Content analysis is a structured form of analysis that first uses the theoretical framework to identify the overall coding frame, and subsequently uses the text to develop operationalized definitions unique to the data and to identify emergent codes (i.e., text passages that are relevant to the research question, but could not be categorized with the initial coding frame) (Hsieh & Shannon, 2005). This strategy allowed the research team to develop a final coding frame that mapped closely to the data (Sullivan-Bolyai et al., 2005). The team conducted a collaborative data analysis process; members used the initial coding frame to review all transcripts and took notes on recurring themes. Research team members also maintained personal notes for reflexivity, including identifying biases and how individual experiences, such as an Indigenous worldview, influenced interpretation of the text (Guba & Lincoln, 1982; Simonds & Christopher, 2013). The research team discussed established and emergent codes and subcodes and finalized the coding frame.

Two research team members trained in qualitative research methods (MP and MG) applied the final coding frame to all transcripts, utilizing QSR NVivo qualitative data analysis software (QSR International, Burlington, MA) for data organization and management. An interrater reliability test was performed to establish trustworthiness in the coding strategy (Morse, 2015), and a study member masked to the initial coding process applied the coding frame to a random 10% sample of all coded text. Results indicated substantial agreement, with a Cohen's kappa of 0.80 (McHugh, 2012). Any disagreements in coding application were resolved through discussion and consensus. Findings, grouped by overall themes and sub-themes, were reviewed by the CAB for member checking and alignment with community perspectives on appropriateness and relevance.

Results

Twenty-one participants completed the semi-structured interview process; ages ranged from 50 to 82 years (mean age was 66 years, SD = 7.6), with 57% female, 48% married, and 62% retired or not working. Ninety-five percent reported comorbidity (defined as two or more co-existing chronic conditions) (Goins & Pilkerton, 2010). All participants self-identified as AI. Participants represented geographic areas throughout the reservation.

Themes

Themes reflected contextual and cultural factors influencing PA-focused EBI implementation among rural AI older

adults (see Table 1). Findings were organized according to the domains for intervention adaptation (Chambers & Norton, 2016).

Target Audience

Motivation to Participate Overall, participants expressed interest in a community-based PA program delivered by the local THD. Social interaction and opportunities to engage in groups, get to know people in the community, and have company while doing PA was described as appealing. One participant said,

> And just meeting other people, getting to know them, getting to meet them and getting to know who they are and what they do. And maybe their interests are similar to yours…You wouldn't be able to do that if you don't come together. Walking clubs can bring you together.

A small number of participants described a different perspective; a preference for walking alone, to enjoy solitude or because of concern that a walking partner would walk too fast or too slow.

Incentives to get older adults involved were mentioned frequently; recommendations for meaningful incentives included financial rewards, matching t-shirts or sweatshirts, and equipment, such as quality walking shoes, walking poles for stability, and anti-slip covers for footwear during the winter months. Others described gifts, such as locally made blankets, or a photo of the older adult with their walking partners.

Engagement Recommended communication pathways to learn about PA programming included advertisements in the local tribal newspaper, social media, and word-of-mouth. It was specified that newspaper advertisements should be placed well in advance of the onset of the program and should appear in multiple issues to allow sufficient time for scheduling and preparation. Facebook was recommended as the preferred social media advertising and communication strategy due to familiarity and frequency of use. Nearly all participants emphasized word-of-mouth, with some advocating for neighborhood door-to-door campaigns. One participant described the importance of recruiting older adults this way: "…You have to go over there and talk to them, and actually get into their world." This was described as a strategy to include older adults who might otherwise be disconnected from social media or other communication pathways.

Some participants learned about the benefits of PA and opportunities for participation in PA programming through their healthcare providers and staff at the local THD. Several participants mentioned the importance of information-sharing

