

UCSF

UC San Francisco Previously Published Works

Title

Development and Implementation of a Hybrid Online and In-Person Food Sovereignty and Nutrition Education Curriculum for Native American Parents: The FRESH Study

Permalink

<https://escholarship.org/uc/item/15f060g2>

Journal

Health Education & Behavior, 50(3)

ISSN

1090-1981

Authors

Haslam, Alyson
Love, Charlotte
Taniguchi, Tori
[et al.](#)

Publication Date

2023-06-01

DOI

10.1177/10901981211067168

Peer reviewed



Published in final edited form as:

Health Educ Behav. 2023 June ; 50(3): 430–440. doi:10.1177/10901981211067168.

Development and Implementation of a Hybrid Online and In-Person Food Sovereignty and Nutrition Education Curriculum for Native American Parents: The FRESH Study

Alyson Haslam, PhD¹, Charlotte Love, MPH², Tori Taniguchi, MPH², Mary B. Williams, PhD³, Marianna S. Wetherill, PhD³, Susan Sisson, PhD³, Ashley E. Weedn, MD³, Tvli Jacob, PhD², Valarie Blue Bird Jernigan, DrPH²

¹University of California, San Francisco, San Francisco, CA, USA

²Oklahoma State University, Tulsa, OK, USA

³The University of Oklahoma—Tulsa, Tulsa, OK, USA

Abstract

The Food Resource Equity and Sustainability for Health (“FRESH”) study is an Indigenous-led intervention to increase vegetable and fruit intake among Native American children. As part of this study, we developed a hybrid (online and in-person) food sovereignty and nutrition education curriculum for the parents of these children. This 16-week curriculum was developed to promote household- and community-level healthy eating and food sovereignty practices to parents of preschool-aged children residing in Osage Nation, Oklahoma. A total of 81 parent/caregivers participated in the curriculum component of the FRESH study, with a median age of 34 years (range: 23–54 years). Most study participants were female (88.9%) and less than half (45.7%) had an annual household income of more than US\$50,000. Most were married or had a significant other (76.5%) and worked full-time (65.4%). The median total number of children in the home <18 years of age was three (range: 1–8). Participation among the 94 parents was 56% during the first week and was 12% in the final week. Having some college or technical training (vs. having a college degree) and having an annual household income of US\$20,000–US\$50,000 (vs. more than US\$50,000) were associated with fewer sessions attended ($p = 0.004$ and 0.02 , respectively). Being married (vs. not) was associated with higher attendance ($p < .0001$). Participation in a hybrid food sovereignty and nutrition education curriculum for parents was generally low, but

Corresponding Author: Alyson Haslam, Department of Epidemiology & Biostatistics, University of California, San Francisco, 550 16th St, 2nd Fl, San Francisco, CA 94158, USA. alyson.haslam@ucsf.edu.

Author Contributions

V.B.B.J. conceptualized and supervised the FRESH study and assisted with the drafting of the manuscript. A.H. drafted the manuscript and performed the data analysis. C.L. oversaw the FRESH study as project coordinator and contributed to writing all sections of the manuscript. T.T. collected data and assisted with writing. T.J. oversaw the video components and assisted with writing. M.S.W. oversaw the final editing of the video scripts used in the online parent curriculum and assisted with writing. All other authors reviewed and assisted with the drafting of the manuscript.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Standards

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving research study participants were approved by the Institutional Review Board at the University of Oklahoma Health Sciences Center, which acted as the IRB of record on behalf of Osage Nation. Written informed consent was obtained from all subjects.

income, education, and marital status were associated with curriculum participation. Our research adds to the literature by describing the development and implementation of this curriculum and recommendations for future research incorporating Indigenous approaches to health.

Keywords

American Indian; native American; hybrid curriculum; nutrition education; food sovereignty; community-based participatory research; multi-sector intervention

Introduction

Obesity is common among Native Americans (NAs) (Subica et al., 2017) and is a major contributor to health inequities across the lifespan of NA populations (Bauer & Plescia, 2014; Espey et al., 2014). Among preschool-aged children, NA children have the highest obesity prevalence of any race, with 21% being obese (Anderson & Whitaker, 2009; Bullock et al., 2017). Although studies indicate a stabilization of obesity rates in national samples of all school-aged children in recent years (Hales et al., 2018), obesity rates in preschool-aged children are increasing, and NA youth continue to have the highest prevalence of obesity, which lends to early onset of diabetes and cardiometabolic disease (Drukteinis et al., 2007; Lindberg et al., 2012; Ogden et al., 2016; Wheelock et al., 2016). Furthermore, NAs who reside in rural areas may have less access to healthy food and physical activity options, compared with those residing in more urban areas (Brown et al., 2018).

Early childhood is a critical window for establishing health behaviors (Birch & Fisher, 1998). Among NA preschool-aged children, previous studies utilizing health curriculums implemented in early care and education programs (Cruz et al., 2016; Mattingly & Andresen, 2016) and home health programs have shown improved fruit and vegetable intake, physical activity, and possibly weight status (Harvey-Berino & Rourke, 2003 ; Tomayko et al., 2017). However, prevention efforts focused solely on children in early care and education settings lack parental involvement that may limit the beneficial effect of the intervention, and attrition due to scheduling conflicts have been reported in studies focused on education programs delivered exclusively at home (S. B. Sisson et al., 2016; Ward et al., 2017). No studies have examined hybrid curriculums (combination of online and in-person) for parents of preschool-aged children to help support parents in promoting and role-modeling healthy nutrition behaviors, and, therefore, the feasibility of implementing these types of programs in the family setting is virtually unknown.

