PROMOTING HEALTHY FOOD ACCESS AND FOOD SECURITY IN URBAN AMERICAN INDIANS THROUGH ADAPTATIONS TO THE LOCAL FOOD SYSTEMS AND DIGITAL STORYTELLING

by

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DEDICATION

For my mother, Lorraine Cowboy,
my grandparents, Rita and Bennie Cowboy,
my siblings and my beautiful nieces and nephews.
And in remembrance of my late father.

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ABSTRACT

BACKGROUND: Food systems are shaped by social determinants that influence health outcomes. American Indian (AI) food systems have been disrupted over the last 200 years by historical factors including policies of removal from traditional lands and food systems and reliance on government provided foods. This dissertation will identify barriers and develop strategies using three studies to improve the connection between urban AIs and a food system that affords healthy food and food security.
STUDY AIMS: These studies aim to: (1) document urban AI adult food access, food security, body mass index (BMI), and barriers and strategies in using Tucson, AZ's food system to explore social determinants of health that impact food availability and accessibility; (2) use a Social Cognitive Theory (SCT) framework and strategies documented in Aim 1 to collaboratively plan the development of a digital storytelling (DST) food system curriculum that promotes personal, behavioral, and environmental strategies to access healthy foods and promote food security; and (3) evaluate the development and application of the DST food system curriculum.
METHODS: Aim 1 is a secondary analysis of existing qualitative and quantitative data sampled from the Tucson Indian Center (TIC) Community Health Assessment (CHA). Aim 2 is the development of DST food system curriculum. Aim 3 is the qualitative analysis of the DST curriculum from the perspective of the DST team and AI community members.
RESULTS: Urban AIs in Tucson experience high rates of low food security and low food access associated with social determinants of health. AI adults with low food security were more likely to not have access to personal vehicles and lived more than 0.5 miles from full-service grocery stores. Combined overweight/obese status among AI adults was associated with low food security based on adjusted models (OR 2.0, CI 1.0, 4.0). Barriers for food access and security occurred at the individual level to environmental level, e.g. food preferences, not having access to community gardening space. Strategies to build food security and access were identified, e.g. build social support, create opportunities for cultural sharing. A food system conceptual model was developed from the participating community members' perspectives and demonstrates the interconnections of social and cultural determinants between culture, social, economic, political, and biophysical systems that influence food access and security. Gaps in the model can be leveraged by efforts of food revitalization, policy, and indigenous-centered approaches. A DST curriculum offers a unique tool to help urban AI community members understand their food system to identify ways to create personal, behavioral, and environmental level changes.
CONCLUSION: Food security and food access impacts the health of urban AIs in Tucson. The urban AI food system is comprised of multilevel factors shaped by social determinants of health. Current barriers included individual behavior to institutional level policies that challenge food security. Strategies that involve community engagement could increase social support and social influence to connect urban AIs to food systems in Tucson that support access to healthy foods and food security. Such strategies include working with community members to develop DST curriculum, consisting of videos and an activity/discussion guide, which can be shared as educational tools and motivators for action.

CHAPTER 1
INTRODUCTION

This dissertation offers three studies that explored food systems, food access, food security, and the influence of social determinants of health for urban American Indians (AIs) in Tucson, AZ. The historical food system for AIs has been the backbone of social and cultural systems for tribal communities (Echo Hawk Consulting, 2015). Colonial oppression and systemic changes have altered food systems for AIs and created a path of injustice and shifts in health and well-being (Echo Hawk Consulting, 2015). In response to social and cultural injustice within AI food systems, concerned community members and public health scholars are pushing for culturally-responsive research and programs that can identify strategies and models to address health disparities through food access and food security (Echo Hawk Consulting, 2015). Unequal access to healthy food and food insecurity can lead to extreme hardship for families or individuals who are most susceptible to health disparities (First Nations Development Institute (FNDI), 2014; Jernigan, Huyser, Valdes, & Simonds, 2017;).

Urban food systems offer a wide range of food choices and healthy food environments for AIs. The challenge is connecting AIs to the resources and strategies that can build their access to healthy food and food security. A food system model as well as a digital storytelling (DST) food system curriculum offers the potential for AI community members to understand and share their strategies and encourage other community members to become active in making changes in the food system. Ultimately, AI community members can work collaboratively with local organizations to revitalize historical food systems and build their knowledge for future generations to maintain traditional lifeways that support health and wellbeing in an urban setting.

Dissertation format and overview

The format of this dissertation consists of three chapters and appendices. Chapter 1 provides an overview of the dissertation, research aims and hypotheses, and a review of the literature. Chapter 2 presents an overview of the study rationale, methods, and results by Specific Aim. Chapter 3 includes important findings, limitations, implications for family and child health, and recommendations for future research. The appendices are attached at the end of the dissertation and include three manuscripts (Appendices A-C), written by the author of this dissertation, the DST evaluation guide (Appendix D), and the IRB approval form (Appendix E).

Table 1. Summary of methods aligned with aims

Research method	**Aim 1** Document food access and security to explore social determinants of health	**Aim 2** Develop DST curriculum	**Aim 3** Evaluate DST curriculum
Data collection	TIC Community Health Assessment (CHA) (2015-2016)	Feedback interviews with DST team members and focus groups with community members who reviewed DST food systems curriculum	
Population recruited	Male and female AI adults, ages 18 and older	Male and female AI adults, ages 18 and older, willing to participate as DST team members	Male and female AI adults, ages 18 and older, willing to review and offer feedback on DST curriculum
Sample	1. Survey data (n=275) 2. Qualitative data: focus groups (n=22), asset mapping (n=32), community input gathering (n=35)	5 DST team members	1. Feedback interviews: DST team members (n=5) 2. 3 focus groups (n=23)
Analysis	1. Quantitative analysis: prevalence of food security and food access, and influence of social determinants 2. Qualitative analysis: strategies and barriers for food access and security; and conceptual model development for urban AI food system of Tucson	1. Qualitative analysis of constructs of the SCT in the DST curriculum; applicability and cultural appropriateness of the curriculum for the targeted audience; and exploration of experiences/perspective viewing and/or using the curriculum	
Publication plan	1. Manuscript 1 presents findings of the secondary quantitative analysis and the qualitative analysis for strategies and barriers (Appendix A) 2. Manuscript 2 presents the secondary data analysis to develop a conceptual model of the Tucson AI food system (Appendix B)	1. Manuscript 3 presents findings from the primary data analysis of feedback interviews from the DST team members and focus groups participants who reviewed the DST food system curriculum (Appendix C)	

Table 1 provides a summary of each Aim and methods incorporated into the study. Aim 1 was a secondary data analysis of existing data sampled from the TIC CHA. The CHA is comprised of quantitative data from a cross sectional survey and qualitative data from focus groups, an asset mapping session, and a community input gathering. The four hypotheses generated for Aim 1 were developed based on the secondary data and are not related to the original research question used for the TIC CHA, which investigated strategies for preventing type 2 diabetes among AI children. Aims 2 and 3 consisted of original research and qualitative data collected from developing and evaluating a DST food system curriculum. These Aims do not include hypotheses due to the explorative and formative nature of this work.

Appendices A-C include two manuscripts that are based on Aim 1 and a third based on Aims 2 and 3. All three manuscripts were developed by the author of this dissertation, who was responsible for analyzing data, summarizing the results, and discussing major findings. Two consultants aided with data analysis, with one coding 20% of qualitative data for manuscript 1 and 2 and another coding 20% of qualitative data for Manuscript 3. The UA Human Subjects Institutional Review Board designated this research as exempt due to the nature of the study using de-identified data for analysis (Appendix E).

Genesis of the Study

To address food access and food security issues within AI communities, food system movements have grown and often use public health research and policy development as strategies to meet the needs of communities. One prime example is in Tucson where a team of community members have worked collaboratively with the

Tucson Indian Center (TIC) and partners from the University of Arizona (UA) Mel & Enid Zuckerman College of Public Health (MEZCOPH) for over ten years on these issues. Together they developed a community advisory board (CAB) and worked on two community projects, Seeds of Wellness and GROW NATIVE that supported the direction and development of this dissertation.

Seeds of Wellness was a family-based health promotion intervention that wove strong elements of indigenous education, including balance and relationship, into the curriculum for urban AI families (American Public Health Association (APHA), 2018). Gardening was suggested as an activity that could benefit families and youth. GROW NATIVE, which resulted from the Seeds of Wellness project, was a small pilot intervention conducted with 21 urban AI youth, ages 10 to 18 years old (Kahn-Thornbrugh, 2010). The project tested the feasibility of using a cultural based gardening intervention with youth and measured changes in behavior, knowledge, attitude, and beliefs related to gardening, native science, and applying to college (Kahn-Thornbrugh, 2010). A community based participatory research (CBPR) approach was used for both projects, including the establishment and active involvement of a CAB in all levels of research. The results from both projects demonstrated how the CABs and community members wanted to address health disparities in the Tucson community by rebuilding cultural and social connection among each other (Kahn-Thornbrugh, 2010). For GROW NATIVE, in particular, the CAB and participants agreed that strengthening access to cultural food and opening opportunities for the AI community members to garden would enhance health and well-being (Kahn-Thornbrugh, 2010; Kahn-Thornbrugh, Foster, Mason, and Gilmore, 2012). Digital stories were incorporated into the curriculum and

helped the students reflect upon different topics relating to food systems, gardening, and wellness.

By building upon these previous studies, a new project was formed by the GROW NATIVE CAB who wanted to expand upon the youth and family gardening program and better understand the Tucson food system and the influence of social and cultural determinants. In particular, the CAB wanted to identify existing strengths and resources in the community to understand cultural based strategies that could enhance access to healthy food in Tucson, including traditional AI food. To carry out the CAB's request, this dissertation research identified barriers and strategies in the historical and existing Tucson food system that impact food security and access to healthy food including traditional food. Following the CBPR approach used with the GROW NATIVE project, the author formed a collaborative partnership with the TIC and was asked by Jacob Bernal, TIC Executive Director, to also investigate the role of policy on food access and security in Tucson.

TIC and CBPR projects

The TIC is located in downtown Tucson, AZ and provides services to the urban American Indian and Alaska Native (AIAN) community. It was incorporated in 1963 as the American Indian Association but conducts business as the TIC (Tucson Indian Center (TIC), 2018a). Services are offered to urban AIAN community members by the center's two main departments, Social Services and Wellness Department (TIC, 2018b). Approximately 6000-8000 AIAN's in Tucson utilize services at the Center annually (Reinschmidt, Kahn, Attakai, Whitewater, & Teufel-Shone, 2016). The service population includes AIAN children, adolescents, adults and elders. Tucson has

approximately 527,586 residents, with 15,077 (2.9%) AIAN alone and 19,903 (3.8 %) identified as AIAN combined with one or more other races (U.S. Census Bureau, 2018).

The TIC has a diabetes educator that offers workshops through funding provided by the Special Diabetes Program for Indians (Indian Health Service (IHS), 2018). The workshops consist of food demonstrations and culturally appropriate educational classes about prevention and diagnosis of diabetes. Other key food-based programs include monthly elders' luncheons, food box distribution, WIC clinics, and a youth coalition that incorporates gardening classes.

The TIC has formed a collaborative partnership with the UA in past CBPR projects, several of which the author of this dissertation took part as a research assistant or consultant. CBPR is an approach recommended for AI communities that involves community members in all levels of the research process and instills ownership of the project among community members (Paradis et al., 2005; Wallerstein & Duran, 2006). In addition, CBPR provides for community capacity building to enable the project to sustain itself. The projects included: 1) Seeds of Wellness, a family health promotion project that was based on cultural strengths such as traditional food, art, and gardening (APHA, 2018); 2) a project that documented AI elders' stories of resilience using digital stories (Reinschmidt, Kahn, Attakai, Whitewater, & Teufel-Shone, 2016); and 3) GROW NATIVE a gardening project with AI youth that also involved the use of digital stories (Kahn-Thornbrugh, 2010).

Research aims and hypotheses

The goal for this study is to understand the Tucson food system from the perspective of AIs and identify barriers and strategies to promote access to healthy food

and increase food security. The PI of this dissertation developed the aims and hypotheses based on theoretical frameworks and past CBPR projects conducted with the TIC.

Specific Aim 1: Document urban AI adult food access, food security, body mass index, and barriers and strategies in using Tucson, AZ's food system to explore social determinants of health that impact food availability and accessibility.

Hypothesis 1: Food security, food access, and food support status will be influenced by gender or age group.

Hypothesis 2: Food security status will be influenced by overweight/obese status and social determinants of health, including education, income, food access, fruit and vegetable (F/V) consumption, and food support.

Hypothesis 3: AI adults with no access to vehicles and public transportation will have greater food insecurity than adults who have access to transportation.

Hypothesis 4: Overweight/obese AI adults will have a relationship with food security different from non-overweight/obese AI adults.

Specific Aim 2: Use a Social Cognitive Theory (SCT) framework and strategies documented in Aim 1 to collaboratively plan the development of DST resources for a food system curriculum that promotes personal, behavioral, and environmental strategies to access healthy foods and promote food security.

Specific Aim 3: Evaluate development and application of the DST food system curriculum on: 1) constructs of the SCT in the DST curriculum, 2) applicability of DST curriculum for the urban AI community, 3) cultural appropriateness for the urban AI community, 4) experience and perspective in making digital stories, and 5) DST curriculum influencing behavior change.

Review of the literature

Chronic disease risk in AIANs

AIAN populations experience high morbidity and mortality rates of chronic disease such as diabetes and cardiovascular disease (CVD). Assessing the prevalence of diabetes and CVD among the AIAN population is challenged by the difficulty in comparing rates among urban and rural populations. The prevalence of CVD, which includes a wide range of diseases or conditions of the heart and blood vessels, among AIAN populations is greater compared with other non-AIAN populations (Echiti, 2005). For the Tucson AIAN population, the mortality rate of CVD is 742.4 per 100,000 compared to 510.6 per 100,000 for non-Hispanic whites. CVD is currently the leading cause for mortality, followed by cancer and diabetes (Urban Indian Health Institute (UIHI), 2018) (Table 2).

Table 2. Top mortality causes for AIANs in Tucson, AZ (2010-2014) (Source: UIHI, 2018)

Cause	Rank	Deaths per 100,000
Vascular disease	1	510.6
Cancer	2	357.4
Chronic lower respiratory disease	3	105.2
Intentional self-harm	4	48.8
Alzheimer's disease	5	47.3

Among the AIAN adults receiving care from the Indian Health Service (IHS) Tucson Service Unit, the prevalence of diabetes is 24.1% (Centers for Disease Control and Prevention (CDC), 2014). In a study by the UIHI, prevalence rates of obesity (31.7%) and diabetes (11.9%) for urban AIs was higher than the general US population (23.4%, 8%, respectively) (UIHI, 2011). For the overall AIAN population, the prevalence

of obesity was 43.7% and the prevalence of diabetes was 17.6% in 2014 (CDC, 2016; CDC, 2017).

Risk factors for chronic disease among urban AIAN populations are not well documented but existing data indicates a need for targeted intervention (Johnson, Bartgis, Worley, Hellman, & Burkhart, 2010; UIHI, 2008). Among urban AIs, a 2008 report found that 74% of the population ate less than five F/V each day (UIHI, 2008). The same study also found that 27.6% of urban AI adults did not do any leisure-time physical activity in the last 30 days (UIHI, 2008).

Historical trauma is a social determinant influencing the psychological and emotional health of AIs, generally experienced through discrimination and cultural loss (Brave Heart, 1998; Doka, 1989, Niederland, 1989; Whitbeck, Adams, Hoyt, & Chen, 2004). Acculturation is associated with depression or identity confusion and risk of suicide among AIs (Hovey, J.D., 1998; LaFromboise, Albright, & Harris, 2010; Lester, 1999). Poor psychosocial health increases the risk of chronic disease including obesity. One study found childhood depression increased the risk higher BMI during adulthood (Pine, Goldstein, Wolk, & Weissman, 2001).