Table 1 Results for evidence-based program adaptation by domain

Domains of adaptation	Themes	Subthemes
Target audience	Motivation to participate	– Social interaction – Community interaction – Incentives
	Engagement	– Communication through local pathways – In-person recruitment – Healthcare providers and staff – Competition or challenge activity
	Scheduling	– Early afternoon or early evening – Added to a pre-existing community event
Mode of delivery	Intervention format	– Group or partner – Frequent local meetings, once-per-month reservation-wide events – Hybrid in-person and group – Structured meeting times and locations – Intervention facilitators
	Physical activity characteristics	– Scaled distance and intensity
	Meals and social time	– Meal provided before or after walk – Space and time provided to socialize, gain education
Cultural adaptations	Family-based opportunities and inclusion of all age groups	– Family members of all ages welcome – Community members of all ages welcome
	Intergenerational opportunities	– Importance of knowledge sharing – Social interaction – Concern for young people's sedentary behavior – Topics for conversation / knowledge-sharing

and encouragement by healthcare providers and staff to get involved in such activities. One participant described the front desk staff person at the local THD as the way to learn about health programming: "Well, I learn it because I come down here and [*staff member name*] tells me, and then I go tell everybody else that I will go see." Another participant shared a story about not knowing she should exercise at her age until her physical therapist recommended it. Motivated by this encouragement, the participant recommended that healthcare staff provide this information to other older adults.

Another form of engagement was creating a challenge or competition within the PA program. Whether this was an individual point system for daily or weekly activity, or a competition across communities, participants expressed that this was a good way to spur engagement, support fun, and maintain adherence.

Scheduling Although responses to scheduling considerations varied, a theme of early afternoon or early evening became evident. Participants who were not retired and working regular hours described either the noon hour or right after work as ideal times for a PA program. Some who were retired described a preference for using morning time for chores, and many described that they would want to participate before dinnertime rather than later in the evening. Some offered ideas of scheduling the PA program around pre-existing events that draw older adults, such as a cooking demonstration for the local diabetes program. One participant described it this way:

> Maybe if you were to do it around...something that's already in place. So, like we have senior citizen meals and if you could do like a walk before or after those meals... because they're already out. It might kind of encourage those accustomed. That happens every week on these certain days. So, that we'd help with the socializing and normalizing of fitness.

Mode of Delivery

Intervention Format Participants described a wish for social opportunities to walk together with a small group or a partner. Given the rural geography of the reservation (i.e., some communities are over 40 miles apart), participants envisioned local PA groups where they could get to know their neighbors. Regarding local walking groups, one participant said, "… I think by doing that, that whole connection as a general community would open that door up to movement of that sort. Basically, get to know the neighbors better."

Some suggested regular local meeting times reinforced with a monthly or quarterly reservation-wide event to meet and walk together with people from other communities. Due to busy schedules and caregiving duties, others recommended a hybrid-style program where regular PA was independent, but a monthly group meeting was interspersed to maintain a sense of community with others involved.

Preferred program structure was identified as having a designated location for PA and providing THD staff on-site at designated times for accountability and safety purposes. Safety was frequently mentioned as a concern, specifically in relation to crime, appropriate walking surfaces for older adults (e.g., even, flat ground), and health issues. Participants preferred group or partner events to reduce risk of crime. Participants recommended an on-site program facilitator at PA sessions, someone who could administer emergency medical attention, answer health-related questions, or provide encouragement. Daylight hours were the preferred timeframe for PA to avoid the dark, and most participants preferred indoor PA during winter months. Some found outdoor PA in the winter acceptable but suggested a designated indoor space in which to get dressed before the PA and to warm up afterwards.

Physical Activity Characteristics Forms of PA were focused on walking, as some questions in the interview guide specifically asked about walking programs. However, participants brought up other forms of PA they were interested in, such as tai chi, cross-country skiing, and canoeing. Several participants expressed interest in hiking in the mountains and suggested guided group opportunities for hiking local trails.

For walking session duration and intensity, responses centered around accessibility and inclusion. Participants emphasized the importance for older adults to not feel intimidated by the program and described opportunities for scaled distances and intensity depending on how the individual was feeling that day. One individual said, "I like the idea of an organized group, but I wouldn't be able to participate if it was very rigorous, they're going to go on a hike and that's two or three miles. I can't do that. Something that's just local and low key for me." Others were concerned that if they needed to stay with the group or a walking partner, they might not be able to walk as fast as they wanted. It was generally recommended that a designated time and place be arranged, but that individuals should have flexibility for distance and intensity.

Cultural Adaptations

Cultural values, such as social connectedness, family, and inclusion, as previously described, were reflected across domains of intervention adaptation. Although walking was the focus in this study, additional physical activities recommended by participants, such as hiking outdoors and in the

mountains, and canoeing on the local lake, may represent culturally congruent activities. Additional broad themes of cultural adaptations are described below.