Prior research has found that online education programs can be effectively administered in the general population (Holt et al., 2019). More specifically, data show that online and technology-based interventions may lead to positive health outcomes in Indigenous communities (Stotz et al., 2021). For example, an intervention that included website interaction led to increased amounts of self-reported physical activity (Albright et al., 2014). Another study found that with the implementation of a nutritional website intervention, NA participants were more likely to search for healthier recipes and have higher intakes of fruits and vegetables (Buller et al., 2008). Our own study that assessed the efficacy of a web-based intervention to support diabetes self-management behaviors found that Native participants

saw improvements in A1c, patient activation, and self-efficacy compared with usual care controls. Native participants also demonstrated improvements in health distress and activity limitations compared with usual care controls subjects (Jernigan & Lorig, 2011; Lorig et al., 2010).

The Food Resource Equity and Sustainability for Health (FRESH) study is a community-based participatory research (CBPR) study guided by an Indigenous food sovereignty orientation, defined as the right and responsibility of Indigenous peoples to healthy and culturally appropriate foods produced through traditional and sustainable practices (Coté, 2016). Indigenous food sovereignty emphasizes the relationship Native peoples have with their food systems and their responsibility to care for those food systems. Food sovereignty is similar to public health interventions that aim to address diet-related health disparities by intervening broadly at the level of the food system with such strategies as increasing access to healthy foods and connecting communities with their local food producers (Mary Story et al., 2009). The primary outcome of the FRESH study was an increase in vegetable and fruit intake among NA children. As part of the FRESH study, and building upon previous online studies, we developed and implemented a hybrid curriculum on nutrition, healthy lifestyles, and healthy parenting practices to parents and caregivers (referred to as parents throughout) to NA families participating FRESH. Here, we report the development and implementation of this hybrid food sovereignty and nutrition education curriculum in two rural communities within the Osage Nation. We also examine predictors of both online and in-person participation in the curriculum.

Method

Recruitment

Osage Nation has nine tribally affiliated early care and education centers in the communities of Pawhuska, Skiatook, Fairfax, and Hominy, which were the main settings for the FRESH study. Various recruitment strategies were implemented to maximize study recruitment at each school. Study staff set up booths in the school lobbies during parent orientation and back-to-school nights. Booths were also set up during drop-off and pick-up times to share information about the FRESH study and invite parents to enroll. Study staff contacted remaining potentially eligible adults via telephone to inform them about the study and invite them to participate. Promotional study materials, such as a letter signed by the Principal Chief of Osage Nation, were distributed in children's backpacks and parent mailings, as well as posted on bulletin boards at the schools. Parents that were eligible and interested in participating in the study were scheduled for an enrollment appointment.

Study Participants

Adult participants in the intervention group of the FRESH study were eligible to participate in the hybrid food sovereignty and nutrition education curriculum component during the spring of 2018. Inclusion criteria for the FRESH study include: (a) have at least one child between 3 and 7 years old enrolled in one of three tribally affiliated early care and education centers; (b) reside within the boundaries of Osage Nation in Oklahoma; and (c) plan to reside within the boundaries of Osage Nation for at least nine months. Tribally affiliated

early care and education centers enrolled NA children, so all families had at least one member who were NA.

Study Design

This cross-sectional analysis of participation in the intervention arm of a hybrid food sovereignty and nutrition education curriculum for parents (FRESH parent curriculum) was conducted as part of the larger FRESH study, a CBPR partnership between Oklahoma State University (study PI and staff were at the University of Oklahoma at the time the study was being implemented) and the Osage Nation in northeastern Oklahoma. (S. B. Sisson et al., 2019) The FRESH study was a randomized, multilevel, multicomponent food sovereignty intervention set in tribally affiliated early care and education centers (NCT03251950). Osage families and leadership identified and prioritized food sovereignty efforts to address poor diet and health outcomes broadly among NA adults and children and had already established a local farm for growing fruits and vegetables for tribal members.

Every aspect of the FRESH study was led by an Executive Committee that comprised the Assistant Chief of the Osage Nation, the principals and directors from all participating school programs, elders from the tribe, and other key stakeholders identified by the Assistant Chief as well as the research team from the university. The Executive Committee began meeting before the grant had been funded and met approximately quarterly in-person in Osage Nation and more frequently via phone conferencing as needed throughout the duration of the 5-year study. The Osage Nation's commitment to excellence and strong beliefs that this was valuable work to bring to their community was integral to the successful development and implementation of the study.

Early care and education centers in two of the four Osage Nation communities (Pawhuska, Skiatook, Fairfax, and Hominy) were randomly assigned to receive the intervention in the spring of 2018. The FRESH intervention consisted of a 16-week classroom-based curriculum for children and a separate, accompanying, self-guided curriculum for parents of children enrolled in the early childhood education programs (S. B. Sisson et al., 2019, 2020; Sleet et al., 2020). Control arm participants received the program at a later date. The FRESH study was reviewed and approved by the Institutional Review Board (IRB) at the University of Oklahoma Health Sciences Center, which acted as the IRB of record on behalf of Osage Nation. All parents provided written informed consent for themselves and their children.

All intervention participants who provided an email address at enrollment ($n = 89$) were sent an email invitation to join the online curriculum. In the body of the invitation email, participants were told that they could have a paper copy of the curriculum mailed to their home address if they preferred (e.g., if they did not have access to the internet). Intervention participants who did not provide an email address at enrollment received hard copies of the curriculum in the mail each week. For analyses, we used a parent representative from each household ($n = 94$), comprising 88% of the total adult intervention sample, to limit bias from household clusters.

This study uses a multilevel ecological framework, including individual, environmental, social, and physical domains, to depict the food system and the multiple influences on dietary intake (M. Story et al., 2008). We hypothesized that the FRESH curriculum intervention would improve diet and health outcomes through a pathway partially mediated by self-efficacy, patient activation, food security, community efficacy, and cultural connection.