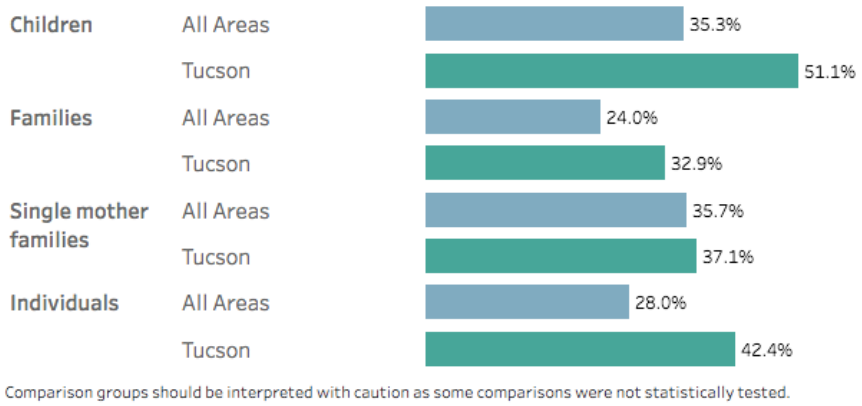
Urban AIANs and social determinants of health

The social determinants of health influence health behavior through the interaction of intrapersonal, interpersonal, and community level factors (Clark & Utz, 2014; Hill, Nielsen, & Fox, 2013). Social determinants of health are defined as, "the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life" (World Health Organization, 2018). Intrapersonal factors impact personal health behavior and choices among urban

AIANs. The literature identifies the following intrapersonal factors as critical to behavior change affecting chronic disease prevention in the general AIAN population: self-efficacy (Thompson, Wolfe, Wilson, Pardilla, & Perez, 2003); beliefs of chronic disease etiology and potential impact of health behavior (Cavanaugh, Taylor, Keim, Clutter, & Geraghty, 2008; Patel, Davila, Patel, & Norman, 2014); and knowledge and skills of chronic disease prevention (Shaw, Brown, Khan, Mau, & Dillad, 2013). Although studies among urban AIANs specifically are limited, Companion's (2013b) documentation that cultural identity influences urban AIANs behavior to make healthy food choices adds to this list of influential intrapersonal factors.

Individual behavior is influenced by interpersonal level factors involving the family, including social support and family related stressors. Interpersonally, stress from acculturation can play a role if families have migrated from rural communities and reservations. Johnson and Tomren (1999) found most urban AIANs lived apart from family and usually dispersed rather than live collectively. Living away from extended family may increase perceptions of disconnection and limited social support. Concurrently, while facing social issues urban AIANs are also challenged with higher rates of poverty and lower completion rates for high school and college than the general urban population (UIHI, 2008). Based on data collected between 2010-2014, the UIHI reported a poverty rate of 42.4% for AIs in Pima County, the local of Tucson, which was higher than the poverty rate for non-Hispanic Whites (12.7%) (UIHI, 2018) (Figure 1).

Figure 1. AIANs with income below federal poverty level in Tucson, AZ (2010-2014) (Source: UIHI, 2018)



The UIHI also reported that 25.2% of AIs who were 25 years old and older did not have a high school diploma, which was higher than the rate reported for non-Hispanic Whites (5.4%) (UIHI, 2017). Additionally, more AIs lived in renter occupied homes (52.3%) than non-Hispanic Whites (32.2%) and less AIs owned homes (47.7%) in comparison to non-Hispanic Whites (67.9%) (UIHI, 2018) (Figure 2).

Figure 2. Housing type for AIANs in Tucson, AZ (2010-2014)
(Source: UIHI, 2018)

Community level factors among urban AIANs include a complex system that requires navigation and adaptation to an unfamiliar environment. Access to community resources and networks that promote culture and health is a barrier for urban AIANs who may be more familiar getting support from their tribes or villages. Low-income urban AIAN families may also face greater challenges accessing tribal health resources (Johnson et al., 2010), often lack access to transportation (Johnson et al., 2010;

Companion, 2013b), and live in neighborhoods lacking full grocery stores (Companion 2013b).

Food systems, food access, and food insecurity

Food systems are influenced by social determinants and are comprised of functions related to agriculture and land preservation, economic systems that involve distribution and processing, political systems for production and access, impact of food on health, and food consumption culture (Neff, 2015). Food environments are found within food systems, including homes, schools, stores, and eateries. These environments are influenced by social factors, media/advertising, the cost of food, and ability to access stores (Johns Hopkins Bloomberg School of Public Health (JHBSPH), 2015).

The Southwest Interdisciplinary Research Center (SIRC) (2011) defines food insecurity as the inability to acquire nutritional and safe foods and having limited availability of such foods. Households must meet at least three criteria to be considered food insecure, including: feeling worry about food shortage before money comes in; after buying food it did not last; and unable to buy balanced meals (USDA, 2018). Hodgson (2012) described food access as the distance or ability to reach affordable and healthy food sources, and/or having the income to buy healthy food. Food access is measured by distance between a home and large grocery store. Access can also be measured by income and/or having access to a vehicle or public transportation (USDA, 2009).

Non-inclusive policy development is a contributing factor for unequal access to healthy food, particularly when urban AIs do not partake in policy development or in the power structure of businesses or organizations at the local level to influence systemic changes on a political level. Historically, AIs have been marginalized in mainstream

society regarding policy advocacy and development (National Urban Indian Family Coalition, 2015). In general, AIs make up a small percentage of the population who are eligible to vote in national elections and do not often play a large role in political systems such as serving political positions to advocate for access to essential services (Huyser, Sanchez, & Varges, 2017; National Congress of American Indians (NCAI), 2018). Concurrently, AIs have had lower voter turnout than other races and ethnicities and some reports indicate that as many as 30% of AIs are not registered to vote (Native American Voting Rights Coalition, 2018; NCAI, 2017; NCAI, 2018).

History of AI food systems

AI people have historically lived healthy lifestyles by eating a healthy diet and being physically active (Mihesuah, 2005). Traditional diets include foods that are Indigenous to the Americas, or Western Hemisphere. These include a vast array of fruit and vegetables such as corn, beans, squash, chili, and blueberries (Caduto & Bruchac, 1996). Foods from domesticated plants, wild plants and wild game were in abundance and provided adequate nutrition. For many AI tribes, food also has an important place in cosmology and ceremonial cycles (Mihesuah, 2005).

Indigenous gardeners and farmers from the Western Hemisphere grew the first crops over 6,000 years ago (Caduto & Bruchac, 1996). Over 150 species of plants were grown in the Americas, including over 150 varieties of corn. More than 80% of local heirloom varieties of fruits and vegetables have disappeared in the US since the early 1900s (Caduto & Bruchac, 1996). Currently, the biggest concern that tribes in the Southwest face is a loss of knowledge in traditional farming and the cultural practices associated with planting and harvesting.

Arizona is the ancestral homeland for 21 tribes in the Southwest including but not limited to the Navajo, Tohono O'odham, Pasqua Yaqui, and Hopi, with many of these tribes making up the intertribal population of the Tucson urban AI community. The Tohono O'odham Nation and Pasqua Yaqui Tribe are two reservations in close proximity to Tucson and have influenced the agricultural history of Tucson. Historically, the Tohono O'odham grow their crops with the monsoon rains, which yield a variety of crops such as red and white tepary beans, squash, and 60-day corn. Many of the crops grown in the desert are drought resistant, such as corn that has been grown for 100-200 generations in the Tohono O'odham tradition (Nabhan, West, & Pirog, 2005).

AI food systems and health

AI's, including the Tohono O'odham in southern Arizona, traditionally hunted, gathered, or farmed until the early and mid 1900's, with most leaving their homes for new occupations, boarding school, and service in the military (Halpern, 2007; Tohono O'odham Community Action (TOCA), 2018). This trend caused families to rely on processed and commercially prepared food for their dietary intake and to lessen their dependence on homegrown foods or food gathered in the wild (Halpern, 2007; TOCA, 2018). The easy access to grocery stores provides readily available food and convenience that reduces the need for farming in AI communities.

AI people can transition their diets to eat healthier and recover activities that helped maintain optimal physical health. Restoring traditional agricultural practices such as gardening is a way to keep active, eat healthy, and involve people of all ages (Mihesuah, 2005). Teaching parents and caregivers to be role models who participate in such activities is also a way to generate healthy lifestyle changes among families.

Agricultural practices are viewed holistically by AIs and relate to restoring family culture, language, and spiritual ecology. White states, "seeds hold cultural value and cultural memory…the seeds become symbols, reflections of the peoples' own spiritual and aesthetic identity, and of the land that shaped them" (as cited in LaDuke, 2005, p.192). Gardening helps AI peoples maintain cultural ties to the land and helps promote family cohesion (Cajete, 2000). Cajete states, "Gardens provided a place to socialize, hold gatherings, and even a place to decorate. Gardens were an essential part of the ritual and ceremonial life of many communities as well" (Cajete, 2000, p.129).

The current push in many AI communities is to return to traditional diets; however, people face many challenges to do so. One challenge is the dominant nutrition education based on a non-AI paradigm taught in AI communities. There is also a major battle that people have to fight against with the American food industry and media due to a lack of education and awareness about where our food comes from (Mihesuah, 2005).

Food systems and public health research

Public health interventions that add food system components have provided evidence of increased changes among environmental, behavioral, and personal factors to build healthy lifestyles among Indigenous communities (Companion, 2013a; Novotny Vijayadeva, Ramirez, Lee, Davison, & Gittelsohn, 2011). Companion (2013a) conducted an intervention using food tasting and container gardening with an urban AI Center in the mid-west to address cultural and economic barriers for accessing healthy and traditional foods to promote healthy food behavior. The rationale for the study was that a supportive environment fostered through the AI Center can enhance connection to cultural roots and consumption of healthy foods. The project fostered empowerment by linking food

choices and traditional culture (Companion, 2013a), shown in past studies to increase transmission of cultural knowledge and practices (Companion, 2008). Novotny et al. (2011) implemented a food system intervention in rural Hawai'i that increased access to healthier food options in stores, increased educational marketing, and provided food demonstrations in two matched control/comparison communities with similar income level and ethnic composition with up to 27% who were Native Hawaiian and Pacific Islander.

Understanding the AI food system is a critical step to defining relationships and important players, thus there is also a need to understand food systems in urban communities. Presently, there is limited understanding of the urban AI food system. Of the limited studies available, one study assessed healthy and affordable food resources in two urban neighborhoods in Washington with high populations of AIAN residents (UIHI, 2012). The researchers found that the AIANs in King County, WA, had higher obesity rates (36.3%) than the general population (20.1%) (UIHI, 2012). The study also found gaps to accessing healthy foods in the neighborhoods with the lack of stores that were accepting WIC and the lack of farmers markets (UIHI, 2012). The recommendations included future studies to investigate purchasing patterns, healthy food intake, and access to traditional foods. They also recommended future studies to investigate if greater access to healthy foods encourages people to eat healthy (UIHI, 2012).

Digital storytelling (DST)

DST consists of visual narratives incorporating images, audio, and video that are typically 3 to 5 minutes in length. Although digital stories have become popular, their potential as a tool for public health to promote individual and community health has not

been fully explored (Cueva, Kuhnley, Revels, Schoenberg, Lanier, & Dignan, 2016b). Digital stories are beneficial to health promotion research and help promote conversations among community members to address health issues of concern (Gubrium, 2009). Briant and colleagues (2016) interviewed promotores who reported that DST was helpful with disease prevention awareness and education, and had emotional benefits in addition to being applicable towards capacity building. DST has also been identified as an alternative approach to understanding health care by its application in a training program for nursing students (Petty, 2017).

Indigenous DST are those stories created for indigenous communities by indigenous peoples (Iseke & Moore, 2011). The storytelling negotiates social priorities and current needs, illustrates viewpoints of the community, and works to safeguard the values and norms of the community. Opportunities are also created for indigenous youth to use digital storytelling as a means to become agents of social change and understand their identity (Iseke & Moore, 2011).

The limited evaluation research available shows that Indigenous communities have investigated some potential effects of DST in public health. An Alaska Native community health project focused on cancer research showed that DST was a culturally respectful way to support learning and inspires behavior change among community health aides (CHA's) (Cueva, Kuhnley, Lanier, Dignan, Revels, Schoenberg, & Cueva, 2016a). Two projects with Alaska Native CHA's investigated community members' perspectives about digital storytelling after viewing the stories and found it was culturally appropriate, created opportunities for conversing, healing, and transformation, and helped

increase understanding of the health topic as well as intention to change health behavior (Cueva et al., 2016b; Cueva, Kuhnley, Revels, Schoenberg, & Dignan, 2015).

Theories and curriculum development

Social Cognitive Theory (SCT)

The SCT offers a framework to explain reciprocal relationships between behavioral, personal, and environmental factors (Damman & Smith, 2011). Based on the SCT, the three factors that affect change in individual behavior are: 1) self-efficacy, 2) goals, and 3) outcome expectancies (Rimer, Glanz, & National Cancer Institute, 2005). Bandura (1998) defined perceived self-efficacy as, "beliefs in one's capabilities to organize and execute the courses of action required to produce given levels of attainments." Self-efficacy is influenced by mastery, modeling, social persuasion, and managing emotional states (Bandura, 1998). The theory explains that health is influenced by social and individual level factors (Bandura, 2004), and health behavior is impacted by the negative or positive reinforcements from the social environment (Beverly, Miller, & Wray, 2008; Pollard, Zachary, Wingert, Booker, & Surkan, 2014).

Based on the theory, the DST food system curriculum will provide activities to increase self-efficacy and emotional coping to change behaviors. The goal is to motivate participants to participate through support from the environment, including social support and access to resources. Once behavior change is adopted through skill building and practice, the participants theoretically will be motivated to change their own environment by taking part in activities such as home gardening or joining a community garden.

Indigenous Theories of Change

Indigenous theories of change are described by Tuck (2009) as an intimately bound connection of four epistemological shifts, sovereignty, contention, balance, and relationship, which represent equal components within a circle. The theory is developed from Tuck's participatory action research work with youth, her own experience and knowledge of Indigeneity, and readings from Indigenous authors such as Vine Deloria, Jr. and Taiaiake Alfred (Tuck, 2009). Sovereignty is defined as a "a call for recognition and full realization of rights to social, cultural, and spiritual (tribal) identities and to our own envisioned political development" (Tuck, 2009, p.56). Contention is a, "process of individual and collective self-education" and "a process of interrupting hegemony, linearity, and unilateralism" (Tuck, 2009, p.57). Balance is a necessity "for distributions of knowledge and responsibility within a collective" and "a process of decolonization" (Tuck, 2009, p.60). Relationship is defined as, "among, within, between, a collective us," and begins with the group, rather than the individual, and moves beyond retaliation to "envision a future from a position outside of our…degradation" (Tuck, 2009, p.62).

In relation to sovereignty, the curriculum will include components that ask families to think about and realize their rights to social, cultural, and spiritual identities in light of living in an urbanized and highly stressed non-AI culture. Contention will also be included as a process of knowledge attainment that encourages people to think about and challenge the dominant colonial systems that work to make people unhealthy. Balance is a component in the DST food system curriculum that will help AIs make important decisions about their individual and collective health. The curriculum will be used to motivate and help people dig into the deeper truths found within their family histories,

culture, environment, and personal strengths to make the changes that will restore health at different levels. Relationship will be applied in the DST food system curriculum by asking families to map their perceptions of the relationship between a healthy and unhealthy food system within the context of physical, mental, spiritual, and emotional health.

CHAPTER 2
URBAN AMERICAN INDIAN FOOD SYSTEM

Overview of the present study

This dissertation is summarized in the following sections, with additional information provided in the three papers attached in the appendices. The methods, results, and conclusion for each Aim can be found in the papers but some analyses not included in the documents are provided below.

Methods/study design

This study used a mixed methods approach, including: 1) a secondary data analysis of existing quantitative and qualitative data from the TIC Community Health Assessment (CHA), and 2) a qualitative analysis of primary data collected from an evaluation of the DST food system curriculum. The design for data analysis is explained below.

