



Can Community Gardens with Workshops Increase Gardening Behavior? A Navajo Wellness Collaboration

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Abstract

This paper seeks to evaluate the potential efficacy of a **community gardening** intervention on the **Navajo Nation** to increase gardening and **healthy eating behaviors**, which are potentially important in preventing obesity and related health conditions. Rates of obesity are high among American Indians, including those living on Navajo Nation land. Eating fresh fruits and vegetables is part of healthy eating. However, availability and access to fresh fruits and vegetables are severely limited on the Navajo Nation, due to distance and cost. One way to increase both availability and consumption of fresh fruits and vegetables is through community gardening, yet many on the Navajo Nation have limited knowledge and capacity to garden.

Methods: We used a quasi-experimental pre-post study design to estimate the effect of a community gardening intervention. Primary outcomes of interest were gardening frequency and fruit and vegetable consumption. Community gardens were constructed and planted in two communities on the Navajo Nation. In addition, a series of gardening workshops were held in each community. Community members were recruited to complete surveys at time points before and after the workshops. The time between baseline and follow-up was approximately one year.

Results: We surveyed 169 participants at one time point at least, across both communities, and 25 of these participated in the gardening workshops. Within the 169, there was a cohort of 32 participants completing both baseline and follow-up surveys. For this cohort, interest in gardening increased from 78% to 97% ($p=0.014$), but none of the changes in gardening self-efficacy, knowledge or gardening frequency reached statistical significance. There were no measurable changes in reported fruit and vegetable consumption, self-efficacy or knowledge. Overall, the reported financial barriers to gardening increased from baseline to follow-up from 4.6 to 5.5 ($p=0.035$). Altogether 52 participants completed follow-up. In this group, those who attended at least one workshop gardened more frequently at follow-up than those who did not attend any workshops (21 times per month compared to 10 times per month ($p=0.07$)).

Conclusion: Despite enthusiasm for the community garden in both the communities studied and the increased interest in gardening, workshop attendance and participant retention in the study were low. These factors limited our ability to evaluate the potential efficacy of the intervention on gardening and healthy eating behaviors. Nonetheless, we found some evidence that participating in gardening workshops may lead to increased gardening frequency. Future studies should augment the intervention to include explicit efforts to reduce barriers to long term engagement and extend intervention reach.

Keywords

behavioral change; community gardening; fruit and vegetables; gardening education; healthy eating behaviors; food sovereignty; knowledge; Navajo Nation; self-efficacy; financial barrier

Cover Page Footnote

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INTRODUCTION

Rates of obesity are high among American Indians and Alaska Native (AI/AN) populations, increasing the risk for cardiovascular disease and type 2 diabetes. Fresh fruit and vegetable consumption decreases obesity risk as they are high in nutrients and low in calories (Jernigan, 2010). Yet for American Indians living in remote and rural areas, poor availability and accessibility of fresh fruits and vegetables serve as barriers to healthy eating. Gardening has been recognized by American Indian communities to be one approach to increasing access to fresh fruits and vegetables and can help improve food systems as a way of promoting health and wellness (Grier et al., 2015; Kamphuis et al., 2006; Sinley & Albrecht, 2015). Gardening also enables greater access to fresh produce at a lower cost. It has been found to have additional benefits of reducing stress and promoting physical activity (Soga et al., 2017).

The Navajo Nation is an area of mostly rural tribal land covering 27,000 square miles and home to over 300,000 enrolled tribal members. Previous research in Navajo communities has shown barriers to fresh fruit and vegetable consumption are the high cost, poor quality, and long distances to reach supermarkets where they are sold (Gittelsohn & Rowan, 2011; McGinnis & Foege, 1993). Our own formative research in partnership with Navajo communities identified gardening as a behavior or practice that leads to healthy eating and the maintenance of cultural traditions (Lombard et al., 2014). Researchers and community members have sought to develop and evaluate interventions to promote gardening to improve health (Ornelas et al., 2017; Ornelas et al., 2018). Bauer and colleagues (Bauer, 2017) evaluated the impact of family gardens and

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gardening education in four Navajo chapters (local communities). The intervention showed increases in gardening frequency, as well as increases in knowledge and self-efficacy related to gardening, harvesting and storing fruits and vegetables. Research in other rural American Indian communities have also assessed the feasibility of community gardening and education intervention aimed to increase the consumption of locally grown foods (Brown et al., 2020). These studies have shown increases in readiness to garden and overall mental health.