Curriculum Adaptation

Research staff worked with tribal leaders to review, revise, and finalize the content of the curriculum over several months of in-person meetings and roundtable discussions. Tribal leaders wanted to ensure the curriculum would be culturally relevant, include instruction on food sovereignty, promote overall healthy lifestyles, and include low-cost and budget-friendly nutrition resources. In addition, research staff determined that the majority of the curriculum would be presented online, with 4 monthly in-person meetings over the course of the intervention to reduce the burden of regular, in-person meetings for participants.

The FRESH parent curriculum was adapted from three sources: (a) Choose Health LA's Healthy Parenting Workshops; Los Angeles County Department of Public Health (2015) (b) First Nations Development Institute's Food Sovereignty Assessment Tool; (Institute of First Nations Development, 2014) and (c) Grassroots International's (2008) Food for Thought and Action curriculum. The food sovereignty tools developed by the First Nations Development Institute and Grassroots International provided a foundation for the food sovereignty education components of the curriculum.

The parenting curriculum from Choose Health LA provided a foundation for nutrition education as well as healthy lifestyle and parenting components of the curriculum. Details of the FRESH parent curriculum are described below, but in brief, we adapted the Choose Health LA curriculum by creating shorter, but more frequent lessons that could be accessed online by participants. The original Choose Health LA curriculum consisted of six 90-min lessons that were designed to be delivered weekly via in-person, facilitator-led workshops. Each of the original workshops covered two topics: nutrition/healthy lifestyle education and healthy parenting practices. The adapted parent curriculum used for the FRESH study covered one lesson each week for 12 weeks, delivered online, and included four in-person meetings to discuss food sovereignty.

The FRESH parent curriculum (Table 1) was divided into 12 lessons to provide one of three general topics each session: (a) nutrition education; (b) healthy lifestyle education; or (c) healthy parenting practices. Since the original Choose Health LA curriculum was designed to be delivered in the form of facilitator-led workshops, the content was completely reformatted to be a self-guided curriculum delivered in an online format. The content was then reviewed, revised, and reformatted by study staff and registered dietitians (RDs), according to current trends in nutrition-related, evidence-based recommendations. Selected handouts to accompany the nutrition and healthy lifestyle lessons were obtained from [ChooseMyPlate.org](https://www.choosemyplate.org).

The revised lessons were designed to be completed in 20 min or less. Each lesson consisted of an introduction to the topic, a video representation of the lesson, the written text of the lesson, a weekly review, a weekly goal, and printable handouts to accompany the lesson. At the end of each lesson, there was a weekly review, which asked participants to look at a set of statements pertaining to the topic they just learned and determine which were true. Scores were not tracked for these reviews, as they were just an additional method of presenting the material and all answer choices were correct for each lesson. Each lesson also contained a weekly goal planning and reflection component. The goal planning component allowed participants to set one or more personal goals and provided participants the opportunity to practice the skills that were taught in each lesson. The goal reflection component asked participants if they achieved their previously set goals and contained space for the participant to reflect on why they did or did not achieve the goal. Finally, the printable handouts included all pertinent information presented in the lesson, as well as a printable version of the weekly goals sheet to remind participants of their goals.

For the in-person component of FRESH, portions of the food sovereignty material were presented at each of four in-person meetings, breaking the material into smaller segments to make it more manageable. The definition of Indigenous food sovereignty as described by Coté (2016) was chosen because of its emphasis on the relational aspects between traditional Indigenous food systems and the Indigenous peoples responsible for caring for these food systems. Osage participants used the general definition as a starting point to discuss the specific ways in which Indigenous food sovereignty would be actualized within their communities, and the in-person meetings focused primarily on restoring and/or strengthening those Osage-specific food gathering, hunting, and preparing practices.

Video Component

The revised lessons were presented as video presentations in addition to written text, which allowed for a demonstration of the group activities that were included in the original curriculum. In developing the video component of the online curriculum, the written text of each lesson was converted to script format by the research video coordinator using Final Draft 10 software. Once the initial scripts were developed, they were reviewed by RDs to ensure the terms, language, and information contained in the scripts were accurate. After the scripts were finalized, the videos were filmed using both university and tribal staff, and each finalized video was added to the corresponding online lesson.

Online Learning Platform

For the online presentation of the curriculum, multiple online learning platforms were compared to find one that best fit the needs of the study. The requirements for the online learning platform were as follows: (a) no cost to study participants; (b) user friendly/uncomplicated; (c) allowed for bulk user enrollment; (d) quiz/poll capabilities; (e) video content capabilities; (f) mobile friendly; (g) allowed user tracking; and (h) a customizable web address was preferred, but not required. Ultimately, Teachable©, (teach:able) an online teaching platform, met all of these requirements and was selected as the platform for presenting the online content.

The website platform was edited by removing automatic scoring from quizzes, tailoring the presentation of certain pages, modifying email templates, and adding the FRESH study logo to the header. The content of the lessons was uploaded to the website. Once all of the content was added, each page of every lesson was reviewed by research staff before to ensure all information was displaying correctly. After the content was reviewed, the online curriculum was then available to intervention parents. A new lesson was made available to participants on a weekly basis throughout the duration of the FRESH intervention, except for when there was an in-person session. Participants were sent a weekly email to notify them of the new lesson. Online participation was tracked using completion records for each participant on the Teachable© website.

In-Person Meetings

In addition to the online content, participants were asked to attend four monthly in-person meetings throughout the intervention period. Flyers for the in-person meetings were emailed to all intervention parents with a valid email address, added to the weekly mailed packet for intervention parents without an email address, and printed and delivered to the early care and education centers for distribution/display. These in-person meetings provided an opportunity for participants to learn about food sovereignty, discuss food sovereignty activities in their communities, eat an Indigenous meal prepared using locally grown and sourced ingredients, as well as provide feedback and ask questions pertaining to the online content. The food sovereignty meetings were led by research staff and encouraged active participation from attendees. Sign-in sheets were used to track participation in in-person meetings. Parents who participated in the meetings received recipes, food, and kitchen equipment so that they could prepare intervention-specific recipes for their families at home. The kitchen equipment that the participants received included: a blender, knife and cutting board, mixing bowls, skillet, saucepan and steamer, measuring cups, measuring spoons, and a cookie sheet. Based upon the decision by schoolteachers, leaders, and parents, in-person meetings were to be held in the evenings at one of the local early care and education centers, and child care was provided so the whole family could attend.