Secondary analysis of existing data from the TIC CHA

The TIC CHA was conducted between October 2015 to May 2016 and included a cross sectional survey from AIs who use TIC services and attend TIC sponsored events. The lead for the collection of the primary data was TIC Health Promotion staff Roy Fallstrom. The CHA primary data was collected to understand the local food system and identify strategies to address childhood type 2 diabetes and obesity. The primary data

from the health assessment included demographics and self-report of access to healthy food, food insecurity, sources of food support, barriers to consume F/V, frequency of children and adult consumption of healthy foods (2-17 yrs old, adults 18+), family income, and body mass index (BMI) (children 2-17 yrs old, adults 18+). The author of this dissertation made a request to the TIC to conduct a secondary data analysis of quantitative and qualitative data. Quantitative data for AI adults included demographics, access to healthy food, food insecurity, food support, consumption of F/V, and BMI.

The TIC CHA included primary qualitative data from three focus groups, two community asset mapping sessions, and two community input gatherings. The focus groups had participants from community leaders working in various areas with the local food systems. Additionally, TIC staff member Roy Fallstrom, was the lead for collecting the qualitative data. The primary data focuses on collaboration opportunities, resources, and root causes of challenges and strategies/opportunities in the local food systems to support AI community members to prevent childhood obesity and type 2 diabetes. Focus group data was used to understand perceptions of the root causes of challenges and strategies/opportunities in the existing food systems to prevent childhood obesity and type 2 diabetes. Two community asset mapping activities identified the key functions of local food system and resources that can prevent childhood obesity and type 2 diabetes. Two input gatherings collected feedback from the general AI community regarding health assessment outcomes, and ideas for a long-term action plan that supports prevent childhood obesity and type 2 diabetes. The author identified strategies in negotiating food systems that support food access and food security from the key themes and patterns identified by the analysis.

Developing and evaluating the DST food system curriculum

The author identified five adults, 18 years old and older, who actively participated in TIC events to join the digital storytelling (DST) team. Team members were recruited by purposeful sampling to represent a mixture of gender and age groups. Potential team members were interviewed for approximately 2 hours to ask their perception about the urban AI food system (Appendix D). Team members were reimbursed for parking and received a $20 gift card for their interview. The interviews were transcribed and analyzed. The author worked with DST team members for 4 hours to create the DST food system curriculum. The final curriculum consisted of seven 1-hour lessons that included a 3-5 min digital story and handout with discussion questions and activities based on the key learning themes from the analysis. Team members were reimbursed for parking and received a $40 gift card to participate in the DST training and create their digital story. The PI has 10 years of experience creating digital stories and utilized a shortened DST training process for this project to meet the timeline set for the study.

The SCT and Indigenous theories of change were used to design the DST food system curriculum. The SCT explains a continual process in which human behavior, personal factors, and environmental factors influence each other (National Cancer Institute, 2005). Indigenous theories of change highlight the connection between four epistemological shifts, sovereignty, contention, balance, and relationship, within a circular model that affects the likelihood of change (Tuck, 2009). The premise is for the DST curriculum to affect behavior change using culturally responsive research and methods to enhance understanding and experiences for urban AI community members who participate. The DST videos allow community members to share personal stories

that are relatable and culturally responsive to the needs of community members. The stories share strategies to make individual behavior changes and support AI community members to become advocates in the political or environmental system. The DST curriculum offers strategies such as community gardening as a way to connect individuals and families with sustainable food practices and cultural food knowledge and skills.

A CAB of seven adults, 18 years old and older, was formed to guide project activities. Five of the CAB members took part in the Seeds of Wellness CAB in 2007 to 2009 and GROW NATIVE CAB in 2009 to 2015 and two were new community members who joined the CAB. Concurrently, three of the CAB members also served on the DST team. The CAB members volunteered their time and included representatives from the UA, TIC, and AI community. The CAB helped ensure that the project was ethical and culturally appropriate for the AI Tucson population. The participants in the CAB were invited to attend five meeting (1.5 hours each) for three months for a total of 7.5 hours. The CAB first met after the draft digital stories and handouts were completed by the DST team and prior to the feedback interviews and focus groups. They assisted the author in creating the DST feedback evaluation guides (Appendix D) and in subsequent meetings they helped develop and review the food system corn model and the final DST food system curriculum. Each CAB member was given a $15 giftcard for attending each meeting.

The feedback interview questions for the DST team were developed by the author and shared with the CAB for modifications and approval using a group consensus approach to decision making (Appendix D). The draft DST food system curriculum was shared with the team members during interviews for feedback before it was finalized. The

interviews, 1-2 hours, were conducted with each member on the DST team to document participants perspectives on: 1) how the constructs of the SCT are applied in the DST curriculum to negotiate the food systems for supporting access to healthy food and food security, 2) applicability of DST curriculum for the general urban AI community, 3) cultural appropriateness of the DST curriculum for AI community; 4) suggestions for future lessons or digital stories, and 4) feedback on experience/perspective in making digital stories (i.e. worries/concerns and interesting part of process). DST team members were reimbursed for parking and received a $20 gift card for their time.

The focus group questions to review the DST curriculum were developed by the author and shared with the CAB for modifications and approval using a group consensus approach to decision making (Appendix D). Three 2-hr focus groups were conducted with the DST team, AI elders, and AI community members. Focus group questions asked participants' perspectives on: 1) what was learned and how SCT constructs are applied in the stories to negotiate the food systems for supporting access to healthy food and food security, 2) applicability of lessons and digital stories for the general urban AI community, 3) cultural appropriateness of the DST curriculum for the AI community; 4) suggestions for future lessons or digital stories, and 5) intent to change health behaviors as a result of viewing the digital story resources. Participants in the focus groups received an incentive that promoted healthy living, e.g. healthy recipe books, cooking utensils, and snacks were provided. Participants also received a $15 giftcard.

Data analysis

Quantitative analysis—documenting food access and food security, and influence of social determinants of health

The secondary data analysis of quantitative data from the TIC CHA was conducted with IBM SPSS Statistics for Mac, version 24.0 (IBM Corp., Armonk, NY). Significance was measured at $P<0.05$. The descriptive demographic data included categorical data, e.g. gender, employment, calculated with percentages and frequency counts, while continuous data, e.g. age, was calculated with means and standard deviations. Quantitative categorical data was analyzed with Fisher's exact test (McDonald, 2014). Binary logistic regression models examined relationships between BMI, food access, and food security. Adjusted and unadjusted models stratified by gender are shared with odds ratio calculations. Models were adjusted for employment, marriage, and education. Please see Appendix A for a complete description of analysis.

The variables for food security, food access, BMI, and F/V were dichotomized and categorized as follows: 1) low food security was counted as "0" when experiencing only 1 indicator and "1" when experiencing two to six of the indicators; 2) low food access, measured by distance from grocery story or transportation access was counted as "0," and high food access was "1"; 3) low BMI was counted as "0" for normal/underweight status and "1" for obese/overweight status; and 4) low healthy food consumption was counted as "0" with having less than 5 servings of F/V.

Qualitative analysis—strategies and barriers using SEM

Secondary qualitative data analysis for the TIC CHA included requesting the transcripts from TIC and analyzing data with QSR International's Nvivo 10 Software (QSR International Pty Ltd, 2017). Deductive thematic analysis was conducted with four factors, e.g. individual, interpersonal, community, and environment, from the social ecological model (Rimer, Glanz, & National Cancer Institute, 2005). Analysis was also

driven by inductive analysis for emerging new themes and patterns the identified strategies and barriers. See Appendix A for a complete description of analysis.

Qualitative analysis—developing urban AI food system model

Secondary data analysis consisted of using the same transcripts mentioned above and analyzing data with QSR International's Nvivo 10 Software (QSR International Pty Ltd, 2017). Deductive thematic analysis was conducted with variables from a previous food systems model (Neff, 2005). Analysis was also driven by inductive thematic analysis for emerging new themes and patterns. Please see Appendix B for a complete description of analysis.

Qualitative analysis—evaluating development and application of DST curriculum

The analysis for primary qualitative data, e.g. feedback interviews and focus groups, collected from the DST development and evaluation included deductive and inductive thematic analysis. All data was transcribed by the author. The author and a second coder independently coded transcripts from 2 interviews and 1 focus group using the parent themes identified from the AI food system model variables described above as well as SCT constructs. New codes were created and consensus was built for conflicting codes. A final code book was created and included the parent themes from the AI food system model, SCT constructs, and emerging themes and patterns that were identified by the author and second coder. The author and second researcher used the new code book to code 20% of a random sample of the qualitative data, and consensus was reached for conflicting codes. Codes were entered into NVivo 10 software as parent nodes and the author then coded all data using the final codebook. Deductive analysis was applied to the interviews and focus groups based on the AI food system variables and SCT

constructs. Inductive analysis was applied to identify emerging themes and patterns. Key themes included applicability, cultural appropriateness, and experience and perspective making or viewing the resources. See Appendix C for a complete description of analysis.

Results

The three papers attached in the appendices include the results for this study (Appendices A-C). The results for Aim 1 presented below are not included in paper 1.

Specific Aim 1: Document urban AI adult food access, food security, body mass index, and barriers and strategies in using Tucson, AZ's food system to explore social determinants of health that impact food availability and accessibility.

Hypothesis 2: Food security status will be influenced by overweight/obese status and social determinants of health, including education, income, food access, F/V consumption, and food support.

- Adults experiencing low food security were more likely to receive food support ($P<0.000$) and have a status of overweight/obese ($P<0.036$) compared to adults who did not experience low food security. Additional results are shared in Paper 1.

Hypothesis 4: Overweight/obese AI adults will have a relationship with food security different from non-overweight/obese AI adults

- The following table was not included in Paper 1 but results were shared.

Table 3. Odds ratios (OR) representing relationship between overweight/obese status by food access and food security among American Indian adults, 2015-2016

	Overweight and obese					
	Total		**Females**		**Males**	
	% (n/N)	Adjusted OR (CI)	% (n/N)	Adjusted OR (CI)	% (n/N)	Adjusted OR (CI)
No vehicle access	36 (95/263)	.931 (.478, 1.811)	43 (73/168)	.684 (.272, 1.718)	23 (22/95)	1.707 (.434, 6.713)
No public transportation access	49 (128/263)	.929 (.449, 1.920)	45 (75/168)	.627 (.251, 1.568)	56 (53/95)	.559 (.166, 1.885)
Lives more than 1/2 mile	71 (184/262)	.698 (.434, 1.742)	72 (121/167)	1.068 (.435, 2.623)	66 (63/95)	1.513 (.518, 4.421)
Low food security	71 (187/263)	**2.002 (1.008, 3.975)**	72 (121/168)	1.505 (.608, 3.726)	70 (66/95)	**3.129 (1.043, 9.386)**

*Boldfaced values indicate P <0.05
Models were adjusted for employment, marriage, and education
OR, odds ratio

CHAPTER 3
CONCLUSION AND RECOMMENDATIONS

The three papers presented in this dissertation offer a unique insight into food insecurity and food access barriers experienced by AIs in Tucson, AZ. The papers present potential strategies that can be used to address social determinants of health that influence the food system. In addition, a conceptual model of the Tucson AI food system was developed with the guidance of a CAB and the perspectives of AI community members. The model offers opportunities to identify resources and key players within the Tucson food system. The study also offers an innovative tool to build food security and food access through the application of a DST food system curriculum.

Paper 1 provided evidence of the high prevalence rates of food insecurity and low food access experienced by urban AIs in Tucson. The data offers information to address gaps in existing knowledge about social determinants that influence food access and

security. Specifically, 71% of AIs in the sampled population experienced low food security, 70% lived more than 0.5 mile from a full-service grocery store, and 37% did not have access to personal vehicles. These alarming rates support the need to create public health interventions that can address current health needs. An ecological framework was applied and a new understanding of barriers and strategies of the urban AI food system and the influence of social determinants emerged. This study identified social determinants that prevent urban AIs from accessing healthy food, including loss of healthy social norms. Strategies to promote food access specific to the community are also proposed, including culture sharing. The findings in Paper 1 are specific to the Tucson urban AI population but they may offer insight into food access and food security issues experienced by AIs in other urban areas around the Southwest. Barriers and strategies identified in this study could benefit policy makers who can form effective approaches to build a healthy food system that includes the perspective of urban AIs.

Paper 2 built upon knowledge and perceptions from AI community members who offered their narratives of the food system through focus groups, asset mapping sessions, and community input gatherings. These dynamic stories and experiences were analyzed by the author and a CAB to identify and document the interconnections of social and cultural determinants between health, culture, social influence, and the environment. A qualitative analysis was applied to a develop a conceptual model of the Tucson AI food system. The model offers one of the first understandings of the Tucson food system from the perspective of AI community members and can serve as a framework for policy development or future interventions.

Paper 3 provided an innovative approach to understanding and teaching the functions of the urban AI food system to community members through the DST resources. The DST resources were developed by community members who shared stories of experiences and strategies learned to navigate the Tucson food system to build food security and access for healthy food. An analysis of the feedback interviews from the DST team and community members who reviewed the curriculum showed how the food system curriculum could influence social determinants through behavioral, personal, and environmental changes among AI community members. The findings provided key themes that illustrated how the curriculum had remarkable potential to be a catalyst to increase interest in the food system and motivate community members to make change. The key themes included SCT constructs within the DST resources; applicability or cultural appropriateness for the targeted audience; and experiences/perspective of AI adults who created and/or viewed the DST resources. The participants felt changing social norms and social influence by demonstrating healthy lifestyles would motivate others to make changes in their own lives. After viewing the DST resources, focus group participants expressed that people have the power to change by supporting one another and bringing back family norms and values. Organizational support is also needed to create change, such as bringing the community together through gatherings and food. During the focus group, participants became engaged in discussions about food access, addressing physical barriers, changing distribution sites, and thinking of policy.

To undertake this study, it was essential to create collaborative partnerships with the TIC and AI community members. By following a CBPR approach, a CAB was created and was instrumental in helping design the DST curriculum, contribute feedback

to the study, and provided resources that would not have been otherwise utilized. Collaborative CBPR partnerships support research though various outlets including encouraging community members to participate and informing them about the project. The CAB did not participate in data collection, but it offered a unique perspective about the challenges and opportunities that exist in the community to build food security and food access. Additionally, the CAB helped generate feasible strategies to include in the DST curriculum to help address the barriers for accessing healthy food choices. Furthermore, the CAB helped ensure that the study was ethical and culturally appropriate for the population.

Limitations

Some of the key limitations of this study included the self-reported data from the TIC CHA that could bias the results; accuracy of participants' responses could not be verified. The sampled population for each study was also small, challenging the application to the overall urban AI population. Additionally, not having the opportunity to triangulate results for Paper 3 created a limitation. The analysis could have benefited from a short quantitative survey that measured SCT constructs or observational research to identify body language and other ethnographic data from participants who experienced the DST food system curriculum.

Another possible limitation was allowing three DST team members to join the CAB introducing potential bias since they each created the digital stories; however, this may be offset by the fact that two of the DST team members are elders who had been previous CAB members of three CBPR projects with TIC including an elders' resilience project (Whitewater, Reinschmidt, Kahn, Attakai, & Teufel-Shone, 2016). The elders'

project found that allowing urban AI elders to have flexible roles, e.g. serving on the CAB and being interviewed, was a positive way to engage elders and benefitted the project in various ways (Whitewater et al., 2016).

Limitations in Paper 3 also included the short training time to develop digital stories. In addition, some of the DST team members were older adults who were not as familiar with technology and modifications to DST training had to be made by the author to ensure videos and handouts were completed by the set timeline. To overcome this limitation the trainer ensured the script came from the participant and created a full draft of the digital story based on the script. The participants reviewed the draft digital story and offered their feedback on the editing process. Participants had the choice to provide their own photos or gave permission for the lead author to choose the photos and they could decide where they can be placed. One DST team member who was younger did his own editing. He was not familiar with the editing software but after a few training sessions he learned to use program.

Implications for Family and Child Health

In recent studies, high obesity and overweight status were reported among urban AIs, including children (CDC, 2016; CDC, 2017; UIHI, 2011). Approximately 81% of the total participants in this study had a status of overweight/obese, which is quite alarming. In addition, having overweight/obese status was associated with low food security ($P<0.036$). These rates strongly indicate that individuals and families are being impacted by multi-level factors influenced by social determinants of health. To address these rates, policy is needed to support parents, grandparents, and caregivers to increase their food security and access to heathy food.