Gardening interventions also have the potential to help maintain language and cultural traditions, which are important for both a strong ethnic identity and health promotion in racial/ethnic minority populations in the United States (Huff et al., 2015; Schultz et al., 2016). For example, using traditional growing practices and eating traditional foods have been associated with positive cardiovascular health outcomes in American Indian communities (Trude et al., 2015; Walters et al., 2012). American Indian communities have recognized these benefits and tried to promote the availability and consumption of healthy traditional foods. Community garden programs that incorporate indigenous eating practices and local agriculture have been part of the “Feast for the Future” initiative in three indigenous communities: the Santo Domingo Pueblo, the Tuba City community on the Navajo (Diné) Nation, and the White Mountain Apache. The Diné Policy Institute and tribal leadership on the Navajo Nation have described the need to increase access and availability of healthy, traditional foods and encouraged gardening education and outreach (KXAZ News, 2016). The Diné government has also instituted policies to reduce access to unhealthy foods through the Healthy Diné Nation Act of 2014 (Navajo Nation Council, 2014; Diné Policy Institute, 2014).

The early formative work of our team using focus groups of Navajo adults identified barriers to gardening of no space to garden, lack of time, limited access to water and poor soil quality (Lombard et al., 2014). Based both on community priorities identified in our formative work and on previous research, we aimed to assess the potential efficacy of a theory-based and culturally relevant community garden intervention to increase gardening and fruit and vegetable consumption among adults in two Navajo communities. In addition, we sought to improve our understanding of barriers and facilitators to gardening and healthy eating behavior, including self-efficacy, the confidence to make a behavior change.

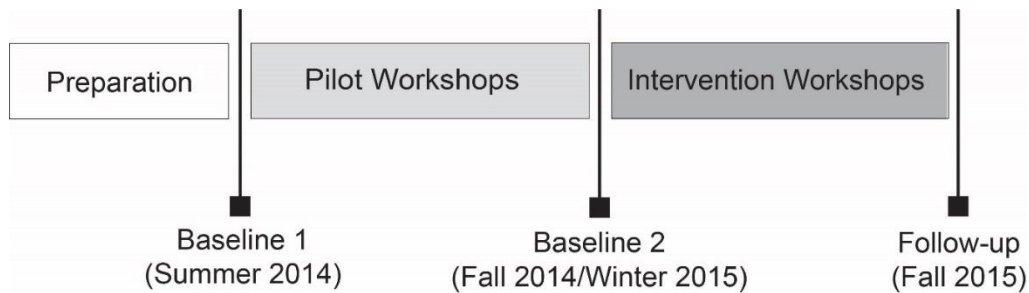
METHODS

Our research team has collaborated with Navajo communities to conduct gardening and health research for the past 14 years, facilitated in part by the land grant missions of agricultural outreach at New Mexico State University, Diné College, and Navajo Technical University. Early in this collaboration, community members identified gardening and healthy eating as priorities (Lombard et al., 2014) which informed the intervention development (Lombard et al., 2015).

Study Design

We used a quasi-experimental study design to estimate the potential efficacy of a community garden and garden education intervention to increase gardening participation and fruit and vegetable consumption (Figure 1).

Figure 1. Quasi experimental design of Yéego [Let's Go] Gardening! Intervention



Ethics Approval

The study sought supporting resolutions from Shiprock and Crownpoint Chapter Houses (where the community gardens were located) through a vote of confidence at the community level. The local Shiprock and Crownpoint Chapter House administrations and their Navajo Nation Council Delegate endorsed the study in May of 2014. An ethnographic permit was obtained through the Navajo Nation Historic Preservation Office.