Meals and Social Time The importance of sharing meals and social time together was underscored. Participants described how sharing food before or after the PA program would be motivation to attend, as it would provide a culturally relevant component of social connectedness. Some participants described an interest in learning more about healthy meal preparation and PA in relation to health conditions, such as diabetes, arthritis, and cardiovascular disease. As one participant said, "… If there was a walk and there was a light meal afterwards, and then maybe sometimes there was talk about how the meal was prepared, or cooking." It was recommended that PA programming take place near a THD clinic or community center, so that participants could gather before or after to share food and socialize, or learn about a specific educational topic regarding health and PA.

Family-Based Opportunities and Inclusion of All Age Groups Most participants preferred including all age groups in PA programming. In one participant's words, "I think it's important to get all the age groups to help the health of those elders out here on our reservation…." Others mentioned the importance of the option to bring grandchildren, a relative, or the whole family along to the programming, highlighting a value of family and inclusiveness.

Intergenerational Opportunities Participants were generally enthusiastic about intergenerational PA programming. The cultural importance of sharing knowledge and stories across generations was emphasized; one participant said,

> Oh yes, I would love it. For one thing the community is getting to know each other better, they're finding out who they can trust should situations arise. But the main thing is you're passing on information that while you're out there having fun with everybody, you're passing on information that's going to get lost if you don't.

And another described it this way:

> These things that the older people know, the elders, I guess you could say coming from a tribal standpoint, the elders have all this knowledge. The thing is getting the people to want to know it, but if you can get everybody involved … I enjoy learning and if I can combine that with physical activity, that makes it even more interesting to me.

Participants expressed the wish to engage young people in healthy, active pastimes that include social participation and avoid technology such as TV screens, video games, and social media. When asked about topics that could be discussed or shared during a walk together, common themes arose. These included knowledge of the natural world, such as plant and tree identification, animal and bird behavior, and how to enjoy nature in what one participant described as an "outdoor playground." Other topics centered on health and well-being, such as nutrition, avoiding substance misuse, the benefits of sleep, PA, muscle groups, and how exercise impacts long-term health and disease. One participant described it this way:

> Well, I better tell them why I'm walking. Because I have to walk because I'm a diabetic. Now, I'm telling you kids this, because I don't want you to be diabetic. I want this to be a part of your life. To walk and enjoy it instead of having to walk because you're diabetic.

Another suggestion was sharing stories about how ancestors lived—what kinds of PA they did every day—and what geographic places on the reservation have historic or cultural meaning. Participants suggested taking young people up into the mountains or in canoes out on the lakes and sharing ways to stay active and healthy while being outside. One participant suggested that young people could ask questions about the history and lives of the older adults to help them recall memories. Another participant described how young people could ask questions, "… and just talk about different things that might make them (*older adults*) feel good, bringing back memories of good times."

Some participants preferred including children as young as 8 years old. Others suggested including teenagers to keep them engaged in the community rather than isolated. A few expressed that they were not interested in intergenerational walking, as they valued solitude while engaging in PA, or were worried that children would slow down their preferred walking pace. Others suggested that caregivers join and supervise children. Background checks were recommended for older adult participants engaged in intergenerational activities, and some emphasized the importance of parental consent before child participation. Concerns expressed about intergenerational PA highlight the importance of collaborative decision-making with the local study population in intervention development and implementation.

Discussion

The purpose of this study was to identify contextual and cultural factors that influence PA intervention implementation among a rural AI older adult population. This research emphasizes the perspective of rural AI older adults in informing the selection, adaptation, and implementation of PA-focused interventions. By utilizing a qualitative

description design and organizing findings by intervention adaptation domain, information is presented in a straightforward, pragmatic manner to facilitate application across future PA-focused research studies among this population.

The findings are useful for translating research-to-practice in two ways. First, findings can be used within the framework of the IAP to identify and select an appropriate PA-focused EBI. Second, findings can inform critical adaptation and implementation strategies once an EBI has been selected, avoiding the misalignment of EBI characteristics and local context that can lead to ineffectual implementation, program failure, and community harm. While previous studies have shared examples of contextual and cultural adaptations that have taken place to enhance implementation specific to one EBI, this study provides findings that can be applied to a range of PA-focused interventions. In addition, this study describes an approach and research design that investigators can use to explore contextual and cultural adaptations to EBIs in the future. This flexibility of information opens myriad opportunities for public health efforts to identify and address health equity among rural AI older adults.