This study demonstrates the importance of designing interventions to target social determinants that impact AI adult females. Results had a strong representation of females that indicated AI females were more likely to not have access to personal vehicles, receive food support, have lower educational attainment, and have lower household incomes than AI male participants. In food systems studies, there is strong indication that females play an important role in making food decisions for the family and they are vulnerable to various social issues. Lemke and Delormier (2017) describe how gender inequality is a determinant of food insecurity for indigenous women locally and globally. In particular, structural violence and cultural violence create structural conditions that cause women to have less access to land, credit, education, and other important services (Lemke & Delormier, 2017). Understanding how gender inequality plays a role in the urban AI food system will support future interventions to become aware of structural conditions and find strategies to address them.

Relationships are a central component of food systems and include the important roles of the family unit and community. AI community members in this study shared they wanted stronger social connections and support in finding ways to come together as community to address health, social, cultural, and economic concerns. Many of the strategies shared in the results, particularly in Paper 2, propose ways to build family and community cohesion around the food system, including revitalizing agricultural practices. Gardening was one strategy identified multiple times by participants as a way for them to maintain cultural ties to the land and promote family and community cohesion. Cajete (2000) supported this strategy in his work by stating that gardening offered community

space to build social networks, increase community activities, and were important for ceremonial reasons.

The AI food system conceptual model identifies historical shifts and creates opportunities for the revitalization of traditional roles, including specific roles for men, women, children, and grandparents. These strategies include gardening as a family or offering a positive environment that promotes encouragement and motivation among family members. In this study, the roles of parents, children, and grandparents were identified and demonstrated the intricate relationships of children connecting with grandparents to learn their knowledge, life lessons, and support them with food projects. Parents served as role models and provided support, nurturing, and education for their children to build strong identities, work ethics, and values to maintain balanced and healthy lives. The DST curriculum offers stories based on these themes and can be used to leverage these specific roles in the urban AI community to support relationships and balance.

Overall, this study identifies a strong need for policy to address social determinants from individual to environmental levels. In particular, policy could support a built environment that promotes AI agricultural practices and opportunities for families to plant traditional foods that could potentially be used as a means of income and economic development. Businesses development related to gardening would greatly help the Tucson AI community financially due to the reported high rates of poverty and low educational attainment. Finding ways to support economic development and income among the AI population would help increase food security.

Recommendations

Based on the positive feedback and results from the participants who reviewed the DST food system curriculum, efforts are needed to continue a collaboration with the TIC to design and implement a larger study. Such a study is needed to fully investigate and evaluate the entire DST food system curriculum and could include a larger sample. The new study could build upon the recommendations made through the interviews and focus groups. Some key recommendations included enhancing the curriculum by keeping the handouts short and simple and making them more visually appealing. To make the videos more appealing, the participants suggested adding more content such as historical facts and stories that can help participants visualize future projects and how policies influence their environment. In addition, videos need to include more background settings and action shots rather than just having participants sitting and talking. Better recording and video equipment are also needed. The focus group participants recommended making the stories easily accessible to youth and writing the stories down and sharing them in other media outlets. Overall, the author recommends future food system studies incorporate digital stories due to the evidence found in this study that illustrates the benefits of a DST curriculum influencing health and well-being.

This study was designed primarily for the TIC and the community members who attend their events but other urban AI centers and communities could build on the results and curriculum as a framework or foundation for future food system projects. Oftentimes research and data are not shared in an effective manner to allow communities to build on existing knowledge and data to support new projects or research opportunities. Overall,

the CAB and author of this study support sharing the curriculum and offering advice for others who wish to build upon this study.

The findings from this study, particularly the AI food system model, identified important stakeholders who help shape and influence food access and food security. Future interventions should build collaborative partnerships with these stakeholders. One key stakeholder includes the Pima County Food Alliance, a grassroots organization that focuses on developing food policy in Tucson based on community needs (Pima County Food Alliance, 2018). In particular, potential university partners like the UA and MEZCOPH could provide technical support in terms of research, education, advocacy, training, and policy development. This opportunity could offer a reciprocal beneficial relationship between community members and university staff/students/faculty. Oftentimes university partners are interested in research opportunities and students need experiential learning opportunities, which could be provided through food systems research or service projects. Overall, using a CBPR approach would support these efforts and could help maintain existing and beneficial research partnerships with community organizations like the TIC.

Lastly, this study recommends future food system projects include cultural based strategies that support aspects of the Indigenous theories of change, including: 1) sovereignty related to food justice and revitalizing cultural food systems in urban areas, 2) contention to challenge existing food systems that promote food insecurity and limit access to healthy food, 3) balance for individual and collective health, and 3) relationship to understand healthy and unhealthy connections to food systems. These concepts are integral to AI education and lifeways that can bridge historical and contemporary urban

food systems. Future research can investigate cultural strategies, including understanding access to traditional foods in urban environments and determining if accessing traditional food encourages healthy eating behavior. Ultimately, the goal is to support AI community members to revitalize historical food systems and build upon existing knowledge to maintain traditional lifeways that support healthier communities within urban settings.

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APPENDIX A: MANUSCRIPT 1

Barriers and strategies to promote food access and food security among urban American Indians

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Barriers and strategies to promote food access and food security among urban American Indians

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The prevalence of food insecurity and associations of food access for urban American Indians (AI) were investigated using close-ended surveys (N=275). An ecological framework was used to interpret the data to understand barriers and strategies related to food access. Results indicated high rates of food insecurity and low food access. Barriers included personal beliefs of hopelessness and loss of healthy social norms. Strategies to promote food access proposed by respondents included culture sharing and building a sense of community. These strategies could be shared with policy makers' to inform their approaches to building urban healthy environments for diverse residents.

1. Introduction

Urban American Indian (AI) challenges with food insecurity and food access are timely public health concerns due to the growing urban AI population and persistent rates of health disparities. This study uses quantitative and qualitative secondary data from the Tucson Indian Center's (TICs) Community Health Assessment (CHA) to explore the gaps in urban AIs food access and food security, and associated strategies and barriers described by interviewed community members.

Food insecurity is defined as having limited availability or ability to acquire nutritional and safe foods (Southwest Interdisciplinary Research Center (SIRC), 2011). The US Department of Agriculture (USDA) classifies households as food insecure if three conditions are met: 1) they worry about food shortage before they get money, 2) if food did not last after purchasing, and 3) if they are unable to afford balanced meals (USDA,

2018). Food access does not have a formal definition, but has been described as the proximal distance or ability to reach food sources that are affordable and healthy and/or having the income to buy healthy food (Hodgson, 2012). Food accessibility indicators include distance to a large grocery store or supermarket, or individual resources such as income and/or availability of personal vehicles or public transportation (USDA, 2009).

While existing literature has reported overall food insecurity rates of US households, studies assessing rates of urban AI food insecurity are limited (Blue Bird Jernigan et. al., 2017; Tomayko et. al., 2017; US Commission on Civil Rights, 2003). Those available sources indicate that urban AI households face higher rates of food insecurity than non-urban AI households. In a nationwide study merging urban and non-urban AIs, this population is two times as likely to be challenged with hunger and food insecurity than the general US population (US Commission on Civil Rights, 2003). Tomayko et. al. (2017) reported the prevalence of food insecurity for urban AI households was 80% compared to 45% for rural AI households using baseline data collected between 2013-2015. Another study analyzed 2009-2010 data from the Current Population Survey-Food Security Supplement national survey and found that urban AIs were 1.4 times more likely to be food insecure than AIs who did not live in metropolitan areas (Blue Bird Jernigan et. al., 2017).

Studies that disclose rates of urban AI food access are also limited. The existing literature illustrates how despite living in environments that offer opportunities for improved food access, urban AIs face challenges with grocery store access and transportation

(Companion, 2013; Tomayko et al., 2017). In a study with urban AI households, the median distance to grocery stores was 2.2 miles (Tomayko et al., 2017), which falls within low food access range (USDA, 2009). Companion's (2013) food study with 37 urban AIs revealed that only 2 respondents owned a car and none of the respondents were within walking distance or one bus ride away from a full-service grocery store. Individuals who rode the bus faced challenges with safety, weather, transfer time along routes, food spoiling, and having limitations on the amount of food they could carry. The challenges with food access may be connected to living in areas considered food deserts (Tong, Buechler, & Bao, 2016; Ver Ploeg, Dutko, Breneman, 2015) and not having personal transportation (USDA, 2009).

In 2016, Tucson, AZ had an estimated population of 527,586 of which 15,077 (2.9%) identified as American Indian and Alaska Native (AIAN) alone and 19,903 (3.8 %) identified as AIAN combined with one or more other races (U.S. Census Bureau, 2018). The Tohono O'odham are the original indigenous inhabitants of the area and make up a large proportion of the Tucson urban population (Buehman, 1911; City of Tucson, 2018). In addition, many AIs migrate to the city in search of career and educational opportunities, as evidenced by the various tribes, Navajo, Cherokee, Chippewa, reported living in Tucson by US Census Bureau (2018). The Urban Indian Health Institute (UIHI) Community Profile (2017) analyzed aggregated data from 2010-2014 and reported that AIs in Pima County, locale of Tucson, AZ, have higher rates of poverty (42.4%) than non-Hispanic Whites (12.7%). In addition, AIs aged 25 and older had a greater percentage (25.2%) of not having a high school diploma compared to non-Hispanic

Whites (5.4%) (UIHI, 2017). Only 47.7% of AIs were homeowners, compared to 67.8% of non-Hispanic Whites (UIHI, 2017). A greater percentage of AIs lived in renter occupied homes (52.3%) compared to non-Hispanic Whites (32.2%) (UIHI, 2017).

Tucson AI specific rates for public transportation use and private vehicle ownership have not been reported. Based on national studies, low-income populations are less likely to own vehicles (USDA, 2009), thus low-income AIs in Tucson may have trouble accessing personal vehicles for activities such as purchasing food. Tucson is a sprawling, geographically widespread city with an aging infrastructure that presents walkability and public transportation barriers particularly for low-income residents (City of Tucson Department of Urban Planning and Design, 2006; Ingram & Adkins, 2018). Tong, Buechler and Bao (2016) found that Tucson had many food deserts, defined by the USDA (2018) as, "urban neighborhoods or rural towns without access to fresh, healthy, and affordable food." A higher percentage of food deserts were reported in downtown Tucson and in South Tucson (Tong, Buechler, & Boa, 2016), which has historically been the location where most AIs resided as Tucson developed (Blaine & Adams, 1981). The UIHI (2017) reported that approximately 31.5% of AIAN households in the Tucson Service Area of Indian Health Service (IHS) received Supplemental Nutrition Assistance Program (SNAP) benefits based on data collected from 2010-2014. The rates of food security and food access for urban AIs in Tucson are not known in existing literature.

Health behaviors are influenced by the social and cultural determinants of health (Clark & Utz, 2014; Hill, Nielsen, & Fox, 2013) and are shaped by a multilevel interaction of

intrapersonal, interpersonal, and community level factors in the food systems. Understanding these interactions for urban AIs is needed to inform public health practitioners, researchers, and policy makers of barriers and potential strategies to address food insecurity and food access among this vulnerable population. Using an ecological framework to understand individual to environmental influences that facilitate or obstruct traditional food consumption in indigenous communities can inform strategies and policies designed to improve access to healthy foods (Gaudin, Receveur, Girard, & Potvin, 2015).

This study, designed to understand food access and security for AIs living in Tucson, was guided by the following questions:

1. What is the prevalence of and relationship between food insecurity, food access, and fruit/vegetable (F/V) consumption among urban AIs in Tucson, AZ?
2. What are the barriers and strategies for food access and food security from the perspective of AIs in Tucson, AZ?

2. Methods

This study used a mixed methods approach collecting quantitative and qualitative data that explored the existing barriers and strategies for accessing healthy food and promoting food security. The lead author completed a secondary analysis of existing data collected through the TIC CHA, funded by the Notah Begay III (NB3) Foundation Seeds of Native Health project. The CHA was conducted from October 2015 to May 2016 by the TIC and consultants, including the lead author, from the University of Arizona Mel

and Enid Zuckerman College of Public Health (UA MEZCOPH). The CHA sample is comprised of self-identified AI adults, 18 years and older, who resided in Tucson, AZ and completed a cross-sectional survey, focus group, asset mapping sessions, and/or a community input gathering. Additional CHA data was collected from two focus groups with stakeholders who were non-AI and AI adults. AI participants were recruited at TIC events and workshops. The UA Human Subjects Institutional Review Board approved the secondary analysis of existing quantitative and qualitative analysis.

2.1. Quantitative component

Measures

CHA survey questions were developed by the TIC staff and consultants to assess risk factors that related to preventing urban AI childhood type II diabetes, the health focus of the NB3 Foundation grant (Notah Begay III Foundation, 2015). The lead author obtained permission from the TIC to analyze de-identified data related to the assessment of food insecurity, food access, and F/V consumption, used as an indicator of healthy food access.

Demographic information was collected including age, employment, marriage status, education, number of children living with an adult, and income. Family income was self-reported and dichotomized into low-income/not low-income. Based on the 2015 federal poverty guidelines (US Department of Health & Human Services, 2018), low-income was defined as having an income less than $25,000 for a family of four.

Obesity status was assessed from self-reported height and weight measurements allowing a calculation of body mass index (BMI). BMI was dichotomized into obese/overweight and normal/underweight using standard weight status categories by the Centers for Disease Control and Prevention (CDC) Adult BMI Calculator (CDC, 2017). Based on the USDA approach used in the report on Access to Affordable and Nutritious Food (USDA, 2009), food access was assessed using the reported distance between residence and a full-service grocery store. Following the recommendations of the USDA report, this study also assessed if adults had access to a vehicle or public transportation. Low food access was defined as living more than 0.5 mile from a full-service grocery store and high food access was defined as living 0.5 miles or less from a full-service grocery store (USDA, 2009). Another determinant of low food access was not having access to a vehicle to go grocery shopping (USDA, 2009). A neighborhood level measurement of low food access was not having access to public transportation (USDA, 2009).

Food security was measured using the six-item U.S. Household Food Security Survey (USDA, 2012). Low food security was defined and measured as experiencing between two to six of the indicators for food insecurity: 1) Food I bought didn't last, and I didn't have money to get more, 2) I couldn't afford to eat balanced meals, 3) In the last 12 months, I cut size of meals or skip meals because there wasn't enough money for food, 4) If yes, how often? 5) In the last 12 months, I ate less than I felt I should because there wasn't enough money for food, and 6) In the last 12 months, I was hungry but didn't eat because there wasn't enough money for food.

Measurements for F/V consumption were taken from the seven-item Healthy Food Consumption scale (NutritionQuest, 2017). Low healthy food consumption was defined as having 5 servings or less of F/V. Federal guidelines recommend that adults should consume 1.5–2.0 cup equivalents of fruits and 2.0–3.0 cups of vegetables per day (Lee-Kwan, Moore, Blanck, Harris, & Galuska, 2017).

Data Analysis

Descriptive demographic data was summarized. Fisher's exact test (McDonald, 2014) was used to analyze quantitative data to assess gender and age differences among food access, food security, and food support categories. Food security differences for selected demographic, food access, F/V consumption, food support, and obesity categories were analyzed with Fisher's exact test. Binary logistic regression models examined relations between food access, food security, and BMI categories. Models were adjusted for employment, marriage, and education, and significance was measured at $P<0.05$. Quantitative data analysis was conducted with IBM SPSS Statistics for Mac, version 24.0 (IBM Corp., Armonk, NY).

2.2. Qualitative component

Measures

The TIC staff and the first author of this manuscript developed culturally informed questions for focus groups, asset mapping, and community input gathering. This primary data was collected through notes and audio recording and later transcribed and de-identified. The lead author made a request to the TIC to conduct a secondary analysis of

the existing qualitative dataset to look at indicators that described the Tucson food systems and barriers and strategies for promoting food security and food access.

One focus group with AI adult participants posed the following questions: 1) What's the timeline (past, present, future) when the diet and lifestyle changed for AIs in Tucson? 2) Based on the timeline, indicate how AIs found and used or continue to use traditional foods in the past, present, and future? 3) Describe your traditional food shopping experience. Where do you go? 4) Do you know where your food comes from? 5) How would you describe the past, current, and future health of AIs in the Tucson community? and 6) What are the strengths in the AI community that help you eat healthy food?