Prior to starting recruitment, the study “Where Horticulture and Health Intersect: A Navajo Wellness Collaboration” was approved by the Navajo Nation Human Research Review Board (NNR-14.175), the Fred Hutchinson Cancer Research Center Institutional Review Board (IR 8167) and Institutional Review Board Authorization Agreement with New Mexico State University (NMSU). All participants provided informed consent.

Recruitment of Study Participants

For our study, we recruited Shiprock and Crownpoint community members with easy access to local community garden sites. Research staff were already working within those communities before the start of this study on other agricultural related projects, and were well respected. Community endorsement had been obtained from elected officials in both communities, as indicated above. Navajo cooperative extension and community leaders helped promote the study, including both the surveys and the intervention workshops, to community members and clients. Research study staff also promoted the study and recruited participants at community events and locations, such as local grocery stores.

To be eligible for the study participants had to identify as being Navajo, be 18+ years of age or older, express willingness to participate in garden-based technical support workshops and participate in the survey, and be re-contacted during the three-year project for follow-up surveys. Our goal was to recruit about 30 participants at each time point in each study site, in hopes that about half would attend the workshops on a regular basis.

At the next time point, also considered to be a second baseline, Dream Diné Charter School was recruited to partner in the project, assuming the role of the Shiprock Chapter House. Parents of the students at Dream Diné were recruited to participate. At the other study site (Crownpoint), parents of youth attending programs at the Office of Diné Youth were recruited. At the third time point, the study staff re-contacted the participants for a follow-up survey interview, and recruited additional participants, using similar methods, to top up the pool of respondents as necessary. A

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consent form was explained to and completed by each newly recruited participant, and the surveys were administered by a Navajo research team member at a time convenient for the participant.

Intervention

In formative work conducted with Navajo community members, diabetes and cancer were noted as health priorities, and gardening was identified as a way to promote healthy eating and Navajo traditions (Lombard et al., 2014; Lombard et al., 2015). In this early research, community members offered suggestions about workshop content, timing, and ways to promote the program. We designed the intervention based on this work, as well as constructs from social cognitive theory. In particular, we chose self-efficacy (confidence) and behavioral capability (knowledge) as targets for the intervention. The intervention for each participating community consisted of three components: 1) establishing an outdoor classroom environment, by enhancing existing community garden sites including raised beds, some form of season extension technology (such as, a greenhouse or hoop house), upgrading irrigation, and building fences to exclude livestock and deter vandalism; 2) adapting existing gardening and healthy eating adult education materials to be taught in workshops held at the community garden; and, 3) promoting positive social norms around gardening and healthy eating through community outreach (Ornelas et al., 2017; Ornelas et al., 2018). After discussion with local community leaders and cooperative extension agents, the communities of Shiprock and Crownpoint expressed interest in participating in the project. Based on this interest, the study team-built community garden spaces in a central location in each community.

In Shiprock, the garden site was located near the Shiprock chapter house and Dream Diné Charter School. The intervention team built two raised garden beds (2 feet x 8 feet) with a hose bib for hand watering. In Crownpoint, the garden was adjacent to the Office of Diné Youth, where a Crownpoint-based NMSU Cooperative Extension agent and member of the community were already conducting youth programs that included some gardening activities. The intervention team built two raised beds within a hoop house for frost protection to extend the season (10 feet x 24 feet). The garden also had an area that was cultivated every year with a small tractor and plumbed for drip irrigation. Both sites had communal garden spaces so there was not a specific space allocated to any particular individual. During the intervention, typical crops grown at both sites included corn, melons, and tomato and the crop selection was determined by what gardeners had available in seed or purchased from a garden center and from transplants grown by a member of the research team at a Farmington-based community college.

Intervention team staff provided technical assistance and coaching on gardening maintenance while governance of the gardens was left to the local community organization staff, who provided maintenance on a voluntary basis. Harvested produce was distributed among participants and was also used by the community organizations independently from our intervention. The intervention team provided soil and fertilizer for garden beds, additional garden hand tools and plumbing upgrades to accommodate water delivery from the main building to the garden site.