Several cross-cutting themes emerged from the data. First, opportunities for social engagement were a common thread across all adaptation domains. Most participants expressed an interest in group or partner walking, with a broader emphasis on becoming more familiar with—and interacting with—others in their neighborhood and community. Also, participants expressed a preference for inclusion of all ages, with specific reference to family members and grandchildren, and recommended including opportunities to share meals and socialize as a component of the PA programming. These themes echoed findings from other research with AI older adults. Belza et al. (2004) found being around other AI older adults was a motivator for PA participation, while Sawchuk et al. (2011) found having someone to walk with was a top PA facilitator.

Evidence suggests that older adults with higher levels of social support are more likely to participate in PA, especially when the support comes from family members (Smith et al., 2017). Supportive community and family, and a sense of purpose or optimism were identified as central tenets to an Alaska Native model of successful aging (Lewis, 2013). The Native Elder Care Study, a cross-sectional study among 505 community-dwelling AI older adults in the southeastern USA, found that social support was associated with positive health outcomes such as decreased depression and chronic pain (Conte et al., 2015). Results from our study, as reinforced by previous evidence described above, indicate social connectedness and social support as important protective factors for prevention research among rural AI older adults.

Implications for EBI selection and adaptation may include the selection of PA-focused interventions that feature group or partnered PA and emphasize group identity and interaction, or those which can be modified to feature such characteristics. For example, the Walk Your Heart to Health EBI, which has demonstrated effectiveness in promoting PA among urban non-Hispanic Black and Hispanic adults, features structured activities to emphasize social support and group cohesion among neighborhood-based walking groups (Schulz et al., 2015). Findings from this study suggest that if an EBI offers options for self-directed or group-facilitated implementation, such as the Walk With Ease EBI (Callahan et al., 2011), selecting the group-facilitated format to promote social connectedness is recommended.

Participants were asked about their interest in PA programming that would include intergenerational interaction; responses overall were positive. Similarly, a study among rural First Nations communities in Canada identified interest among grandparents and elders in being involved in health promotion efforts involving younger people in their communities, and the recommended involvement included role modeling of healthy behavior and teaching respectful cultural traditions (Varcoe et al., 2010). These sentiments were supported by findings in our study. A range of topics and activities of interest for intergenerational PA programming were identified, representing culture-based topics to be integrated into the curriculum of a selected EBI, or topics that could be added as additional sessions or learning components.

Incorporation of intergenerational participation into an existing EBI may be another example of a strengths-based approach to adaptation. Evidence for intergenerational PA promotion remains limited (La Park, 2014), and none has been reported among Indigenous populations, leaving opportunity for examination in future research. Recruiting grandparent and grandchild pairs could be an effective strategy to incorporate family-based and intergenerational values. Another strategy could be selecting an already seated intergenerational intervention, such as the question-and-answer style Building Community Legacy Together intervention (Baschiera et al., 2019), and adapt this content for a paired or group PA-focused EBI.

Recommendations for format of intervention delivery highlighted several issues that were central to adaptation efforts for the SDPI, which implemented the National Diabetes Prevention Program across 36 diverse AI and AN communities (Jiang et al., 2013). Some SDPI sites adapted the program to reflect culturally appropriate forms of gathering and communication. Findings from our study identified the importance of participants sharing a meal together before or after the PA session, and including experiential forms of education (e.g., a cooking demonstration) rather than a lecture format. Implications for EBI adaptation include modification of intervention delivery to feature a gathering space for sharing a meal, and conversion of lecture- or seminar-based education delivery to demonstrations and experiences. Similar recommendations have been reflected in intervention development with other ethnic/racial populations, such as Latina women (Toobert

et al., 2011). A local example suggested by participants in this study was to utilize a community center or health center equipped with a kitchen and meeting room as the designated location for the PA-focused intervention sessions, and to incorporate a shared meal and/or cooking class either before or after the PA session. This adaptation could be incorporated into existing EBIs, using community-identified resources to support the gathering and meal preparation space.