Two focus groups with non-AI and AI stakeholders from the TIC, the UA, and non-profit organizations that address food security in Tucson posed the following questions: 1) What are your professional experiences in working with AI families? 2) What are your thoughts on the health issue of AI childhood type 2 diabetes and obesity? 3) What are the root barriers and causes of childhood obesity and type 2 diabetes in Tucson? 4) What about in the Tucson American Indian community? 5) How can we involve organizations and community members to take action?

The asset mapping questions asked AI adult participants to identify factors in their environment that are barriers or facilitators for preventing type II diabetes in AI children in Tucson. The community input gathering session asked participants to provide feedback and insight for results from the CHA survey.

Data analysis

The qualitative analysis for strategies and barriers for food security and access consisted of deductive-inductive thematic analysis of the data transcribed from the focus groups, community input gathering, and asset mapping (Braun and Clarke 2006). Deductive analysis was applied because factors were organized into four levels, individual, interpersonal, community and environment, using the social ecological model (SEM) (Rimer, Glanz, & National Cancer Institute, 2005). The data was not pre-determined to fit into factors of the SEM and analysis was driven by the data, thus inductive analysis was also applied. Codes were developed for the key concepts of the SEM and organized into a coding book, which was entered into NVIVO 10 software as parent nodes (QSR International Pty Ltd., 2017). The lead author coded all data and a second researcher independently coded 20% of a random sample of the data and built consensus for conflicting codes.

3. Results

3.1. Demographics of survey respondents

All respondents (N=275) were AI, with a majority female (64%) (Table 1). Overall, 69% had household income less than $25,000 and a high percentage (70%) of adults were not married (never married, divorced, separated, or widowed). Approximately half of the adults were under age 45 years old, had no children, and were not employed due to being out of work, retired, or a student. Approximately half (55%) of the adults had some college education or were college graduates. The female adults were significantly older

(P<0.000), more likely to not be employed (P<0.000), less likely to be college educated (P<0.002), and more likely to have an income between $10K to $25K than male adults.

3.2 Quantitative outcomes: Urban AI experiences with Food Access and Food Security

Adult females were significantly more likely to receive food support from one or more programs like the Special Supplemental Nutrition Program for Women, Infants, and Children

(WIC), SNAP, food commodities, or have children in reduced school meal programs than male adults (Table 2) (P<0.004). Females were more likely to not have vehicle access than males (P<0.001) (Table 2). Adults who were 45 years and older were significantly more likely to live more than 0.5 mile from a full-service grocery store (P<0.03) and have low food security (P<0.02) compared to those under 45 years old (Table 2). Overall, 49% of all adults received food support and 58% consumed less than five servings of F/V a day (Table 4). Consuming less than five servings of F/V was not associated with food access (data not shown). 71% experienced low food security, a rate considerably higher than the general rate reported for Arizona households (19%) (Arizona Department of Health Services (ADHS), 2014) (Table 2).

In adjusted models, males and females who experienced low food security were 13.6 times and 6.5 times, respectively, more likely to not have access to a vehicle than their respective genders who did not have low food security (Table 3). Based on adjusted models, males and females who had low food security were 6.0 and 3.7 times, respectively, more likely to not have access to public transportation than those who did

not have low food security (Table 3). Females who had low food security were 3.0 times more likely to live more than 0.5 mile from full service grocery stores than those females who did not have low food security (Table 3). No significant relationship was found between low food security status and living more than 0.5 mile from full service grocery stores for male respondents. Overall, 70% of the participants lived more than 0.5 miles from a full service grocery store and 37% did not have access to personal vehicles (Table 2).

Adults with low food security were significantly more likely to not be married, have low-income, and to have a high school diploma/GED or not have completed the 12th grade than those with high/moderate food security (Table 4). Additionally, they were also more likely to not have access to a vehicle or public transportation, and more likely to live more than 0.5 mile from full service grocery stores than their more food secure peers (Table 3). Those who had high food security were less likely to receive food support and not have a status of overweight and obese (Table 4). No significant relationship was found between low or high food security status and consuming less than five servings of F/V a day.

Overall, AI adults who were overweight or obese were 2.0 times more likely to experience low food security in adjusted models (Data not shown) (OR 2.002, CI 1.008, 3.975). In adjusted models, male adults who were overweight and obese were 3.1 times more likely to experience low food security than females who were overweight and obese (Data not shown) (OR 3.129, CI 1.043, 9.386). No significant relationship was found

between overweight and obese status and food access indicators of not having a personal vehicle, using public transportation, or living more than 0.5 mile from a full-service grocery story for males and females.

3.3. Qualitative outcomes: Urban AI experiences with Food Access and Food Security

Narratives were analyzed from one focus group with AI participants (N=15), two stakeholder focus groups with combined non-AI and AI adult participants (N=7), asset mapping sessions with AI participants (N=32), and a community input gathering with AI participants (N=35). The narratives offered stories of treasured heritage food from the past, first-hand accounts of how food has greatly shifted the current health status of many AIs, and ponderings of food and health for a future that is uncertain. Based on the SEM, the respondents offered individual to environmental level barriers and strategies that could promote food access and food security for AIs in Tucson. Table 5 lists additional barriers and strategies based on the SEM.

3.4 Individual level experiences

The individual level included personal beliefs, skills and knowledge, lifestyle, and preferences that create barriers to access affordable, healthy, and cultural based food. With regard to individual beliefs, some respondents mentioned they felt lost navigating the system to access healthy food and also felt daily challenges caused them to eat to cope with stress. Other barriers included lacking skills for problem solving, and preparing and cooking nutritional or traditional food. Lifestyle barriers included abusing alcohol or illegal substances, resorting to comfort eating when bored or stressed, and not having

family time for sharing healthy activities or meals. Some of the strategies mentioned to address these individual level barriers included increasing skills to maintain a garden and learning new skills for food preparation, such as incorporating a plant-based diet and not using sugar or salt when cooking.

3.5 Interpersonal level experiences

This level included social influence from family, elders, children, friends, and social norms that threatened and supported food security or food access. Some social barriers mentioned included elders not having opportunity to connect with their grandkids or being the ones responsible for raising their grandkids, and youth not having opportunities to build cultural identity. Some suggested strategies included elders attending church with grandkids to build connection and youth spending time with elders by offering service projects or making time to ask elders questions about culture and their life experiences. Other strategies included helping children produce homemade juice or smoothies and not buying sugary drinks or snacks. Barriers to healthy eating included unstable families characterized by poor parental relationships, inadequate parental and adult role models. Some strategies mentioned to strengthen social relationships included creating opportunities for opening dialogue to create healthy relationships and heal from past hardships.

3.6 Community level experiences

The community level included influences such as beliefs, relationships, schools, community space, and businesses that challenged food security and food access. The

barriers included community beliefs of expecting a poor future due to the loss of natural resources, potential wars, and food production issues. Some barriers to build community relationships referenced moving away from home communities and living in urban areas where connecting with other AI families was challenging. Strategies to promote healthy eating included creating community space for involvement and healthy food environments. One key strategy was to establish a group of community health champions to lead events and programs to build food security and food access.

3.7 Environmental level experiences

This level included influences of policies and the built environment as well as food access. Some barriers mentioned for the built environment included lack of safe community gardens, affordable housing, and afterschool programs. Some promotion strategies included creating laws and policies that support healthy food environments, such as installing healthy vending machines in businesses frequented by AIs and developing gardens for the AI community. Ideas for building a sustainable urban community included addressing water availability and land access to support gardening projects.

Food access barriers included having limited financial resources, long walking distances to food stores, and challenges in carrying groceries if no personal transportation was available. Strategies to support healthy eating included growing healthy food at home, including raising chickens, and attending Community Food Bank workshops to learn about low cost ways to garden and to get help with installing gardens.

5. Discussion

Low food secure adults were more likely to not have access to a personal vehicle and were more likely to live more than 0.5 mile from full service grocery stores. A high walkability range in urban areas is less than 0.5 mile, medium if it is 0.5 to 1 mile, and low if it is more than 1 mile away (USDA, 2009). Analysis suggests that not having a vehicle or distance is aligned with challenges related to grocery store access, including walking or driving to access stores. These findings support identifying ways urban AI families with low food security can use public transportation services and/or acquire vehicles.

Adults with low food security were more likely to have only a high school diploma/GED or have not completed high school. Educational programs that help prepare or support urban AIs to complete high school and enter college or trade school could strengthen urban AI food security. AI adults in this study with low food security were more likely to be single, divorced, or widowed indicating that single adult headed households face economic and social challenges to afford a consistent supply of food.

Overweight/obese AI adults were more likely to have low food security status, similar to the work with non-AI adults (Pan, Sherry, Njai, & Black, 2012). AI males who had overweight/obese status were more likely to have low food security than normal weight status AI males. This finding contrasts with previous reports of non-AI males that indicate food security is not associated with weight status for males (Hernandez, Reesor,

& Murrio, 2017; Pan, Sherry, Njai, & Black, 2012; Seligman, Bindman, Vittinghoff, Kanaya, & Kushel, 2007). Interestingly, overweight/obese status for adults in this study was not associated with access to a vehicle or public transportation or distance to a grocery store, which suggests that overweight/obese status is more closely associated with affording or maintaining a constant food supply than with distance or transportation access.

In this study, 42% of AI adults were eating 5 or more servings of F/V a day, which is higher than the reported rate of 25.2% for all adults within Arizona in 2014 (ADHS, 2014). Interestingly, F/V status was not associated with food security status. F/V consumption may be associated with other factors beyond those measured with the food security scale such as preference and knowledge of preparing or consuming F/V as well as availability or cost of desirable F/V in local stores.

This study documents gender and age differences in food access. Females reported getting more federal resources for food access and not having vehicle access than males, suggesting that females may be more comfortable accessing support or are more aware of social services. The disparity in vehicle access suggests that females encounter more transportation related barriers accessing food than males. AI adults who were 45 years old and older were more likely to live 0.5 mile from full service grocery stores and face low food security than adults younger than 45, suggesting that older urban AI adults and elders are a vulnerable age group and need extra support with transportation to acquire nutritious and safe meals daily.

The SEM was applied to the qualitative data to understand how food access and security is influenced by individual, interpersonal, community, and environmental factors (Table 6) (Damman & Smith, 2011; Rimer, Glanz, & NCI, 2005). At the individual level, key barriers included AI adults' beliefs and preferences to feel indifferent or not open to being healthy and making better food choices. Some adults shared that the determination to be healthy starts within oneself and this motivation could be fostered by strengthening cultural identity, exposure to new food, and making time to cook healthy meals. Personal beliefs about feeling hopeless or not feeling up to taking on responsibility to change the food environment was aligned with reduced interest in addressing barriers on the community or environmental level, such as school systems or within the built environment. Participants suggested parents need to share their voices at school meetings to strengthen health and food resources at schools. Another finding was the limited interaction between elders and grandchildren at the community level that influenced feelings of losing cultural identity and knowledge on the individual level, indicating a need to build intergenerational connection.

Social systems greatly influenced family members' decisions to be persistent with health activities or trying new healthy food. In addition, elders and children had important roles to strengthen food security and access, but they faced barriers to practice those roles in the city. Anecdotally, intra-group social support was also observed in the focus groups. This behavior could be promoted to foster encouragement to build, new food knowledge, and reinforce resources for community food programs.

Urban community members expressed unique issues to access traditional food because of distances to their tribal food sources. They felt that specialty cultural food in Tucson is expensive at stores such as Native Seeds Search (Native Seeds/SEARCH, 2018) or hard to reach at places like San Xavier Co-op, a co-op run by a board of directors who are Tohono O'odham plot owners (San Xavier Cooperative Association, 2018). Some suggestions included strengthening traditional food security through gardening in the city by reassessing land and water policy to support indigenous food production.

Participants mentioned a need to take action and develop policy to address barriers. They wanted to build community support, strengthen community relationships, and identify and share resources in Tucson. Policies for the built environment included making housing affordable so families would not have to worry about renting and constantly moving, which they said prevents them from planting. The also wanted more afterschool programs for AI children that would focus on improving healthy food access such as traditional food or gardening projects. Overall, participants wanted to understand policy development and to use policy to acquire funding that supported the strategies identified.

Implications for intervention development

The high rates of food insecurity and low food access in this study herald the need for future public health interventions to build upon the strategies suggested by the community members and stakeholders. One strategy was to focus on strengthening social systems, particularly among those groups who were most vulnerable, including AI females and older adults and elders who faced transportation issues and males who had

limited access to federal/state systems for supporting food purchasing. Social systems may also be influenced by acculturation if families have migrated from rural communities and reservations. Urban AI individuals tend to live apart from extended family and are usually dispersed throughout urban centers (Johnson & Tomren, 1999). The strategies suggested by the participants ranged from targeting social norms, building community relationships, and creating community space for social interaction.

Building cultural strengths in the community is another important strategy mentioned in the narratives. Interventions could use multi-cultural based strategies including cultural teachings and language to positively influence urban community beliefs and build relationships between community members and institutions that support healthy food access, e.g., schools, programs, and businesses. Other public health interventions that consider adding cultural components in food-based interventions have demonstrated an increase in environmental, behavioral, and personal changes associated with healthy lifestyles (Companion, 2013; Fialkowski et al., 2014; Novotny et al., 2011).

The narratives demonstrated how environmental, economic, social, and political factors impact food choice and behavior. Future interventions should focus on changing policies, the built environment, and food access. The barriers identified in this study demonstrate a need for AI community members to get involved and take action to shift the power dynamics among policy makers, corporations, and other stakeholders who influence food security and food access.

6. Limitations and strengths

The intention of this study was not to generalize but rather understand food access, food security, including potential barriers and strategies among urban AIs specific to the geographic area. A limitation is analyzing only the perspective of urban AI adults in Tucson and not collecting information from the youth or from AIs in other urban settings. The study results may underestimate the prevalence of food insecurity and food access in urban areas, as the sample was small and mainly involved people who were familiar with the TIC and its food resources. Additionally, self-reported survey data and a larger sample of women who took the surveys may overestimate levels of food indicators. Strengths of this study include the source of data, as this data is specific to the Tucson population and was collected by the TIC. AIs adults who participated may have been more willing to provide accurate information due to having familiarity with the TIC.

7. Conclusion

The high rates of food insecurity and low food access presented in this study demonstrate a need to further understand the factors influencing the greater urban AI food systems. This study provides stories, experiences, and knowledge of food barriers and potential strategies from the perspective of AIs that has not been examined in the Tucson community. Policy makers informed of the history and strengths of the AI people of Tucson could incorporate their voice and presence into existing and future food policy by creating opportunities for dialogue and forming a policy council with AIs. Overall, the results suggest a strong need to expand an evidence base for existing public health

models, interventions, and policy development to promote food security and food access for urban AIs.