Workshops aimed to provide hands-on learning of gardening techniques and reinforce self-efficacy and skills around gardening and healthy eating. An early pilot used a master-gardener curriculum. Due to some concerns that the assumed skill level of attendees was too high, we consulted with some of our Navajo collaborators and advisors to refine the workshop content and

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accessibility. Community members confirmed that the master-gardener curriculum was too advanced since most of the participants had little to no previous gardening experience. Further, the master gardener curriculum was not tailored to incorporate Navajo culture and traditions. We determined that weekly workshops would be difficult for those with work and family obligations, so we opted to conduct workshops once per month. The revised workshops were launched in March 2015 with an event to celebrate the opening of the community garden. The monthly workshops took place in the afternoons and evenings and included content on planting, maintaining the garden, harvesting, and healthy eating. At the end of the workshops, a culminating Harvest Festival event was held at the community garden. All community members were invited to community events. Throughout the study, weekly team meetings monitored the progress of the implementation of the gardens and the workshops.

The community outreach component of the intervention was designed to increase gardening and healthy eating and involved extension agents and students attending community events, such as chapter meetings and community fairs, to provide additional information. Some of these events were well-attended and involved other local health agencies, such as Indian Health Services. Topics included additional gardening tips, recipes, and taste tests. In addition, monthly newsletters with gardening and healthy eating information were made available to community members.

Survey Measures

As has been mentioned, surveys were administered at three time points (Baseline 1, Baseline 2 and Follow-up) as shown in Figure 1. Surveys included questions related to gardening (frequency, interest, knowledge and self-efficacy) and fruit and vegetable consumption (frequency, self-efficacy, behavioral capability, self-monitoring, and social norms).

Gardening Behavior: To assess gardening frequency, participants were asked about how many times they gardened per month in the past growing season. From this question, we created an indicator variable for whether the participant had gardened in the last year.

Gardening Attitudes: We assessed interest in gardening with two questions. We used responses to create indicator variables for those that were not interested in gardening, had thought about gardening (an indicator of readiness to garden), and had an interest in gardening. We assessed gardening knowledge with two items asking whether participants knew how to (a) prepare a garden, and (b) maintain a garden. Response options were not at all, a little, and a lot. A participant was regarded as having high knowledge if they responded “a lot” to either question. Similarly, we assessed gardening focus group with two items asking how confident participants were that they can (a) prepare a garden, and (b) maintain a garden. Response options were not at all, somewhat and very confident. A participant was regarded as having high confidence if they responded “very confident” to either question. Lastly, participants were asked about financial barriers to gardening (costs of water, tools, irrigation systems, fencing materials, and gas). For each barrier, participants could indicate how concerned they were: not at all (0), a little (1), and a lot (2). Responses were summed across items for a total score ranging from 0 to 10.

Fruit and vegetable consumption: Participants were asked the number of servings of fruits and vegetables consumed each day using the single question (Beresford et al., 2001). A small banner of photographs of portion sizes were included in front of the question, to reduce the respondent bias at follow up likely to occur with increased knowledge among those attending the

workshops about what constitutes a serving. In addition, consumption was measured using the abbreviated food frequency fruit and vegetable questionnaire that is comprised of seven questions that ask about the *usual* frequency of consuming juices, fruits and vegetables over the last month (Thompson & Byers, 1994). This common measure was used in the original 5 a Day studies that surveyed adults (Beresford et al., 2001; Buller et al., 1999; Havas et al., 1995; Sorensen et al., 1999). In our earlier study, we found a correlation between response to the single question and the abbreviated food frequency questionnaire to be 0.62 and more responsive to change (Beresford et al., 2001).