Variables

We assessed sociodemographic variables from the baseline survey that was administered to all adult participants during the fall of 2017. Age, the number of children in the home under the age of 18 years, and the number of educational sessions attended were all evaluated as continuous variables. Income was categorized as <US\$20,000, US\$20,000–US\$50,000, or >US\$50,000. Education was categorized as less than high school/high school degree/GED, some college or technical school, or college degree or higher. Marital status was categorized as married/having a partner or significant other or not married/having a partner or significant other (widowed and not remarried, divorced and not re-married, separated, or never married). Employment was categorized as either working outside of the home full-time or other (part-time, seasonal, retired, student, homemaker/caregiver) or not employed. Race was categorized as NA/Alaska Native or other race. The parent role was categorized as parent, stepparent, grandparent, or other.

Statistical Analysis

Descriptive data were calculated for weekly lesson engagement, including weekly goals entered, weekly reflections completed, and weekly videos watched (some or all). We also calculated descriptive statistics for all parents with complete demographic data, which included medians and ranges for continuous variables, since most outcomes were not normally distributed, and numbers and percentages for categorical variables. Poisson regression was used to assess predictor variables for number of sessions completed, including total sessions and in-person only (models run separately). For a sensitivity analysis, we also ran these models with only the participants who completed at least one educational session. All data were recorded in Microsoft Excel 2016 and analyzed using R statistical software, version 3.6.1.

Results

There were 94 participants that enrolled in the FRESH parent curriculum, and 81 had complete demographic information (12 were missing age and one was missing the total number of children under 18 years). Eighty-nine (95%) of the 94 parent participants provided email addresses. Eighty-three (88.3%) were parents of the children included in the study, as opposed to stepparent, grandparent, or other. For those with complete demographic information, the median age was 34 years (range: 23–54 years; Table 2), and the median total number of children in the home < 18 years of age was three (range: 1–8). Most participants were female (88.9%; $n = 72$), 39.5% ($n = 32$) had a high school diploma or GED, 34.6% ($n = 28$) had a college degree or higher, and less than half (45.7%; $n = 37$) had an annual household income of more than US\$50,000. Most were married/had a significant other or partner (76.5%; $n = 62$), most worked full-time (65.4%; $n = 53$), and the majority identified as NA/Alaska Native (67.9%; $n = 55$).

Figure 1 shows the percent of participants who engaged in the weekly online lessons, completed a weekly reflection, entered a weekly goal, and watched at least some portion of the online video. The first week had the highest participation rate, with 56% ($n = 54$) of participants engaging in the online lesson, while the final week of online lessons had the lowest participation rate, with 12% ($n = 11$) of participants completing the lesson. Forty-nine percent ($n = 46$) of participants watched some or all of the video in the first lesson, and 8% ($n = 7$) watched some or all of the video in the final lesson. Figure 2 shows the percent attendance for both in-person and online sessions, which also declined throughout the intervention period.

Having some college or technical school or having an annual household income US\$20,000–US\$50,000 was associated with participating in fewer number of *total* sessions (online and in-person; $p = .01$ and 0.02 , respectively), while being married/having a significant other was associated with participating in a higher number of *total* sessions ($p < .0001$). Similarly, having some college or technical school or having an annual household income US\$20,000–US\$50,000 was associated with participating in fewer number of *online* sessions ($p = .004$ and 0.02 , respectively; Table 3), while being married/having a significant other or partner was associated with participating in a higher number of *online* sessions ($p < .0001$). No factors were statistically associated with number of *in-person* sessions. In looking at only

those who engaged in any session (online or in-person), the patterns of association were similar to those in the total analytic sample (data not shown).

Discussion

To our knowledge, this is the first research study examining the implementation of a hybrid online and in-person food sovereignty and nutrition education curriculum for parents in a rural, NA community. Overall participation in the hybrid curriculum was modest, with rates being higher in the beginning and steadily declining as the intervention continued. We tried to minimize the information presented each week to keep time commitment manageable, but the busy schedules of families with young children who have many competing commitments may have made it difficult for parents to regularly engage in the online sessions. The lower than expected rates of engagement in the adult portion of the FRESH intervention may be an indicator that nutrition education programs in NA populations require special considerations to achieve higher participation, such as opportunities to connect with other NAs and program material that is culturally tailored (Nicholson et al., 2015).

Low participation in the intervention can be problematic because it can minimize the treatment effect with regard to major outcomes. However, adherence to the intervention is generally low in randomized controlled trials that include a lifestyle prescription intervention (Burgess et al., 2017; Haynes et al., 2002), and therefore it is important to identify factors that may influence participation rates in our study population. We found that education (having some college or technical training) and having an annual household income of US\$20,000–US\$50,000 were associated with engaging in fewer sessions of the online curriculum and that being married/having a significant other or partner was associated with engaging in more online sessions. These factors have been examined in context of adherence to lifestyle interventions in adults with obesity and found that while lower education was generally associated with lower adherence, being married was either not associated with or was associated with lower adherence (Burgess et al., 2017).

The finding that being married/having a significant other or partner was associated with higher completion of educational sessions indicates that social support may be an important factor in participating in educational programs. Married people report higher social support than non-married people (Soulsby & Bennett, 2015; Thoits, 1995), but studies on cardiovascular lifestyle interventions have shown differing health effects between being married and measurements of social support (Aggarwal et al., 2010), suggesting that social support is a broader social construct than whether a person is married or not, particularly in NA populations, where cultural values and community cooperation are components of social support (Conte et al., 2015; Sherman et al., 2011). We did not collect measures of social support in our study. Consequently, marriage may be an imprecise proxy for social support for program participation in our study population.