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Table 1. Characteristics of American Indian Adults by Gender, 2015-2016

		Male	Female	Total	P-value*
Gender		98 (36%)	177 (64%)	275 (100%)	
Race	AIAN	93	173	266 (97%)	
	AIAN and other	5	4	9 (3%)	
Age, y, mean (SD)		40 (14.2)	49 (17.2)	45.62 (16.68)	**0.000**
Age, y					**0.001**
	18-29	28 (26/94)	18 (30/167)	21 (56/261)	
	30-44	34 (32/94)	23 (39/167)	27 (71/261)	
	45-59	30 (28/94)	30 (51/167)	31 (79/261)	
	60 and older	9 (8/94)	28 (47/167)	21 (55/261)	
Employment					**0.000**
	Employed (Employed for wages; Self-employed)	61 (58/93)	38 (64/168)	122 (47%)	
	Not employed (out of work, homemaker, student, retired)	38 (35/93)	62 (104/168)	139 (53%)	
Marriage status					0.315
	Married	30 (29/97)	24 (42/175)	26 (71/272)	
	Not married (Divorced, widowed, separated, never married)	70 (68/97)	76 (133/175)	74 (201/272)	
Education					**0.002**
	K-12 (including HS Graduate or GED)	32 (31/98)	52 (92/175)	45 (123/273)	
	Some college	40 (39/98)	31 (55/175)	34 (94/273)	
	College graduate	39 (28/98)	16 (28/175)	21 (56/273)	
Children currently living with the adult					0.954
	No children under 18 years	49 (48/98)	50 (88/177)	50 (136/275)	
	1-2 children under 18 years	32 (31/98)	30 (53/177)	30 (84/275)	
	3 or more children	19 (19/98)	20 (36/177)	20 (55/275)	
Income					**0.013**
	Less than $10,000	22 (21/97)	24 (41/174)	23 (62/271)	
	$10,000 to $24,999	35 (34/97)	51 (90/174)	46 (124/271)	
	$25,000 to $49,999	27 (26/97)	15 (26/174)	19 (52/271)	
	$50,000 and higher	17 (16/97)	10 (17/174)	12 (33/271)	

Boldfaced values indicate P<0.05

*Fisher's exact test

Table 2. Food access, food security, and food support status among American Indians by Gender and Age, 2015-2016

	Total	**Male**	**Female**	
	% (n/274)	**% (n/98)**	**% (n/176)**	**P-value***
No vehicle access	37 (103)	24 (24)	45 (79)	**0.001**
No Public transportation access	48 (133)	55 (54)	45 (79)	0.103
Lives more than 1/2 mile	70 (191)	77 (65)	72 (126)	0.338
Low food security	71 (194)	68 (67)	72 (127)	0.579
Receive food support	49 (134)	37 (36)	56 (98)	**0.004**
	Total	**Under 45 years old**	**45 years old and older**	
	% (n/260)	**% (n/127)**	**% (n/133)**	**P-value***
No vehicle access	37 (97)	32 (41)	42 (56)	0.125
No Public transportation access	49 (128)	51 (65)	47 (63)	0.537
Lives more than 1/2 mile	70 (182)	63 (80)	76 (102)	**0.03**
Low food security	71 (184)	64 (81)	77 (103)	**0.02**
Receive food support	48 (125)	48 (61)	48 (64)	1

Boldfaced values indicate P<0.05

*Fisher's exact test

Table 3. Odds ratios (OR) representing relations between food access and food security among American Indian adults by gender, 2015-2016

	Low Food Security											
	Total				**Females**				**Males**			
	% (n/N)	Unadjusted OR (CI)	% (n/N)	Adjusted OR (CI)	% (n/N)	Unadjusted OR (CI)	% (n/N)	Adjusted OR (CI)	% (n/N)	Unadjusted OR (CI)	% (n/N)	Adjusted OR (CI)
No vehicle access	38 (103/274)	**7.4 (3.5, 15.7)**	36 (92/256)	**7.1 (3.1, 16.3)**	45 (79/176)	**7.9 (3.3, 18.8)**	44 (72/164)	**6.5 (2.6, 16.4)**	24 (24/98)	**7.1 (1.5, 32.4)**	22 (20/92)	**13.6 (1.5, 121.7)**
No Public transportation access	48 (132/274)	**5.6 (3.1, 10.1)**	50 (128/256)	**4.3 (2.3, 8.3)**	44 (78/176)	**4.9 (2.4, 10.0)**	45 (74/164)	**3.7 (1.7, 8.1)**	55 (54/98)	**7.2 (2.5, 21.2)**	59 (54/92)	**6.0 (1.7, 21.9)**
Lives more than 1/2 mile	70 (191/272)	**2.4 (1.4, 4.2)**	70 (179/255)	1.0 (.5, 1.7)	72 (126/174)	**3.0 (1.5, 6.1)**	73 (119/163)	.909 (.4, 2.0)	66 (65/98)	1.7 (.7, 4.1)	65 (60/92)	1.2 (.4, 3.3)

*Boldfaced values indicate P <0.05

OR, odds ratio

Table 4. Demographics, food access, F/V consumption, food support, and obesity status among American Indians by food security status, 2015-2016

	Total	Food security		
		High	Low	
	% (n/N)	% (n/80)	% (n/194)	P-Value*
Female Gender	64 (176/274)	61 (49/80)	65 (127/194)	0.579
K-12 Education	45 (123/272)	31 (24/78)	51 (99/194)	**0.002**
Not married	74 (200/271)	61 (49/80)	79 (151/191)	**0.004**
1 or more children	51 (139/274)	51 (41/80)	50 (98/194)	1
Employed	53 (138/260)	47 (37/78)	55 (101/182)	0.278
Low income	69 (186/270)	44 (35/79)	79 (151/191)	**0.000**
Food Access no vehicle	37 (103/274)	11 (9/80)	48 (94/194)	**0.000**
Food Access no public transportation	48 (132/274)	76 (61/80)	37 (71/194)	**0.000**
Food Access more than 1/2 mile	70 (191/272)	56 (44/78)	76 (147/194)	**0.002**
F/V consumption less than 5	58 (159/273)	52 (42/80)	61 (117/193)	0.227
Food support	49 (134/273)	24 (19/80)	60 (115/193)	**0.000**
Obesity Status	81 (213/263)	72 (55/76)	84 (158/187)	**0.036**

Boldfaced values indicate P < .05
*Fisher's exact test (2-sided)

Table 5. Barriers and strategies to promote food security and food access

Level	Barrier	Strategy	Quote
Individual			
Beliefs	No responsibility to change food environment. Feel hopeless and a loss of cultural identity Fail to set/carry out goals	Build self-efficacy to practice spirituality Build cultural identity Carry out goals; have a positive outlook on life	"The problem to the hopelessness within the culture is that you don't see a bright future. So, if you don't see a bright future you're not going to do anything in the present to change it." (Male)
Skills and knowledge	Do not know food processing/production Loss of cultural and historical knowledge	Build knowledge to prevent obesity Make healthy food desirable	"I have no problem-solving skills, no one's ever taught me how to budget." (Male)
Lifestyle	Do not use agricultural practices (gardening)	Learn to problem solve and budget money	
Preferences	Indifferent/passive to live a healthy lifestyle Daily time limitations for food choices Do not apply cultural teachings/language	Be open to participating in activities Incorporate tribal language into daily activities Find time to run and eat healthy	"And be willing to participate to prevent obesity" (Female) "It (traditional food) wouldn't be something that would be big… they wouldn't eat it right away and they would probably taste it." (Female)
	Not open to healthy food Prideful/intimidated to access food resources	Appreciate and prepare new food Buy less processed, low in fat, high in fiber food Become familiar with traditional food (i.e. taste)	
Interpersonal			
Family	Lack of family support to take action Limited family connectedness	Teach family health goals and healthy eating Be resourceful (use low-cost healthy recipes)	"It's a family effort to come and take care of the garden and then seeing all as a family in a community, the benefits from it." (Female)
Elders	Loss of intergenerational knowledge	Create cultural and language games for kids to learn	"The connection between the elders, their children and the grandchildren are no longer in existence because that's where the teaching comes from." (Male)
Children	Limited opportunity to teach culture Need assistance with daily food activities	Teach values/ways of living healthy Connect with grandkids	"Urbanization of Natives...come to the city to better themselves, but don't go back…lose the language/traditions. They don't teach their kids." (Female)
Friends	Need help to access traditional food	Teach languages and cultural food knowledge	"How about like a friend bouncing ideas off of that person...someone to confide in." (Female)
Social norms	Barriers to learn culture Limited cultural teachers Feel apathetic and abuse substances	Teach what unhealthy foods do to bodies Build cultural and language knowledge Teach children historical events	"I think they would eat it (traditional food) in time. It wouldn't be something…right
	Limited social space to build relationships and have social support	Go with a friend to Produce on Wheels Build friendships to support health goals	
	Lack of social support to change unhealthy social norms or help people take action	Support healthy social norms and cultural values	

		Encourage healthy/traditional food as a social norm	away. They would probably taste it." (Male)
Community			
Community beliefs	Believe F/V spoil or are not affordable	Change community beliefs about healthy food Think as a community to take action to create changes in food systems	"So I think as a community, yeah, we do have to come together and actually do something." (Female)
Community relationships	Lack of intergenerational relationships	Build a sense of community for social support and culture sharing	"Rebuild a strong relationship between adults, elders or grandkids and then bring in that sense of community again." (Female)
School	Limited health education and awareness in schools	Work with schools to address concerns and offer cultural knowledge and language sharing.	"We need to tell them (TUSD)… our concerns about what we're just saying right now, the awareness to diabetes with our children." (Female)
Community space	Lack of opportunities or space to share community food knowledge and resources	Create a place for youth social and health support	"We need a structural building that consists of a community center." (Female)
Businesses	Not knowing urban food resources in and around Tucson	Create a building for community events and cultural sharing Utilize Garden Kitchen for food demos; TIC for cultural activities; TOCA for planting; churches for health/food resources; UA for language classes.	"Garden Kitchen…They were doing a taco recipe yesterday…That reminds me a lot of how the O'odham eat the cholla buds." (Female)
Environment			
Policies & built environment	Unhealthy policies and built environments Too many convenience food establishments	Participating in the Pima County Food Alliance to build food equity and access	"Tucson's going to be dry here the next four or five years, where do we get the water from?" (Male)
Food access	No personal transportation Difficulty using public transportation	Support grants for organizations that enhance food access and activities.	"Price of the crops are going really sky high. Get some chickens and grow your own food." (Male)

APPENDIX B: MANUSCRIPT 2

Exploring urban American Indian food systems: A conceptual model

Paper will be submitted to Health and Place

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Exploring urban American Indian food systems: A conceptual model

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Abstract

Urban American Indians' (AIs) experience high rates of food insecurity and issues with food access, particular healthy foods. This research applied a community based participatory research approach to understand the key players of an urban AI food system and the interconnections of social and cultural determinants between health, culture, social influence, and the environment. A conceptual model of the Tucson AI food system was developed based on an analysis of qualitative data collected through the Tucson Indian Center's Community Health Assessment. The model offers a framework for future public health interventions or policy development to promote healthy food access or food security for urban AIs.

1. Introduction

The high food insecurity experienced by urban and non-urban American Indians (AIs) demonstrates a need to investigate food systems among these populations (US Commission on Civil Rights, 2003). Food insecurity is defined as having limited availability or ability to acquire nutritional and safe foods (Southwest Interdisciplinary Research Center (SIRC), 2011). Studies show that non-urban AI communities are revitalizing their food systems and investigating ways to enhance food security and health using an approach centered on indigenous knowledge, culture, language, and self-determination (Dine Policy Institute, 2014; EHC, 2015; Fleischhacker, Byrd, Ramachandran, Vu, Ries, Bell, & Evenson, 2012). To date, studies assessing urban AI food systems are limited.

On a national level, community organizations in the US are building local sustainable urban food systems and stress the importance of creating space for social, political, economic, and intellectual initiatives (Ilieva, 2017; EHC, 2015). In the existing literature, evidence is limited to determine if urban AIs are joining or leading movements to build local sustainable food systems. Movements to build sustainable urban food systems and revitalize AI food traditions may offer an approach for urban AI communities to follow to address food insecurity and food access. To initiate this effort, urban AI communities could document and interpret their food systems using an indigenous centered approach to understand underlying inequalities that influence disparities in access to food and specifically, to healthy foods. This study seeks to bridge this gap in knowledge and offers an overview of the food systems from the perspective of AIs who live in Tucson, AZ.

1.1 American Indian food systems

The role of AI food systems in non-urban communities has been explored by tribes and non-profits such as the First Nations Development Institute (FNDI). The FNDI states, "Native nations had their own systems that relied upon traditional knowledge for harvesting, planting, and consuming locally harvested foods" (FNDI, 2013, Page 2). AI food systems on reservations consist of interconnections between people, culture, politics, law, and economics that serve to provide food for tribal members (Echo Hawk Consulting (EHC), 2015). The strengths from social, political, spiritual, and cultural

connections with the land base can be leveraged to improve food systems both on and off reservations (EHC, 2015).

The historical reference of food insecurity among AIs extends to the 1600-1800s when reservations were established. From that time to the 1950s, non-urban AIs faced malnutrition and deficiency in nutrients, as the food provided did not consist of traditional food and was usually of poor quality or insufficient in quantity (FNDI, 2014). Access to quality food continued to be impeded after the 1950s with reliance on government commodities and welfare checks (Bass & Wakefield, 1974). Relocation and the migration between urban and non-urban AI communities influenced food access and preferences, particularly through exposure and acceptance of non-traditional foods and prevalence of commodities programs (Companion, 2013). AI communities have historically and currently face environmental challenges accessing healthy food contributing to their high rates of health disparities (CDC, 2016; CDC, 2017; EHC, 2015).

Tribal nations and indigenous organizations have been working to revitalize AI food systems (EHC, 2015; Fleischhacker et al., 2012). These movements are guided by indigenous knowledge, culture, language, and self-determination. A report by Echo Hawk Consulting (2015) listed examples of AI food networks, advocacy, and policy development taking place among AI communities in New Mexico, Arizona, and Oklahoma. The report also shared examples of food systems development through community gardens, community supported agriculture, and AI enterprises (EHC, 2015).

Fleischhacker et al., (2012) describes the work of the AI Healthy Eating Project, a collaborative project with seven tribes that worked to improve community food access. The project used a culturally appropriate process to identify sustainable strategies and policy recommendations based on ideas from the community and tribal leaders.

1.2 Urban food systems: Lifestyle and role of AIs

In general, the functions of urban and non-urban food systems include but are not limited to land preservation and agriculture, economic distribution and processing, policy for production and access, culture informing food consumption, and the impact of food on health (Neff, 2015). Within food systems exists food environments experienced in homes, schools, stores, and eateries that are characterized by social influence, media and advertising, food cost, store access, and store inventory (John Hopkins Bloomberg School of Public Health (JHBSPH), 2018). Nationwide, urban food movements have grown and provide a platform to help communities streamline and implement sustainable development to support their food systems and infrastructure (EHC, 2015; Ilieva, 2017). Ilieva (2017) shared how major cities in the US are participating in a global effort with other countries to carry out urban food systems strategies that utilize holistic assessments and policy frameworks to connect institutions and programs with action plans. Although limited, nonprofit organizations such as the Notah Begay III (NB3) Foundation and the FNDI have been integral in supporting the capacity for AI entities and centers to develop community-based strategies that can increase access to healthy and affordable food and nutrition education (EHC, 2015).

The lifestyle and role of AIs in urban food systems has not been fully explored in existing literature. In 2010, the population of American Indians and Alaska Natives (AIANs) was 5.2 million in the US, with 71% classified as living in an urban area (U.S. Census Bureau, 2012). A 2016 report from the Urban Indian Health Institute (UIHI) analyzed aggregated data from 2010-2014 and found that poverty rates were higher among urban AIs (28%) than non-Hispanic Whites (9.5%) (UIHI, Seattle Indian Health Board (SIHB), 2016). Tomayko et. al. (2017) and Blue Bird Jernigan et. al.'s (2017) work reveals that urban AIs experience higher food insecurity than AIs who do not live in metropolitan areas. In addition, Tomayko et al. (2017) and Companion (2013) demonstrate that urban AIs face challenges with food access in the distance they traveled to grocery stores and not having personal vehicles. Unequal access to healthy food environments, particularly for low socioeconomic communities, contributes to poor food choices and ultimately health disparities (Glanz, Sallis, Saelens, & Frank, 2005; Larson, Story, & Nelson, 2009; Sturm, 2008). Concurrent with these determinants of healthy food access, urban AIs have higher prevalence rates of obesity (31.7%) and diabetes (11.9%) than the general US population (23.4%, 8%, respectively) (UIHI, SIHB, 2011). In 2015, the prevalence of obesity for the general AIAN population was 43.7 % and the prevalence of diabetes in 2014 for AIANs was 17.6% (CDC, 2016; CDC, 2017). For urban AIs, cultural perceptions and identity as well as income and purchasing power influence food choices. Urban AIs experience various levels of acceptance or rejection of acculturation which is manifested through food habits, cultural perceptions of food, and emotional attachment to food (Companion, 2013a).