Fruit and vegetable related attributes: We assessed knowledge to prepare fruit and vegetables by asking participants whether they knew how to prepare fruits and vegetables for consumption with response options including not at all, a little, and a lot, which were coded respectively one, two and three. A participant was regarded as having high knowledge if they responded, “a lot.” We assessed confidence to consume by asking how confident they were that they could eat fruits and vegetables every day with response options of not at all confident, somewhat confident, and very confident. A participant was regarded as having high confidence if they responded, “very confident”.

Statistical Analysis

Statistical analyses were completed using SAS statistical software package version 9.4 (SAS Institute, Cary, NC). Statistical significance was based on $\alpha=0.05$. A subset of participants who completed either one or both of the baseline surveys *and* the follow-up survey were used as the primary analytic cohort. Mean values for the survey measures at baseline were calculated and used for participants with two baseline surveys.

The primary outcomes (fruit and vegetable consumption; gardening frequency per month) were continuous measures, so a paired Student’s t-test with $\alpha=0.05$ was used to evaluate pre- post-intervention differences. Change in continuous secondary measures (e.g. financial barriers to gardening) was also evaluated using Student’s t-test. The remaining secondary outcomes (e.g. gardening and fruit and vegetable related attitudes) were dichotomous measures, so McNemar’s test for paired proportions was used in each case to compare proportions of respondents in the top category pre- and post-intervention.

A second subset of participants was used to evaluate differences in primary outcomes post-intervention based solely on the follow-up survey following the main intervention workshops. These participants had completed a follow up survey but may or may not have completed a baseline survey. Participants who had attended only a master gardener workshop but no behavioral workshop were excluded from this analytic subset. Within this analytic group, those who received the intervention by attending at least one behavioral workshop (exposed) were compared with those who did not receive the intervention (unexposed) with respect to the primary outcomes of fruit and vegetable consumption and gardening frequency per month. This analysis is referred to as the post-intervention exposure analysis. We evaluated differences in outcome by exposure using a two-sample t-test, with pooled variance except when the variances were unequal, when we used the Satterthwaite approximation for average variance.

Qualitative Interviews

In an effort to understand further how best to promote gardening among community members, we conducted qualitative interviews with 15 program participants at the end of the

project. Project participants were categorized into high, medium or low participation in the workshops. We aimed to engage two or three households per category at each site in qualitative family in-person interviews. The protocol included questions about both gardening and food preparation. Interviews took place in August of 2015 and were recorded and transcribed. Transcriptions were coded to identify common themes related to intervention engagement.

RESULTS

Participant characteristics are described in Table 1. Of those recruited to participate in the study (N = 169), 132 completed a baseline survey (1 and/or 2).

Table 1. Participant characteristics

	All Participants (N=169)		Primary analytic cohort (N=32)		Post-Intervention exposure analysis (N=52)	
	N	%	N	%	N	%
Gender						
Female	119	70	24	75	50	77
Male	50	30	8	25	12	23
Age						
18-29	46	28	7	23	11	22
30-39	36	22	6	19	11	22
40-49	37	22	7	23	13	25
50-59	28	17	9	29	10	20
60+	20	12	2	6	6	12
Marital Status						
Single	79	47	9	28	14	27
Married	64	38	18	56	32	62
Divorced	16	10	4	13	4	8
Widowed	8	5	1	3	2	4
Navajo						
No	7	4	1	3	2	4
Yes	162	96	31	97	50	96
Education						
High school or GED	48	28	4	13	10	19
Some College/vocational degree	95	56	23	72	35	67
College degree	23	14	5	15	7	14
Employment Status						
Year round	51	30	20	63	29	56
Day/seasonal	38	23	2	6	6	12
Other	77	46	10	31	17	32

Among those completing a baseline survey, 32 adults also completed a follow-up survey, less than a third of those participating at baseline. These 32 participants formed the primary analytic cohort. Almost all participants identified as Navajo, most were female and had at least some college education. Of these 32, 17 adults were from Crownpoint and 15 were from Shiprock. Compared with the baseline responders, slightly more of the analytic cohort were married, fewer had less than high school education, and slightly more reported regular employment. Characteristics of the post-intervention exposure analytic group were similar to the analytic cohort, as shown in Table 1. Workshop attendance was low, ranging from one to eight people at a given session. In all, 25 participants attended at least one workshop, of which only eight participants attended two or more workshops.