Other factors, such as number of children under 18 years in the household and working full-time, were not statistically associated with the number of sessions in which the parents engaged. Although busy parents may have limited free time to engage in the educational sessions of this intervention, the lack of association suggests that busyness from common

daily activities was not the reason for engaging in sessions. Indeed, prior research has suggested that busyness in work and family life may be underestimated in scientific studies, thus making “busyness” difficult to quantify (Vercruyssen et al., 2014).

A concern that weekly in-person meetings could become overly burdensome was expressed in the study planning, and therefore most of the curriculum was presented in an online format. However, we found that adherence to in-person meetings was twice as high compared with the online content. The reason for this may be that although the in-person meetings involved extra time and commitment, these meetings allowed for participants to share their thoughts and feelings and receive feedback and motivation from other participants, thus being motivation for better attendance. Or, perhaps this may be an indicator that the participants preferred fewer but longer education sessions. Parents may also have been more inclined to attend the in-person meetings because a meal was provided free of charge for the whole family, child care was provided, and parents received cooking equipment as an incentive to attend. There were no incentives for completing the online portion of the curriculum. Based on conversations with parents, we do believe that the online format offered parents the flexibility of participating in the educational curriculum at their convenience. One parent commented, “I really enjoy completing the [FRESH] lessons online because with our busy schedule and my son's baseball, it is convenient for me.”

One question regarding declining participation rates is whether it is better to administer the curriculum as-is in light of declining participation rates or to make adjustments in an attempt to increase participation. To reduce burden upon the participants, we did not query feedback until the end of the 16-week curriculum, which meant that we were not able to make adjustments to our curriculum during the intervention. Knowing participation rates for the existing curriculum, a direction for future research would be to implement changes based on the feedback. Comparing participation rates once changes are made with participation rates with the existing curriculum would help researchers better determine whether it is the curriculum itself or other factors that are determining participation.

Limitations

A key limitation is that we were not able to assess and receive feedback on the participants' feelings about the format and length of the curriculum, thus we do not know specific reasons for non-adherence. In addition, sending lessons in the mail to participants without an email address also proved to be a limitation. Participation could not be tracked for these individuals because no data could be collected in regard to curriculum completion. However, these individuals comprised a small proportion of the total intervention sample ($n = 5$). In addition, because our study focused on a single tribal nation, the results may lack generalizability to other Indigenous communities. Finally, there may be other factors associated with adherence that we did not consider, and therefore, did not capture in our analysis.

Conclusion

We found that engagement in a hybrid food sovereignty and nutrition curriculum was lower than expected but was comparable to adherence rates reported in prior research

on health behavioral interventions in adults. We found that low-income, lower education, and being unmarried/not having a significant other or partner were associated with low adherence to the FRESH parent curriculum. Identifying barriers to adherence in health promotion programs can help researchers and educators to better plan and develop nutrition educational programs for NA adults with a variety of social and demographic backgrounds in future studies. In the future, greater research is needed to examine the efficacy of interventions guided by Indigenous models of health and wellness, such as the concept of food sovereignty. This component of the FRESH study was positively received and highly attended. This study adds to the limited information available with regards to hybrid curricula as well as interventions based upon Indigenous models of health (Walters et al., 2020).

Acknowledgments

The authors thank the Osage Nation for partnering with us on this study. In particular, we would like to thank the tribal leaders who assisted with the planning and development of the study, the Early Childhood Education Center site managers and staff who assisted with the implementation of the study, and the staff at Bird Creek Farm for assisting with the preparation and delivery of study materials.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: This study was funded by the National Institute on Minority Health and Health Disparities (R01MD011266).

References

- Aggarwal B, Liao M, Allegrante JP, & Mosca L (2010). Low social support level is associated with non-adherence to diet at 1 year in the Family Intervention Trial for Heart Health (FIT Heart). *Journal of Nutrition Education and Behavior*, 42(6), 380–388. [PubMed: 20696617]
- Albright CL, Steffen AD, Wilkens LR, White KK, Novotny R, Nigg CR, ... Brown WJ (2014). Effectiveness of a 12-month randomized clinical trial to increase physical activity in multiethnic postpartum women: Results from Hawaii's N Mikimiki Project. *Preventive Medicine*, 69, 214–223. 10.1016/j.ypmed.2014.09.019 [PubMed: 25285751]
- Anderson SE, & Whitaker RC (2009). Prevalence of obesity among U.S. preschool children in different racial and ethnic groups. *Archives of Pediatrics & Adolescent Medicine*, 163(4), 344–348. 10.1001/archpediatrics.2009.18 [PubMed: 19349563]
- Bauer UE, & Plescia M (2014). Addressing disparities in the health of American Indian and Alaska native people: The importance of improved public health data. *American Journal of Public Health*, 104(Suppl. 3), S255–S257. 10.2105/AJPH.2013.301602 [PubMed: 24754654]
- Birch LL, & Fisher JO (1998). Development of eating behaviors among children and adolescents. *Pediatrics*, 101(3 Pt. 2), 539–549. [PubMed: 12224660]
- Brown B, Harris KJ, Heil D, Tryon M, Cooksley A, Semmens E, Davis J, & Gandhi K (2018). Feasibility and outcomes of an out-of-school and home-based obesity prevention pilot study for rural children on an American Indian reservation. *Pilot and Feasibility Studies*, 4, Article 129. 10.1186/s40814-018-0322-4 [PubMed: 30065847]
- Buller DB, Woodall WG, Zimmerman DE, Slater MD, Heimendinger J, Waters E, Hines JM, Starling R, Hau B, Burreis-Woodall P, Davis GS, Saba L, & Cutter GR (2008). Randomized trial on the 5 a day, the Rio Grande Way Website, a web-based program to improve fruit and vegetable consumption in rural communities. *Journal of Health Communication*, 13(3), 230–249. 10.1080/10810730801985285 [PubMed: 18569356]
- Bullock A, Sheff K, Moore K, & Manson S (2017). Obesity and overweight in American Indian and Alaska native children, 2006–2015. *American Journal of Public Health*, 107(9), 1502–1507. 10.2105/ajph.2017.303904 [PubMed: 28727519]