1.3 Tucson, AZ, food systems: Urban AIs in the system

As an urban food hub, Tucson's food system functions are similar to those described by Neff (2017), and are closely tied to agriculture and land, economic systems for food distribution and processing, policy that addresses production and access, food consumption culture, and health systems influenced by food (Nabhan, 2016). The unique and dynamic composition of Tucson's food system was recognized in December 11, 2016, when Tucson was given the designation of United Nations Educational, Scientific, and Cultural Organization (UNESCO) World City of Gastronomy (Mabry, Nabhan, & Ojeda, 2016). With this title, Tucson joined a network of international cities that promote cooperation and value creativity while promoting cultural industry development at local levels. As Jonathan Mabry, Tucson's UNESCO liaison and Historic Preservation Officer explains, the honor highlights Tucson's rich "agricultural history, living food traditions, innovations in all parts of (the) food system, creative approaches to addressing food insecurity, thriving food scene, and culinary distinctiveness" (Mabry, Nabhan, & Ojeda, 2016, p. 2).

At the heart of Tucson's food justice organizations is the push to increase access to cultural and diverse foods, particularly for marginalized populations such as indigenous peoples, refugees, and immigrants (Nabhan, Mabry, Johnson, & Ferrales, 2018). Despite this push and Tucson's special designation of being a city of gastronomy, there is little evidence that AI's have been participants of the power structure in Tucson's cultural

industries at the local level, including agriculture, business, and community organizations. Out of 20 community organizations that were included in a report as contributors to Tucson's food system, the San Xavier Co-op Farm (Tohono O'odham Nation) was the only AI owned business that was mentioned (Nabhan, Mabry, Johnson, & Ferrales, 2018). In addition, a 2018 food deserts survey reported that of the 76 adults in a Tucson urban agriculture group, no AIs participated (Buechler, Tong, Erbe, & Marderness, 2018). Overall, a recent report found that AI's were underrepresented in federal and state, including Arizona's, agricultural departments as board members or staff (Nabhan & Glennon, 2016). To address this deficit, the authors recommended having listening sessions with AI communities, recruiting AIs for state and federal advisory councils, and encouraging AI participation in non-profit power structures or dialogue with University of Arizona (UA) agricultural departments (Nabhan & Glennon, 2016). These reports highlight a need to explore the food system from the perspective of urban AIs in Tucson. Understanding the urban AI food system could inform strategies for public health prevention and policy development.

This study seeks to understand the key players of the urban AI food system and the interconnections of social and cultural determinants between health, culture, social influence, and the environment. To understand the food system, we aim to develop a conceptual model that will map the key factors and functions that drive the urban food environment. The knowledge gained from mapping the system can offer a framework for future public health interventions or policy development that promote healthy food access

or food security for urban AIs. We seek to address the following questions using the conceptual model:

1. Does the urban AI food systems model have differences or similarities to the general urban food system or non-urban AI food systems?
2. Is there evidence through the model that urban AIs are revitalizing their food systems using an approach centered on indigenous knowledge, culture, language, and self-determination? If not, is there evidence that urban AIs perceive this step as an important undertaking to strengthen their food systems?

2. Methods

Secondary analysis of existing data was collected through the Tucson Indian Center (TIC) Community Health Assessment (CHA). The CHA was funded by the NB3 Foundation Seeds of Native Health project from October 2015 to May 2016 to investigate prevention of childhood type II diabetes among AIs. The lead author, from the UA Mel and Enid Zuckerman College of Public Health (MEZCOPH), and TIC staff conducted a survey, focus group, asset mapping sessions, and/or or a community input gathering. Qualitative data collection included notes and audio recording; both were transcribed and de-identified. The participants consisted of self-identified AI adults, 18 years and older, who resided in Tucson, AZ, and were recruited at TIC events and workshops. AI and non-AI stakeholders from the TIC and organizations that promote food security in Tucson, AZ, also participated in focus groups. The lead author made a request to the TIC to look at indicators from the qualitative data that described functions of the Tucson food

systems. A community based participatory research approach was applied and a collaborative partnership was formed with the TIC to conduct this study. A community advisory board with five members served to offer guidance and feedback to develop the conceptual model. The CAB convened for five meetings to provide their guidance to develop the model. The UA Human Subjects Institutional Review Board approved the data collection protocols.

The questions for the CHA primary data collection activities were developed collaboratively by TIC staff and the first author. AI adults were asked the following questions during the focus groups: 1) What's the timeline (past, present, future) when the diet and lifestyle changed for AIs in Tucson? 2) Based on the timeline, indicate how AIs found and used or continue to use traditional foods in the past, present, and future? 3) Describe your traditional food shopping experience. Where do you go? 4) Do you know where your food comes from? 5) How would you describe the past, current, and future health of AIs in the Tucson community? and 6) What are the strengths in the AI community that help you eat healthy food? Stakeholders from the UA, TIC, and non-profit organizations that address food security in Tucson were asked the following questions during their focus groups: 1) What are your professional experiences in working with AI families? 2) What are your thoughts on the health issue of AI childhood type 2 diabetes and obesity? 3) What are the root barriers and causes of childhood obesity and type 2 diabetes in Tucson? 4) What about in the Tucson American Indian community? 5) How can we involve organizations and community members to take action? AI adults who took part in the asset mapping session were asked to identify

barriers and promoters for childhood type II diabetes prevention in the Tucson food environment. AI adults who participated in the community input gathering session were asked to offer comments on CHA survey results.

The secondary analysis of existing data consisted of deductive thematic analysis based on a priori research concepts of food systems. Codes were developed for the key concepts and organized into a coding book. Transcripts were uploaded and analyzed with QSR International's Nvivo 10 Software (QSR International Pty Ltd, 2017). The codebook content was entered into the program as nodes and the nodes were modified as the analysis progressed. The research questions served as a guide to conduct the analysis. Data was coded by the lead author and a second researcher who independently coded 20% of a random sample of the data. Intercoder-reliability scores were measured and the two researchers built consensus for conflicting codes. Table 1 provides a list of the codes used for analysis. A report of the analysis was provided to community members who served on the project advisory board to check for interpretation and validation.

3. Results

The qualitative data was collected from one focus group with 15 AI participants, two stakeholder focus groups with 7 non-AI and AI adult participants, an asset mapping session with 32 AI adults, and a community input gathering with 35 AI adults. A summary of the data analysis was shared with the community advisory board and feedback was offered to share perspectives on the key themes and patterns.

3.1. Conceptual Model of AI Food System in an Urban Setting

The AI food system of Tucson consists of interconnections social and cultural determinants between cultural/social, food input/output systems, biophysical, economic, and political systems. A conceptual model (Figure 1) was developed to illustrate these systems, represented by the leaves and stalk of the corn. The cultural and social system is represented by the spiral pattern within the corn stalk and serves as the backbone of the food systems for AIs in Tucson. A dashed arrow moves from the base of the corn stalk, past the leaves, and ends at the tassels, where health and wellbeing are outcomes for the food system. "Balance" and "unbalance" are two functions that the arrow flows through, indicating that balance or unbalance may occur in the food system to impact health and well-being.

Data analysis illustrates how the food systems of Tucson have been shaped by the city's history and the AIs who have lived and continue to live in the region. The narratives shared how the area now called Tucson was inhabited by the Tohono O'odham, who had a rich agricultural system by using the nearby rivers. As the city formed, most of the AIs lived on the far south side of Tucson or resided in the San Xavier District, a Tohono O'odham reservation located about eight miles south of the city. Some of the AI adults mentioned they were not born in Tucson but would live in the city primarily for school and employment, and travel back to their reservation communities for the summer or on weekends when they were younger. As adults, they now live in Tucson full-time. Other

participants shared that they were born and raised in Tucson. One male elder offered a summary of the history of Tucson and the start of the urban AI food systems:

"We've been here forever. That's where Tucson came from. Tucson is an O'odham word. It means Chukson because the O'odham in the old days would name a significant land mark. Chukson was the name for A Mountain. Because when you look at A Mountain, it's got a black base…The Spaniards were the first ones that came in here and they introduced the Catholic religion that we adopted to it…along with their new fruits and vegetables. That's how we became cattle ranchers because the Spaniards were ranchers and we were Indian cowboys back in the day. When the Gadsden purchase took place back in 1853, everything was turned over to the state…And because water is scarce out there, the water is very sacred to us."

Qualitative analysis guided the development of the conceptual model. The analysis identified parent themes and subthemes that made up the urban AI food systems. The relationship between these themes—cultural/social, food input/output systems, biological, economic, political systems—as well as their influence on health and well-being are described as functions of the food systems in Table 2 and in the following sections.

3.2. Cultural and social system: culture and languages

Urban AI adults mentioned they practiced culture sharing while living in Tucson, mainly through activities sponsored by the TIC. Several of the respondents expressed the desire

to learn their tribal languages and teach their children so they could grow up with a strong cultural identity. One participant shared, *"Also, you know, nowadays we need to teach our kids the language, our language. The O'odham. From all these speaking English, that's what I'm trying to do with my grandkids."* AI elders shared that having a strong cultural identity can be a deterrent to poor health outcomes.

3.2.1. Cultural and social system: Culture of food consumption

The food consumption culture was described by AI adults in terms of food "balance" where culturally-based food was once at the center of daily life, and food "unbalance" where food culture was disrupted by harmful events like US policies limiting land and displacing tribes from their food systems. The shift in food access created many health issues and was described by one participant as: *"Tohono O'odham had cultural balance and.. beans and corn. But the rest of the other stuff like oranges and pomegranates…all that was introduced by the Spanish and we adopted most of them but not all of them. Of course the government, they introduced sugar, a lot of sugar to us. That's why we became all fat and lazy…we got diabetes and everything."*

3.2.2 Cultural and social system: Cultural food

Elders described missing the taste of AI food and felt that young people have lost the taste, thus leading to a decline in traditional food preference. A few adults mentioned how AI families had farms in the past that produced crops and meat sources like chicken,

rabbit, and beef. People also hunted deer and other lean meat. One participant shared his past experience with cultural food: *"We didn't have all them toys and things of distraction. And then the farm, we always had to garden. I don't even remember ever having to buy any vegetables at the store. All they bought was bread, maybe meat, you even had your own chickens and all of that. We had chickens."*

Currently, some families still hunt and plant crops such as corn, squash, and watermelon on non-urban land, but the majority of respondents felt this knowledge was lost and they did not continue the practice of having gardens while living in the city.

3.2.3. Cultural and social system: Education

Education was discussed in the context of western influenced schools and pathways, as well as in the context of AI centered education to know AI lifeway knowledge and traditional teachings. AI adults mentioned that family members who advanced in their education and careers were key role models for future generations to achieve higher education. One adult shared how her grandmother was a role model, *"My grandmother, she went through college. She come back and (was) an example for her children. How can you tell your children go to school, get an education, make something of yourself when you didn't, you know?"* Respondents mentioned the challenge in returning to home communities after obtaining degrees due to limited job options or not feeling accepted or appreciated, and usually settling in urban areas like Tucson.

3.2.4. Cultural and social system: Social influence

Some respondents mentioned they worked together as a family to harvest crops on family land located on their reservation and used the time to share stories and build connection. One participant shared, *"Yeah. We could buy the corn…with the urbanization and stuff like that we don't have the right tools. We used to put it all in a big bonfire and dry them (corn) out... In the winter months, which is our storytelling time, we would all gather around inside and husk the corn over there."* In addition, social norms often presented challenges, particularly when community members shared a belief that obesity is normal and some expressed that people do not actively make changes to their food environment.

3.2.5. Cultural and social system: People

The respondents shared that parents need to have more involvement with their children and be advocates for policy changes. Several AI adults mentioned that elders are keepers of knowledge for food and culture; but sadly, cultural knowledge is slowly lost as more elders pass on. To express the loss of elders, one participant shared, *"Peoples' storytelling would tie in with the culture, the beliefs, and the folklore in general. We taught the stories and the songs that go with the story of the O'odham immigration… four nights to do it. There's nobody else in the nation that can do it now. The elders are gone."* Urban elders identified their assets as serving as role models and sources of strength for their families. Several grandparents stated that they served as caretakers for their grandchildren.

3.3. Food input and output system: Food access, food security, food cost

Participants expressed they had trouble accessing nutrient dense food and faced food security issues: "*At the end of the month, you know, a lot of people don't have food. They're relying on beans and, you know, very basic foods to get by. Literally get by the last couple weeks so, you know, access to…a wide variety of affordable food is definitely an issue too*." The greatest challenge to access healthy food was transportation, including not having a vehicle. Elders shared they had trouble paying for taxis and transporting groceries on the bus. Food cost was discussed as affordability, with most respondents stating they faced challenges buying produce or not being able to afford transportation.

3.3.1. Food input and output system: Food distribution and processing

A few adults mentioned that most of the food in Tucson is distributed and processed from sites located outside the city. They shared their concerns that commercial food was processed with chemicals, "*Powdered eggs is made from a lot of chemicals and stuff that is used to make Styrofoam. The same with Ramen noodles*." Several adults in the focus group agreed that Tucson offers a plethora of food choices, with an extensive offering of fast food and grocery stores that sell inexpensive calorie dense options appealing to those on limited budgets.

3.4. Biophysical system: Agricultural history

AIs adults mentioned they have a strong agricultural history and diverse food system: "*Tohono O'odham means desert people. We've been here forever and forever and a day back in creation…And we were part of our people back then. We just diverted the Santa Cruz River all the way down into, almost into Mexico. The archaeologists have found diggings of the soot at the bottom of canals where we sent the water all the way up and who were planters all along, we planted our crops and everything."* Respondents mentioned a need to continue traditional practices like community gardens in Tucson. AI adults shared they had limited access to traditional crops so they bought food at the San Xavier Co-op Farm or asked family such as grandparents who had farms on tribal land.

3.4.1. Biophysical system: Land and water

The respondents expressed sadness at the loss and degradation of land and water, resulting in unsafe water and chronic diseases. One adult shared, *"They made a bad deal with the O'odham nation to divert the Colorado river...you can't use it to plant crops anyway cause it's all salt water, you just dehydrate the plant.*" The adults felt they could access city land through community gardens, but they expressed concern in participating due to historical loss of water, feeling that some authority figure would take away water like they did in the past.

3.5. Political system: Food policy

AI participation would help enhance knowledge of food access and health to promote collaborative efforts in shaping food policy that can impact the AI food systems in Tucson. *A* non-AI stakeholder for a local policy organization *said: "We don't really have any direct connections to people working with American Indian populations in Tucson and I think that's a big gap."*

3.5.1. Political system: Politics and law

Educational laws were passed that required children to attend school, resulting in family disruption. The participants reported being sent to boarding school when they were young:

"Then the Mormons moved here. They started establishing boarding schools and they will recruit young kids and transfer them all the way out to different parts of the country." Urban AIs feel the impact of multilayered political structures influenced by tribal, city, state, and federal policies. Tucson's political history stems from the Tohono O'odham, and other tribes, who influenced the area with their lifeways, culture, and food systems.

3.6. Economic system: Economics in the city

Many adults shared examples of how Unemployment and low-incomes impacted their ability to purchase healthy food, afford car insurance or gas, and maintain a vehicle; thus further limiting food access and security. They also felt Tucson had a history of

segregation that impacted the type of jobs they could hold in the city, as explained by one participant: *"There is a history of the city of Tucson being very segregated. That's why you have individuals even though they have a high school diploma or college education. Being segregated plays a big part in the incomes of Indian people throughout the city."* Despite experiencing discrimination, they had job opportunities in Tucson, while on their reservations they were limited due to low economic development.

3.7. Health and well-being: Health, food, and environment

The respondents felt that having easy access to food sources in the city has created a societal norm of being complacent and not being an active participant in food production. To express the issues with easy access, one elder stated: *"No, because we grew fat and lazy..and the Mickey D's. All that with no one having to work for it, like… running the deer down… Getting good lean meats and everything."* Health issues identified by the respondents included mental illness, suicide, physical disability, and social issues such as drugs, alcoholism, violence, and bullying. Participants were unsure how the future health of urban community members would be, especially because they felt youth were dying at an early age.

5. Discussion

The conceptual food systems model (Figure 1) illustrates how health and well-being for urban AIs are influenced by different functions and identifies key factors that can be

targeted for future interventions or policy implementation. AI community members' narratives offered perspectives that helped shape the urban AI food systems of Tucson. The community advisory board also contributed by offering their feedback and interpretation of the functions. Their contributions helped refine and explain the model. As an example, the board members agreed that the cultural and social system is comprised of culture, language, food, education, spirituality and religion, and people. The decision to use a spiral pattern was supported because they felt this graphic was representative of the way AI adults described cultural and social factors as intricately inter-connected without specific directionality. The advisory board felt the model would be appropriate to incorporate into future teaching tools or food systems curriculum reflecting the cultural community-based and relational experiences of AIs in Tucson.