Overall, no significant changes were observed in any of the primary outcomes (Table 2). While the gardening frequency increased, the single fruit and vegetable consumption question and the abbreviated fruit and vegetable food frequency questionnaire decreased, although none were significant. Consistent results were obtained in analyses adjusting for age, gender and education.

Table 2. Pre- and Post-Intervention Changes in Gardening and Fruit and Vegetable Consumption (N=32)

	Pre- Intervention		Post- Intervention		Difference	95% CI for difference
	Mean	SD	Mean	SD		
Gardening frequency (per month)	10.1	12.2	12.6	14.4	2.51	(-3.61, 8.64)
Proportion respondents gardened in last year	0.39	0.48	0.47	0.51	0.08	(-0.11, 0.26)
Fruit and vegetable servings per day (Single Question)	2.30	1.21	2.25	1.22	-0.06	(-0.63, 0.51)
Fruit and vegetable servings per day (Abbreviated FFQ)	4.23	3.66	3.97	3.15	-0.26	(-1.51, 0.99)

With one exception, there was no significant change observed between the pre-intervention and post-intervention time points for the gardening and fruit and vegetable related attributes. As shown in Table 3, there was a significant increase in expressed interest in gardening from 78% to 97% (p=0.014). Overall, there appeared to be a small increase from pre- intervention to post-intervention in the proportion of adults with high confidence to garden (50% to 53%), with “a lot” of gardening knowledge (41% to 53%), and who thought about gardening last year (38% to 47%). Similarly, the proportion reporting high confidence in consuming fruits and vegetables daily increased from pre – to post-intervention (63% to 72%). On the other hand, the proportion with a lot of knowledge of fruit and vegetable preparation decreased (72% to 59%) and the average level of concern regarding financial barriers to gardening increased from 4.6 to 5.5 (p=0.035).

Table 3. Pre- and Post-Intervention Changes in Knowledge, Self-Efficacy and Interest in Gardening and Fruit and Vegetable Consumption (N=32)

	Pre- Intervention		Post- Intervention		Difference	p-value
	N	%	N	%		
High Gardening Knowledge	13	41	17	53	12%	0.21
High Gardening Confidence	16	50	17	53	3%	0.78
Thought about Gardening in the Last Year	12	38	15	47	9%	0.41
Expressed Interest in Gardening	25	78	31	97	19%	0.014
High Knowledge to Prepare Fruits and Vegetables	23	72	19	59	-13%	0.21
High Confidence to Consume Fruits and Vegetables Daily	20	63	23	72	9%	0.26
	Mean	S.D.	Mean	S.D.	Difference (95% Confidence Interval)	p-value
Sum of Five Financial Barriers	4.6	3.0	5.5	3.0	0.83 (0.06, 1.59)	0.035

In the post-intervention exposure analysis, 52 participants completed the follow-up survey, but two were excluded since they attended only a master gardening workshop. This left 50 participants in the analytic group. Again, 25 of these participants attended at least one workshop.

There were no significant differences in fruit and vegetable consumption between those exposed and unexposed to the main intervention workshop series, as shown in Table 4. A slightly higher gardening frequency per month (21 times versus 10 times, $p=0.07$) was reported for those exposed to the behavioral workshop(s) compared to those who attended none. The estimated increase in gardening frequency was 11 times per month, with 95% confidence interval (-0.8, 22.6).

Qualitative Findings

Interviews with program participants suggested that community garden plots led some Navajo community members to garden more at their own homes. Participants noted that their children had participated in gardening activities at the community garden sites and encouraged their families to garden more. Participants also shared that it was beneficial to have the learning garden sites at youth serving organizations, to provide learning opportunities for both youth and their families. Being connected to an organization could also provide more consistent maintenance of the garden. Participants also noted that a curriculum geared towards youth could potentially encourage Navajo community members to develop healthier eating habits at an earlier age.