- Burgess E, Hassmén P, & Pumpa KL (2017). Determinants of adherence to lifestyle intervention in adults with obesity: A systematic review. *Clinical Obesity*, 7(3), 123–135. [PubMed: 28296261]
- Conte KP, Schure MB, & Goins RT (2015). Correlates of social support in older American Indians: The Native Elder Care Study. *Aging & Mental Health*, 19(9), 835–843. 10.1080/13607863.2014.967171 [PubMed: 25322933]
- Coté C (2016). “Indigenizing” food sovereignty: Revitalizing Indigenous food practices and ecological knowledges in Canada and the United States. *Humanities*, 5(3), Article 57.
- Cruz TH, Davis SM, Myers OB, O’Donald ER, Sanders SG, & Sheche JN (2016). Effects of an obesity prevention intervention on physical activity among preschool children: The CHILE study. *Health Promotion Practice*, 17(5), 693–701. 10.1177/1524839916629974 [PubMed: 27091603]
- Drukteinis JS, Roman MJ, Fabsitz RR, Lee ET, Best LG, Russell M, & Devereux RB (2007). Cardiac and systemic hemodynamic characteristics of hypertension and prehypertension in adolescents and young adults: The Strong Heart Study. *Circulation*, 115(2), 221–227. 10.1161/circulationaha.106.668921 [PubMed: 17210838]
- Espey DK, Jim MA, Cobb N, Bartholomew M, Becker T, Haverkamp D, & Plescia M (2014). Leading causes of death and all-cause mortality in American Indians and Alaska Natives. *American Journal of Public Health*, 104(Suppl. 3), S303–S311. 10.2105/AJPH.2013.301798 [PubMed: 24754554]
- Grassroots International. (2008). Food for thought and action. <https://grassrootsonline.org/what-we-do/publications-and-resources/educational-resources/food-thought-action/>
- Hales CM, Fryar CD, Carroll MD, Freedman DS, & Ogden CL (2018). Trends in obesity and severe obesity prevalence in U.S. youth and adults by sex and age, 2007–2008 to 2015–2016. *Journal of American Medical Association*, 319(16), 1723–1725. 10.1001/jama.2018.3060
- Harvey-Berino J, & Rourke J (2003). Obesity prevention in preschool native-American children: A pilot study using home visiting. *Obesity Research*, 11(5), 606–611. 10.1038/oby.2003.87 [PubMed: 12740449]
- Haynes RB, McDonald HP, & Garg AX (2002). Helping patients follow prescribed treatment clinical applications. *Journal of American Medical Association*, 288(22), 2880–2883. 10.1001/jama.288.22.2880
- Holt CL, Tagai EK, Santos SLZ, Scheirer MA, Bowie J, Haider M, & Slade J (2019). Web-based versus in-person methods for training lay community health advisors to implement health promotion workshops: Participant outcomes from a cluster-randomized trial. *Transl Behav Med*, 9(4), 573–582. 10.1093/tbm/iby065 [PubMed: 29955889]
- Institute of First Nations Development. (2014). *Food Sovereignty Assessment Tool* (2nd ed.).
- Jernigan VB, & Lorig K (2011). The internet diabetes self-management workshop for American Indians and Alaska natives. *Health Promotion Practice*, 12(2), 261–270. 10.1177/1524839909335178 [PubMed: 20534807]
- Lindberg SM, Adams AK, & Prince RJ (2012). Early predictors of obesity and cardiovascular risk among American Indian children. *Maternal and Child Health Journal*, 16(9), 1879–1886. 10.1007/s10995-012-1024-9 [PubMed: 22527771]
- Lorig K, Ritter PL, Laurent DD, Plant K, Green M, Jernigan VB, & Case S (2010). Online diabetes self-management program: A randomized study. *Diabetes Care*, 33(6), 1275–1281. 10.2337/dc09-2153 [PubMed: 20299481]
- Los Angeles County Department of Public Health. (2015). Healthy parenting workshops. <http://www.choosehealthla.com/wp-content/uploads/2016/09/PDF-6-Healthy-Parenting-Workshops-2nd-Edition-English-Toolkit.pdf>
- Mattingly JA, & Andresen PA (2016). NAP SACC: Implementation of an obesity prevention intervention in an American Indian head start program. *Journal of Community Health Nursing*, 33(3), 145–153. 10.1080/07370016.2016.1191871 [PubMed: 27383778]
- Nicholson LM, Schwirian PM, & Groner JA (2015). Recruitment and retention strategies in clinical studies with low-income and minority populations: Progress from 2004–2014. *Contemporary Clinical Trials*, 45, 34–40. [PubMed: 26188163]
- Ogden CL, Carroll MD, Lawman HG, Fryar CD, Kruszon-Moran D, Kit BK, & Flegal KM (2016). Trends in obesity prevalence among children and adolescents in the United States, 1988–1994

through 2013–2014. *Journal of American Medical Association*, 315(21), 2292–2299. 10.1001/jama.2016.6361