Limitations to this study include the narrow scope of older AI adults from one rural AI reservation, which limits generalizability. This issue is omnipresent with research among AI populations, as broad heterogeneity exists across AI tribes and communities. Given the rural setting of this study, findings may not translate to the large portion of AI older adults living in urban locations. This study used qualitative methods, which features a smaller sample size ($n=21$); however, recruitment techniques that included a multifaceted, targeted approach to advertising the study, and purposive selection of participants, ensured inclusion of diverse perspectives within the target audience (i.e., gender, older adult age groups) and followed recommended guidelines and standards for sampling to establish theme saturation.

This study identified contextual and cultural factors that influence PA intervention implementation among a rural AI older adult population; findings can be used to inform collaborative processes of selection and adaptation of PA-focused EBIs among this population, addressing upstream issues in the research-to-practice gap. Findings advance the field of EBI adaptation among this population by providing details on the preferences across adaptation domains. On a local level, our study findings provide valuable perspectives that the THD and other community-based stakeholders can use when designing opportunities for health behavior engagement among older adults. Findings from this study may also enhance health equity efforts for PA promotion by improving the relevance and effectiveness of EBIs for rural AI older adults.

Acknowledgements The authors are grateful for the support and assistance of members of the Community Research Mentor Panel throughout the research and writing process. We also thank the Confederated Salish and Kootenai Tribes (CSKT) Health Department, and the CSKT Tribal Council for reviews and approval of this manuscript. Finally, we thank the CSKT community members who engaged as participants to share their experiences and perspectives for this study.

Funding 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. Maja Pedersen is supported by a National Cancer Institute postdoctoral fellowship under Award Number K00CA253761.

Declarations

Disclaimer The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Salish Kootenai College Institutional Review Board under approval # 2019_6_Pederson.

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

Conflict of Interest The authors declare no competing interests.

References

Barrera, M., Castro, F. G., Strycker, L. A., & Toobert, D. J. (2013). Cultural adaptations of behavioral health interventions: A progress report. *Journal of Consulting and Clinical Psychology, 81*, 196–205. https://doi.org/10.1037/a0027085

Baschiera, B., Pillemer, K., & Yau, H. (2019). Building a Community Legacy Together (BCLT)–An intergenerational program for youth and older adults aimed at promoting a more equitable society. *Encyclopaideia, 23*, 29–41. https://doi.org/10.6092/issn.1825-8670/9347

Belza, B., Walwick, J., Shiu-Thornton, S., Schwartz, S., Taylor, M., & LoGerfo, J. (2004). Older adult perspectives on physical activity and exercise: Voices from multiple cultures. *Preventing Chronic Disease, 1*(4), A09. PMCID: PMC1277949.

Bersamin, A., Wolsko, C., Luick, B. R., Boyer, B. B., Lardon, C., Hopkins, S. E., ... & Zidenberg-Cherr, S. (2014). Enculturation, perceived stress, and physical activity: Implications for metabolic risk among the Yup'ik–The Center for Alaska Native Health Research Study. *Ethnicity & Health, 19*(3), 255–269. https://doi.org/10.1080/13557858.2012.758691

Jernigan, B. B., & V., D'Amico, E. J., & Keawe'aimoku Kaholokula, J. (2020). Prevention research with Indigenous communities to expedite dissemination and implementation efforts. *Prevention Science, 21*, 74–82. https://doi.org/10.1007/s11121-018-0951-0

Buonsenso, A., Fiorilli, G., Mosca, C., Centorbi, M., Notarstefano, C. C., Di Martino, G., …& di Cagno, A. (2021). Exploring the enjoyment of the intergenerational physical activity. *Journal of Functional Morph. and Kinesiology, 6*, 51. https://doi.org/10.3390/jfmk6020051

Burnette, C. E., Sanders, S., Butcher, H. K., & Rand, J. T. (2014). A toolkit for ethical and culturally sensitive research: An application with indigenous communities. *Ethics and Social Welfare, 8*, 364–382. https://doi.org/10.1080/17496535.2014.885987

Callahan, L. F., Shreffler, J. H., Altpeter, M., Schoster, B., Hootman, J., Houenou, L. O., ... & Schwartz, T. A. (2011). Evaluation of group and self-directed formats of the Arthritis Foundation's Walk With Ease Program. *Arthritis Care & Research, 63*(8), 1098–1107. https://doi.org/10.1002/acr.20490