Table 4. Gardening and Fruit and Vegetable Consumption by Receipt of Intervention (N=50)

	Received intervention		Did not receive intervention		Mean Difference	95% Confidence Interval	p-value
	Mean	SD	Mean	SD			
Gardening Frequency (times/month)	20.7	20.0	9.8	12.2	10.9	(-0.8, 22.6) [†]	0.07
Fruit and Vegetable Consumption (servings/day)	2.5	1.2	2.6	1.8	-0.04	(-1.1, 1.0)	0.94
Fruit and vegetable intake from abbreviated FFQ (servings/day)	4.5	4.5	4.1	3.0	0.33	(-1.8, 2.5)	0.76

[†] Equal variances rejected (p=0.03).

DISCUSSION

We found only weak support for our hypothesis that a community garden and gardening education workshop series would be associated with an increase in gardening behavior, confidence and knowledge, and no support for our hypothesis of a change in fruit and vegetable eating choices. Despite enthusiasm for enhancing existing community gardens in both the communities studied, individuals most connected with the garden sites by virtue of their children attending the school or the youth center, did not consistently participate in the assessments or in the intervention workshops. Nonetheless, among those who did participate in the workshops, a notable increase in gardening frequency was reported on follow-up survey.

Our findings are consistent with previous studies of gardening interventions in American Indian communities. In a study of family gardens on the Navajo Nation, adults that attended gardening workshops did not increase their fruit and vegetable consumption (Bauer, 2017). Our findings are also consistent with a small study assessing community gardens in an American Indian community in the Northern Plains, which showed only weak positive changes in self-efficacy to garden and no changes in fruit and vegetable consumption (Brown et al., 2020). Together, these findings suggest that garden programs may serve to increase gardening, but they may not be enough to increase fruit and vegetable intake. Some research suggests that interventions to improve healthy eating can be strengthened by including more consistent messaging and that ongoing reinforcement is needed to motivate and sustain healthy eating, such as flier, phone and text messages after the intervention has ended (Vaillancourt et al., 2019; Williams-Piehotka et al., 2006).

Our results point to some limitations of the study. In a community based study, it is often challenging both to conduct community-based gardening interventions and to evaluate their impact in a the community (Jernigan et al., 2020). Despite having community support from key leaders in

both communities, there was limited grass-roots level community support for gardening maintenance tasks needed to sustain the sites. Both communities are located more than 30 to 60 miles from towns like Gallup and Farmington, NM which can lead to long commutes for work and shopping, reducing potential time for working in the community garden. In addition, there were challenges to recruiting a cohort of adults from the community and retaining them as a cohort over a two-year period, resulting in a small sample. Other researchers have reported similar challenges. Because attendance in workshops was low, participants also received a lower “dose” of the intervention, limiting our ability to assess the impact of the workshops. Our findings may indicate that even when there is community interest and enthusiasm in community gardens or gardening in general, there are still significant barriers to participation in rural communities (Lombard et al., 2014). Alternative approaches emerged from our qualitative findings, including the need to involve children more explicitly in the garden and in future workshops.

Future research should explore additional ways to introduce gardening skills to Navajo communities that are consistent with Navajo culture and traditions of farming their land. Interest in food sovereignty, or consuming foods that have been produced locally, has only increased during the current COVID-19 public health crisis (Morales, 2020). Future gardening education programs can build on collaborations involving the Navajo Nation and New Mexico State University, as well as land-grant offices at Navajo Technical University and Diné College.

CONCLUSION

A community garden and gardening education workshop series was only weakly associated with an increase in gardening behavior, confidence and knowledge, and there was no change in fruit and vegetable eating choices among adult participants in two Navajo communities. However, among the few participants who did attend the workshops, a notable increase in gardening frequency was reported on follow-up survey. Healthy eating and access to healthy foods remain high priorities for the Navajo Nation. Future studies should augment the intervention to include explicit efforts to reduce barriers to long term engagement and to extend intervention reach.

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