- Sherman AM, Skrzypek A, Bell R, Tatum C, & Paskett ED (2011). The contribution of social support and social strain to depressive symptoms in African American, native American, and European American women. *Journal of Social and Personal Relationships*, 28(8), 1104–1129.
- Sisson SB, Krampe M, Anundson K, & Castle S (2016). Obesity prevention and obesogenic behavior interventions in child care: A systematic review. *Preventive Medicine*, 87, 57–69. 10.1016/j.ypmed.2016.02.016 [PubMed: 26876631]
- Sisson SB, Sleet K, & Rickman R (2020). Impact of the 2017 Child and Adult Care Food Program Meal Pattern Requirement Change on Menu Quality in Tribal Early Care Environments: The Food Resource Equity and Sustainability for Health Study. 4(Suppl 1), 12–22. Cdn. /nzz094. <https://doi.org/10.1093/>
- Sisson SB, Sleet K, Rickman R, Love C, Williams M, & Jernigan VBB (2019). The development of child and adult care food program best-practice menu and training for Native American head start programs: The FRESH study. *Preventive Medicine Reports*, 14, Article 100880. [PubMed: 31080707]
- Sleet K, Sisson SB, Dev DA, Love C, & Williams MB (2020). The impact of responsive feeding practice training on teacher feeding behaviors in tribal early care and education: The Food Resource Equity and Sustainability for Health (FRESH) Study. *Current Developments in Nutrition*, 4 (Suppl. 1), 23–32. 10.1093/cdn/nzz105 [PubMed: 32258996]
- Soulsby LK, & Bennett KM (2015). Marriage and psychological wellbeing: The role of social support. *Psychology*, 6(11), 1349–1359.
- Story M, Hamm MW, & Wallinga D (2009). Food systems and public health: Linkages to achieve healthier diets and healthier communities. *Journal of Hunger & Environmental Nutrition*, 4(3–4), 219–224. 10.1080/19320240903351463 [PubMed: 23144670]
- Story M, Kaphingst KM, Robinson-O'Brien R, & Glanz K (2008). Creating healthy food and eating environments: Policy and environmental approaches. *Annual Review of Public Health*, 29, 253–272. 10.1146/annurev.publ-health.29.020907.090926
- Stotz S, Hebert LE, Brega AG, Lockhart S, Henderson JN, Roubideaux Y, DeSanta K, & Moore KR (2021). Technology-based Health Education Resources for Indigenous adults: A scoping review. *Journal of Health Care for the Poor and Underserved*, 32(2), 318–346. [PubMed: 36111137]
- Subica AM, Agarwal N, Sullivan JG, & Link BG (2017). Obesity and associated health disparities among understudied multiracial, Pacific Islander, and American Indian adults. *Obesity*, 25(12), 2128–2136. [PubMed: 29071803]
- Thoits PA (1995). Stress, coping, and social support processes: Where are we? What next? *Journal of Health and Social Behavior*, 1995, 53–79.
- Tomayko EJ, Prince RJ, Cronin KA, & Adams AK (2017). The healthy children, strong families intervention promotes improvements in nutrition, activity, and body weight in American Indian families with young children: ERRATUM. *Public Health Nutrition*, 20(2), Article 380. 10.1017/s1368980016002068 [PubMed: 27460873]
- Vercruyssen A, Roose H, Carton A, & Putte BVD (2014). The effect of busyness on survey participation: Being too busy or feeling too busy to cooperate? *International Journal of Social Research Methodology*, 17(4), 357–371.
- Walters KL, Johnson-Jennings M, Stroud S, Rasmus S, Charles B, John S, Allen J, Kaholokula JK, Look MA, de Silva M, Lowe J, Baldwin JA, Lawrence G, Brooks J, Noonan CW, Belcourt A, Quintana E, Semmens EO, & de Silva M (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(1), 54–64. [PubMed: 30397737]
- Ward DS, Welker E, Choate A, Henderson KE, Lott M, Tovar A, Wilson A, & Sallis JF (2017). Strength of obesity prevention interventions in early care and education settings: A systematic review. *Preventive Medicine*, 95(Suppl.), S37–S52. 10.1016/j.ypmed.2016.09.033 [PubMed: 27693295]

Wheelock KM, Sinha M, Knowler WC, Nelson RG, Fufaa GD, & Hanson RL (2016). Metabolic risk factors and type 2 diabetes incidence in American Indian children. *Journal of Clinical Endocrinology and Metabolism*, 101(4), 1437–1444. 10.1210/jc.2015-4309 [PubMed: 26913636]

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

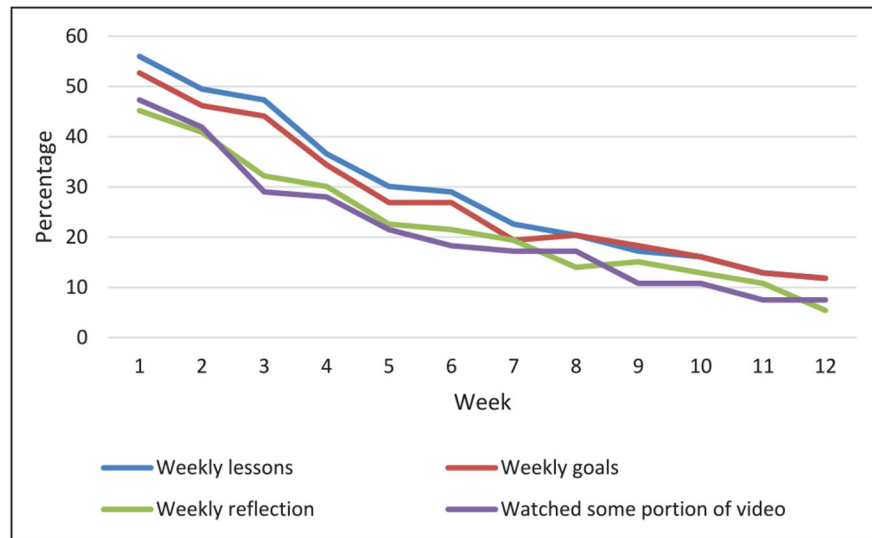


Figure 1. Percentage of FRESH study participants who completed items in the parent curriculum.