Carlson, S. A., Adams, E. K., Yang, Z., & Fulton, J. E. (2018). Percentage of deaths associated with inadequate physical activity in the United States. *Preventing Chronic Disease, 15*, E38. https://doi.org/10.5888/pcd18.170354

Chambers, D. A., & Norton, W. E. (2016). The adaptome: Advancing the science of intervention adaptation. *American Journal of Preventive Medicine, 51*, S124. https://doi.org/10.1016/j.amepre.2016.05.011

Conn, V. S., Chan, K., Banks, J., Ruppar, T. M., & Scharff, J. (2014). Cultural relevance of physical activity intervention research with underrepresented populations. *International Quarterly of*

Community Health Education, 34, 391–414. https://doi.org/10.2190/IQ.34.4.g

Conte, K. P., Schure, M. B., & Goins, R. T. (2015). Correlates of social support in older American Indians: The native elder care study. *Aging & Mental Health, 19*, 835–843. https://doi.org/10.1080/13607863.2014.967171

Dickerson, D., Baldwin, J. A., Belcourt, A., Belone, L., Gittelsohn, J., Keawe'aimoku Kaholokula, J. K. A., ... & Wallerstein, N. (2020). Encompassing cultural contexts within scientific research methodologies in the development of health promotion interventions. *Prevention Science, 21*(Suppl 1), 33–42. https://doi.org/10.1007/s11121-018-0926-1

Division of Cancer Control and Population Sciences, NCI. Physical activity evidence-based program listing. (n.d.). Evidence-based programs listing. Retrieved January 20, 2021, from https://ebccp.cancercontrol.cancer.gov/topicPrograms.do?topicId=102268&choice=default

Dixon, A. L., Yabiku, S. T., Okamoto, S. K., Tann, S. S., Marsiglia, F. F., Kulis, S., & Burke, A. M. (2007). The efficacy of a multicultural prevention intervention among urban American Indian youth in the southwest US. *The Journal of Primary Prevention, 28*, 547–568. https://doi.org/10.1007/s10935-007-0114-8

Glasgow, R. E., & Emmons, K. M. (2007). How can we increase translation of research into practice? Types of evidence needed. *Annual Review of Public Health, 28*, 413–433. https://doi.org/10.1146/annurev.publhealth.28.021406.144145

Goins, R., & Pilkerton, C. (2010). Comorbidity among older American Indians: The Native elder care study. *Journal of Cross-Cultural Gerontology, 25*, 343–354. https://doi.org/10.1007/s10823-010-9119-5

Gone, J. P., & Trimble, J. E. (2012). American Indian and Alaska Native mental health: Diverse perspectives on enduring disparities. *Annual Review of Clinical Psychology, 8*, 131–160. https://doi.org/10.1146/annurev-clinpsy-032511-143127

Guba, E. G., & Lincoln, Y. S. (1982). Epistemological and methodological bases of naturalistic inquiry. *ECTJ*, *30*(4), 233–252. https://www.jstor.org/stable/30219846. Accessed 18 Dec 2020.

Hsieh, H., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research, 15*, 1277–1288. https://doi.org/10.1177/1049732305276687

Indian Health Service. (2019). *Fact sheet on American Indian and Alaska Native disparities*. Retrieved on January 25, 2020, from https://www.ihs.gov/newsroom/factsheets/disparities/

Israel, B. A., Eng, E., Parker, E. A., & Schulz, A. J. (2012). *Methods for community-based participatory research for health* (2nd ed.). Jossey-Bass.