Note. FRESH = Food Resource Equity and Sustainability for Health.

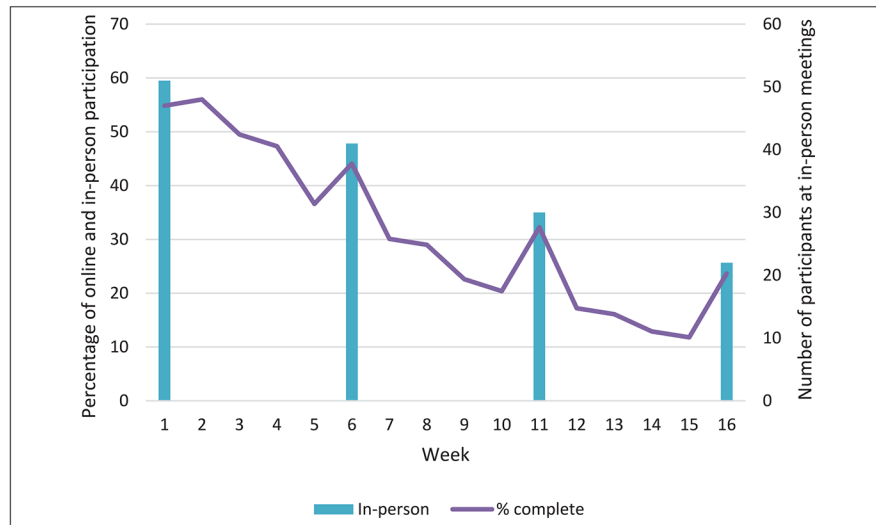


Figure 2. Percentage of FRESH study participants engaging in weekly in-person and online lessons and number of participants at each in-person meeting.
Note. FRESH = Food Resource Equity and Sustainability for Health.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 1.

Lesson Included With the Parent Curriculum in the FRESH Study.

Lesson number and topic	Contents
Online	
Lesson 1: The Power of Praise	How to alter your child's behavior and how to reward good behaviors without using food
Lesson 2: MyPlate and the Five Food Groups	MyPlate, the five food groups, daily intake recommendations, and serving/portion sizes
Lesson 3: Giving Commands	How to implement and enforce family rules more effectively
Lesson 4: Screen Time and Mealtime Behaviors	Screen time and healthy mealtime behaviors
Lesson 5: Setting Routines	The importance of having routines
Lesson 6: Physical Activity	Ways to encourage your child to be physically active
Lesson 7: Reading Nutrition Labels	How to properly read a nutrition label
Lesson 8: Healthy Eating and Shopping	How to overcome barriers to healthy eating in your home
Lesson 9: Enforcing Rules	How to set limits with your child
Lesson 10: Making Healthy Beverage Choices	How to make healthy beverage choices for your family
Lesson 11: Addressing Unwanted Behaviors	How to handle unwanted behaviors from your child
Lesson 12: Healthy Snacks and Celebrations	How to choose healthy foods for snacks and celebrations
In-Person	
Part 1: Introduction to Food Sovereignty	The definition of food sovereignty and the six principles of food sovereignty
Part 2: Value Chain of Food	The value chain of your food, or the journey that a food item takes from the farm to your table
Part 3: Food Sovereignty in Your Community	How each person can improve food sovereignty
Part 4: Food Sovereignty Values	A discussion on important aspects of food sovereignty for each participant and their community

Note. FRESH = Food Resource Equity and Sustainability for Health.

Table 2. Sociodemographic Characteristics and Lesson Component Completion for Adult Participants in the FRESH Study (2018; *N* = 81).

Characteristic	Median	Range
Age (years)	34	23–54
Number of children <18 years of age in the home	3	1–8
Total online and in-person sessions completed (max = 16)	4	0–16
Total in-person sessions attended (max = 4)	2	0–4
Total online sessions attended (max = 12)	3	0–12
Number Percentage		
Female	72	88.9
Role as caregiver		
Parent	83	88.3
Stepparent	1	1.1
Grandparent	8	8.5
Other	2	2.1
Education		
High school degree/GED/or less than high school	32	39.5
Some college/technical	21	25.9
College degree or higher	28	34.6
Income		
<US\$20000	17	21
US\$20000–US\$50000	27	33.3
>US\$50000	37	45.7
Married or had a significant other	62	76.5
Work full-time	53	65.4
American Indian or Alaskan Native	55	67.9

Note. FRESH = Food Resource Equity and Sustainability for Health.

Factors Associated With the Number of Completed Online and In-person Sessions in the FRESH Study (2018), Using Poisson Regression (N = 81).

Table 3.

Factor	Online		In-person		Online and in-person	
	Estimate	p-value	Estimate	p-value	Estimate	p-value
Age	-0.002	0.83	0.005	0.68	0.0004	0.95
Female	-0.10	0.60	-0.33	0.22	-0.17	0.27
Education (reference college degree or higher)						
High school degree/GED/or less than high school	-0.17	0.28	0.11	0.65	-0.08	0.53
Some college/technical	-0.39	0.01	-0.34	0.17	-0.38	0.004
Number of children <18 years of age in the home	-0.003	0.95	-0.05	0.44	-0.02	0.60
Income (reference >US\$50000)						
<US\$20000	-0.40	0.10	-0.23	0.47	-0.34	0.07
US\$20000–US\$50000	-0.34	0.02	-0.14	0.50	-0.28	0.02
Married or had a significant other	1.01	<0.0001	0.36	0.19	0.76	<0.0001
Work full-time	-0.03	0.83	-0.31	0.13	-0.11	0.31
American Indian or Alaskan Native	-0.03	0.82	0.32	0.14	0.08	0.50

Note. Bolded values are significant. FRESH = Food Resource Equity and Sustainability for Health.