Ivanich, J. D., Mousseau, A. C., Walls, M., Whitbeck, L., & Whitesell, N. R. (2020). Pathways of adaptation: Two case studies with one evidence-based substance use prevention program tailored for indigenous youth. *Prevention Science, 21,* 43–53. https://doi.org/10.1007/s11121-018-0914-5

Jiang, L., Manson, S. M., Beals, J., Henderson, W. G., Huang, H., Acton, K. J., & Roubideaux, Y. (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*, 2027–2034. https://doi.org/10.2337/dc12-1250

Jiang, L., Manson, S. M., Dill, E. J., Beals, J., Johnson, A., Huang, H., ... & Roubideaux, Y. (2015). Participant and site characteristics related to participant retention in a diabetes prevention translational project. *Prevention Science, 16*(1), 41–52. https://doi.org/10.1007/s11121-013-0451-1

La Park, A. (2014). The impacts of intergenerational programmes on the physical health of older adults. *Journal of Aging Science, 2*(3). https://doi.org/10.4172/2329-8847.1000129

Lewis, J. P. (2013). The importance of optimism in maintaining healthy aging in rural Alaska. *Qualitative Health Research, 23*, 1521–1527. https://doi.org/10.1177/1049732313508013

Lewis, J. P. (2017). *Conducting qualitative research in rural Alaska communities: Engaging elders to ensure cultural relevance and sensitivity*. SAGE Publications Ltd. https://doi.org/10.4135/9781526411457

Luborsky, M. R., & Rubinstein, R. L. (1995). Sampling in qualitative research: Rationale, issues, and methods. *Research on Aging, 17,* 89–113. https://doi.org/10.1177/0164027595171005

McHugh, M. L. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica, 22*, 276–282. https://doi.org/10.11613/BM.2012.031

McKinley, C. E., Figley, C. R., Woodward, S. M., Liddell, J. L., Billiot, S., Comby, N., & Sanders, S. (2019). Community-engaged and culturally relevant research to develop behavioral health interventions with American Indians and Alaska Natives. *American Indian and Alaska Native Mental Health Research, 26*, 79. https://doi.org/10.5820/aian.2603.2019.79

Mok, A., Khaw, K., Luben, R., Wareham, N., & Brage, S. (2019). Physical activity trajectories and mortality: Population based cohort study. *BMJ, 365*, l2323. https://doi.org/10.1136/bmj.l2323

Moore, S. C., Lee, I., Weiderpass, E., Campbell, P. T., Sampson, J. N., Kitahara, C. M., ... & Patel, A. V. (2016). Association of leisure-time physical activity with risk of 26 types of cancer in 1.44 million adults. *JAMA Internal Medicine, 176*(6), 816–825. https://doi.org/10.1001/jamainternmed.2016.1548

Mora, S., Cook, N., Buring, J. E., Ridker, P. M., & Lee, I. (2007). Physical activity and reduced risk of cardiovascular events: Potential mediating mechanisms. *Circulation, 116*, 2110–2118. https://doi.org/10.1161/CIRCULATIONAHA.107.729939

Morse, J. M. (2015). Critical analysis of strategies for determining rigor in qualitative inquiry. *Qualitative Health Research, 25*, 1212–1222. https://doi.org/10.1177/1049732315588501

National Institutes of Health. (2019). *Dissemination and implementation research in health.* https://grants.nih.gov/grants/guide/pa-files/PAR-19-274.html. Accessed 4 June 2020.

Okamoto, S. K., Kulis, S., Marsiglia, F. F., Steiker, L. K. H., & Dustman, P. (2014). A continuum of approaches toward developing culturally focused prevention interventions: From adaptation to grounding. *The Journal of Primary Prevention, 35,* 103–112. https://doi.org/10.1007/s10935-013-0334-z

Patton, M. Q. (2014). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). Sage Publications.

Pedersen, M., Harris, K. J., Lewis, J., Grant, M., Kleinmeyer, C., Glass, A., ... & King, D. (2021). Uplifting the voices of rural American Indian older adults to improve understanding of physical activity behavior. *Translational Behavioral Medicine, 11*(9), 1655–1664. https://doi.org/10.1093/tbm/ibab107

Resnicow, K., Baranowski, T., Ahluwalia, J. S., & Braithwaite, R. L. (1999). Cultural sensitivity in public health: Defined and demystified. *Ethnicity & Disease, 9*, 10–21. PMID: 10355471.

Sandelowski, M. (2000). Whatever happened to qualitative description? *Research in Nursing & Health, 23*, 334–340. https://doi.org/10.1002/1098-240x(200008)23:4%3c334::aid-nur9%3e3.0.co;2-g

Sawchuk, C. N., Russo, J. E., Bogart, A., Charles, S., Goldberg, J., Forquera, R., ... & Buchwald, D. (2011). Barriers and facilitators to walking and physical activity among American Indian elders. *Preventing Chronic Disease, 8*(3), A63. PMCID: PMC3103568.

Schulz, A. J., Israel, B. A., Mentz, G. B., Bernal, C., Caver, D., DeMajo, R., ... & Woods, S. (2015). Effectiveness of a walking group intervention to promote physical activity and cardiovascular health in predominantly non-Hispanic Black and Hispanic urban neighborhoods. *Health Education & Behavior, 42*(3), 380–392. https://doi.org/10.1177/1090198114560015

Simonds, V. W., & Christopher, S. (2013). Adapting Western research methods to indigenous ways of knowing. *American Journal of Public Health, 103*(12), 2185–2192. https://dx.doi.org/10.2105%2FAJPH.2012.301157

Smith, G. L., Banting, L., Eime, R., O'Sullivan, G., & Van Uffelen, J. G. (2017). The association between social support and physical activity in older adults: A systematic review. *International Journal of Behavioral Nutrition and Physical Activity, 14*, 1–21. https://doi.org/10.1186/s12966-017-0509-8

Storti, K. L., Arena, V. C., Barmada, M. M., Bunker, C. H., Hanson, R. L., Laston, S. L., Yeh, J. L., Zmuda, J. M., Howard, B. V., & Kriska, A. M. (2009). Physical activity levels in American Indian adults: The strong Heart Family Study. *American Journal of Preventive Medicine, 37*, 481–487. https://doi.org/10.1016/j.amepre.2009.07.019

Sullivan-Bolyai, S., Bova, C., & Harper, D. (2005). Developing and refining interventions in persons with health disparities: The use of qualitative description. *Nursing Outlook, 53*, 127–133. https://doi.org/10.1016/j.outlook.2005.03.005

Toobert, D. J., Strycker, L. A., Barrera, M., Jr., Osuna, D., King, D. K., & Glasgow, R. E. (2011). Outcomes from a multiple risk factor diabetes self-management trial for Latinas: ¡ Viva Bien! *Annals of Behavioral Medicine, 41*, 310–323. https://doi.org/10.1007/s12160-010-9256-7

Tudor-Locke, C., Johnson, W. D., & Katzmarzyk, P. T. (2010). Frequently reported activities by intensity for U.S. adults: The American time use survey. *American Journal of Preventive Medicine, 39*(4), e13. https://doi.org/10.1016/j.amepre.2010.05.017

U.S. Census Bureau. (2019). *Quickfacts.* https://www.census.gov/. Accessed 6 June 2020.

Varcoe, C., Bottorff, J. L., Carey, J., Sullivan, D., & Williams, W. (2010). Wisdom and influence of elders: Possibilities for health promotion and decreasing tobacco exposure in First Nations communities. *Canadian Journal of Public Health, 101*, 154–158. https://doi.org/10.1007/BF03404363

Walters, K. L., Johnson-Jennings, M., Stroud, S., Rasmus, S., Charles, B., John, S., ... & Boulafentis, J. (2020). Growing from our roots: Strategies for developing culturally grounded health promotion interventions in American Indian, Alaska Native, and Native Hawaiian communities. *Prevention Science, 21*(Suppl 1), 54–64. https://doi.org/10.1007/s11121-018-0952-z

Watson, K. B., Carlson, S. A., Gunn, J. P., Galuska, D. A., O'Connor, A., Greenlund, K. J., & Fulton, J. E. (2016). Physical inactivity among adults aged 50 years and older—United States, 2014. *Morbidity and Mortality Weekly Report, 65*, 954–958. https://doi.org/10.15585/mmwr.mm6536a3

Whitesell, N. R., Sarche, M., Keane, E., Mousseau, A. C., & Kaufman, C. E. (2018). Advancing scientific methods in community and cultural context to promote health equity. *American Journal of Evaluation, 39*, 42–57. https://doi.org/10.1177/1098214017726872

Whitfield, G. P., Carlson, S. A., Ussery, E. N., Fulton, J. E., Galuska, D. A., & Petersen, R. (2019). Trends in meeting physical activity guidelines among urban and rural dwelling adults - United States, 2008–2017. *MMWR. Morbidity and Mortality Weekly Report, 68*, 513–518. https://doi.org/10.15585/mmwr.mm6823a1