The model illustrates that the urban AI food systems has differences and similarities to the general urban food system. Urban AIs expressed that their food systems existed before the current Tucson food system, and had been disrupted by non-AI influence and policy. Due to this disruption, AIs utilized the general Tucson food systems and were influenced by barriers within the economic system, policy system, food consumption culture, health system, and land and agriculture system that other urban community members faced. The main differences were that AIs who participated in the qualitative data activities were community members who utilized TIC services, indicating they may have had wellness or service needs and were more likely to be low-income or in need of food security support. As a vulnerable group, their responses showed that they were downstream on the food system, meaning they did not comprise roles of being on the

upstream end and having power positions to influence the functions such as policy or land and agriculture. Their health outcomes were numerous, suggesting this population also had to contend with daily struggles of multiple unbalanced functions within the Tucson food systems. An additional difference was the role of culture and social systems not seen in the general food systems that served as a foundation and strength for the urban AI food system.

In this study, AIs did not participate in organized urban food movements in Tucson, but there was evidence they were aware of concerns and injustices within the systems. Tucson was given the designation of World City of Gastronomy but the food systems model indicated that AIs were not accessing the food assets or taking part in food related innovations and preserving food heritage. Most of the AI respondents considered the heritage foods of Tucson as part of their original food systems and understood the health benefits of traditional foods; however, their narratives described how they were struggling to access these important food sources that many Tucson organizations were promoting or utilizing in their businesses and economic development pursuits. Future studies should evaluate if these community initiatives and outlets are affordable and accessible for AIs, and identify root challenges and strategies for access. The model reveals that AIs are not active on the policy level. Understanding the reasons why urban AIs do not participate would help address this issue. Future interventions should open avenues for dialogue and bring the urban AI perspective to the forefront. One strategy could include the use of digital storytelling (Gubrium, 2009; Whitewater et al., 2016) to

share urban AI food systems stories with community members, non-urban AI organizations, City of Tucson Council, and the UA.

The analysis of narratives showed that the urban AI food systems model contained functions of non-urban AI food systems, particularly for the cultural and social systems. Urban AIs faced the same issues within the cultural and social systems found within non-urban AI food systems. One of the main differences was that while efforts were made by tribal organizations or governments to support non-urban AI food systems, AIs in Tucson did not get organizational support to strengthen their cultural and social systems. Future interventions can strengthen cultural and social systems by bridging gaps and creating opportunities to identify factors that can be leveraged in Tucson.

The model showed evidence that urban AIs have ideas about how to revitalize their food systems individually using an approach centered on indigenous knowledge, culture, language, and self-determination. Many participants expressed the strengths of culture and past AI food systems. They faced challenges to return to traditional food systems but they could identify knowledge and cultural strengths including language that could support their drive to relearn past agricultural heritage traditions. Future food systems interventions should consider including efforts to build food sovereignty. In 2002, a global forum on food sovereignty defined it as, "the right of people, communities, and countries to define their own agricultural, labor, fishing, food, and land policies which are ecologically, socially, economically, and culturally appropriate to their unique circumstances" (FNDI, 2014, p. 4). Food sovereignty is an approach used by cities and

indigenous communities to educate and train community members to be the decision makers for their communities and could support urban AIs to join in efforts for food systems development and shaping food policy.

Some key complex relationships identified by the participants related to historical trauma. Although the term "historical trauma" was not specifically mentioned, many of the AI respondents shared narratives of historical oppression, injustice, and loss of culture and ancestral land. In the past, Tucson was a segregated community, bolstered by government efforts to colonize the local tribes and strip away their cultural identity (Blaine, Sr., 1981). Most AIs lived in South Tucson within barrio communities that were largely ignored and faced many social, cultural, and political challenges (Devine, 2015). The narratives show that the factors associated with historical trauma influenced the functions of the food systems. Future studies should identify how to strengthen or support these functions to help offset challenges from historical trauma.

6. Limitations and strengths

This study was used to understand the food systems for urban AIs specific to Tucson and does not generalize results for other AI communities. A limitation is basing this analysis on a small sample of urban AI adults who utilized TIC services, thus this study may provide a narrow perspective of the Tucson AI food systems. In addition, the AI adults who participated in the focus groups, asset mapping, or community input gathering may

have had greater familiarity with TIC, thus the data may have more accurate information based on their knowledge.

Data from AI youth were not included, which would have added an additional layer to the food systems model. A strength of this study was its specificity to Tucson and the shared urban experience of the participants.

7. Conclusion

The Tucson urban AI food system is a blending of cultural, social, economic, political, and biophysical systems. Optimal health and well-being are achieved when the systems are balanced and strengthened. Policy can be used to strengthen health and social systems, particularly by using food sovereignty to promote cultural and community strengths. The urban AI community has opportunities to revitalize their food systems with the help of local organizations, political partners, and community members. This study demonstrates the need to expand an evidence base for existing public health models, interventions, and policy development to help urban AIs build local sustainable food systems centered on AI knowledge, culture, language, and self-determination.

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Table 1. Code book for food systems

Theme	Patterns
Category I: Cultural and social systems	
Culture	Identity, clans, history, family cultural roles, intergenerational, sharing, stories, loss, cultural barriers; strategies; cultural space
Culture, consumption	Food beliefs; food value; food balance/unbalance
Food	Source; assets; traditional; urbanization; strategies; food space
Education	Knowledge, needs, school characteristics; family role; history; sharing, strategies
Language	Loss; needs; level of use; assets; strategies to increase language
Social influence	Support barriers, social norms; strategies; relationships; social space; connection
People	Inter-tribal, values of people, history, future of people; minority status
Elders, parents, youth	Roles, concerns/needs; strengths; strategies to support; elders as knowledge keepers
Spirituality, religion	Religious group; assets, issues, history, strategies
Category II: Food input and output system	
Food access	Business, traditional source, non-profit; transportation; strategies; barriers
Food cost	Affordability; cost of transportation; strategies
Food security	Food spoilage, feeling hungry/not hungry, resources; strategies
Processing & distribution	Urban/non-urban area; healthy/unhealthy food; origin of food; distribution issues; processing issues; strategies; availability
Category III: Biophysical system	
Land and water	Water use, rural/urban land barriers; indigenous names; rural/urban water barriers; strategies; history; loss
Agriculture	Entity/people involved, history; barriers, strategies; loss; traditional agriculture
Category IV: Political system	
Food policy	Limiting/enhancing food input and output; people impacted; impacting health; entity/people influencing food policy; strategies
Politics	AI policy; fed/state policy; resources; history; power; needs, benefits, strategies
Law	Historic laws; environmental law; food law; health law
Category V: Economic system	
Economics	Income level; employed/unemployed; job type; role models; barriers to work; marriage; leaving/returning to community; history; strategies
Category VI: Health	
Food & health	Positive/negative food impact; purchasing behavior, eating pattern; food preparation
Health	Issues (physical; social; mental; other); barriers; past/future health; strategies
Health & environment	Land and health; water and health

Table 2. Urban AI food system in Tucson: Summary of key functions

Function	Description
Category I: Cultural and social systems	
Culture	Culture included tribal beliefs, history, origin stories, and clan introduction to establish kinship. Cultural beliefs and knowledge are challenging to practice in Tucson but continue to be transmitted and adapted to the environment.
Culture of food consumption	Food unbalance influenced societal norms where people do not strive to take a healthier path in their food choices. Passive norms lead people to no longer hunt or plant gardens for energy dense foods, and not use food skills and knowledge passed from their ancestors.
Cultural food	Food production historically involved cultural teachings, songs, stories, and cooperation between entire families. Urbanization disrupted AI food production.
Education	Education is used to build employment opportunities and income stability. Low education status impacted employment, income, and food access to afford commercially available food and transportation.
Social influence	Social interaction was an element of healthy food production, and included social support and activities related to gathering, planting and hunting.
People (elders, parents, youth)	Tucson has a growing number of AIs from diverse tribes comprised of youth, parents, and elders. Youth were central to food systems and had responsibility to carry forward knowledge but educational systems have shifted their roles. Youth have adapted societal norms, preferring convenience food and a passive attitude towards food and health.
Category II: Food input and output system	
Food access, food security, food cost	In the past, people worked hard to access food and did not eat as much; and in the present, people eat greater portions and depend on convenient, inexpensive, and quick processed food. AI adults shared how they had varying levels of food security; most expressed that they run out of food easily.
Distribution & processing	In the past, AIs could hunt, gather, or grow their food and process it naturally. In the present, commercial, processed food is distributed throughout the urban environment.
Category III: Biophysical system	
Agriculture	Farming became less affordable and infrequent as land development and land privatization ensued. Elders indicated they had farming jobs in and around Tucson when they were younger.
Land and water	AI history and culture is tied to the land, and respondents referenced land as, "mother earth," a respectful way to show connection to the land. Health of AI people is connected to the health of the land and water.
Category IV: Political system	
Food policy	Food policy can both promote and inhibit food production and access. A return to traditional and historical practices, such as gardening, is challenging due to policies related to land and water access.
Politics and law	Federal and state courts strategically passed laws that oppressed AI people and took away their land and resources, forever impacting their food systems.
Category V: Economic system	
Economics in the city	According to the respondents, social factors contribute to economic hardship that impacts food security and stems from issues related to prison records, disability, alcohol and substance use, and hopelessness.

Category VI: Health

Health, food, and environment	In the past, food was produced through many hours of physical activity and was a lifestyle that helped people maintain their health. Current health issues include chronic disease and obesity that were influenced by lack of physical activity, stress, depression, physical disability, and feeling unmotivated.

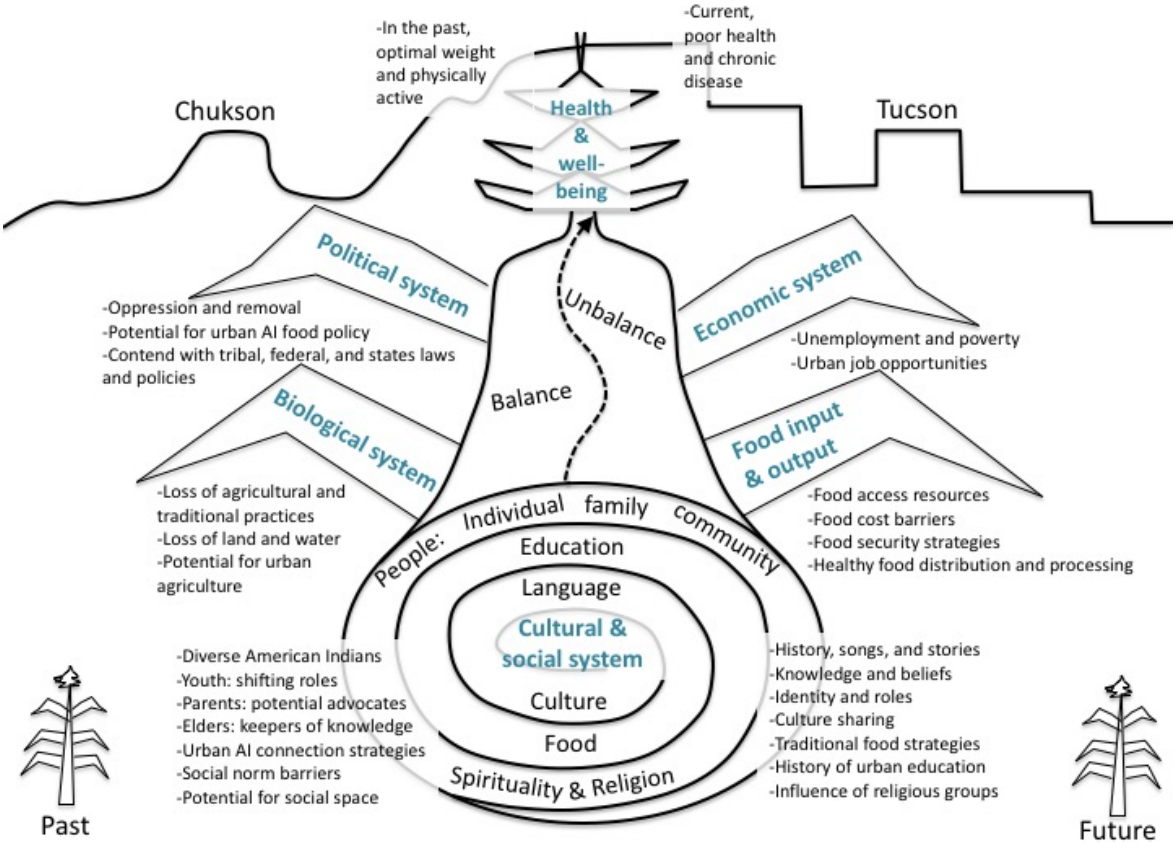

Figure 1. Conceptual corn model for urban AI food system of Tucson

APPENDIX C: MANUSCRIPT 3

Evaluating the development and application of food system digital storytelling resources for urban American Indians

Paper will be submitted to Preventing Chronic Disease

Title Page:

Evaluating the development and application of food system digital storytelling resources for urban American Indians

Preventing Chronic Disease

Abstract word count: 248
Manuscript word count: 2867
References word count: 470
Number of references: 16

Abstract 250 words (Current count 248)

Introduction

Urban American Indians (AIs) experience high rates of food insecurity and issues with food access. This study investigated the development and application of food system digital storytelling (DST) resources to understand how the resources can influence behavioral, personal, and environmental changes among AI community members in Tucson, AZ.

Methods

The DST team members were purposefully recruited to create DST resources with the lead author. Each team member was interviewed after developing his/her DST resource and focus groups were conducted with urban AI adults. Data was collected by written notes and audio recording, and later transcribed and coded using NVivo 10 software. Inductive and deductive analysis was applied using the Social Cognitive Theory (SCT).

Results

Five AI DST team members were interviewed (2 male and 3 female) and a total of 23 urban AI adults participated in three focus groups (6 male and 17 female). The key themes included constructs of the SCT in the digital stories or mentioned by the participants; understanding how the DST resources were applicable/culturally appropriate for the targeted audience; and exploring the experiences/perspective of AI adults who created and/or viewed the DST resources.

Conclusion

This study provides evidence that DST resources influenced change through SCT constructs to help urban AIs connect with the Tucson food system. Using the SCT

framework, findings illustrated how health behavior is influenced by or impacts environmental and personal determinants. Future interventions are needed to investigate the potential impact of DST food systems curriculum for urban AI community members.

Introduction 300 words allowed (current count: 243)

Food systems play an important role in the health status of a population, interconnecting health, social norms, and the environment. These systems include inputs/outputs related to food production, distribution, and consumption, and relationships between system components (1,2). Public health interventions with indigenous people that consider food systems have demonstrated an increase in environmental, behavioral, and personal changes associated with healthy lifestyles (3-5). Food systems research among urban American Indians (AI) has not been fully explored (6-8).

Over the last 200 years, the food systems of AIs have been disrupted and devastated (9), and for urban AIs the level is magnified, contributing to some of the highest rates of diabetes and obesity among this population (10). Urban AIs are reported to have higher rates of food insecurity than non-urban AIs (6,7) and face issues with food access (3,7). One potential strategy to address issues of food access or security is using digital storytelling (DST) to influence the food system through changes in Social Cognitive Theory (SCT) constructs. Limited evaluation of DST research with Indigenous communities supports the DST approach as a culturally respectful way to support

learning and inspire behavior change (11), and creates opportunities for conversing, healing, and transformation (11,12). DST has not been fully explored or evaluated with urban AI food system projects. The objective of this project was to develop and evaluate DST resources using the SCT (13) to improve the connection between urban AIs and a food system that affords healthy food and food security.

Methods:

Evaluating development of DST resources. To develop a DST team, five AI adults, 18 years and older, who resided in Tucson, AZ, were purposefully recruited to represent different age groups and genders. The lead author had worked with all DST team members for at least eight years on community based participatory research (CBPR) health promotion projects with the Tucson Indian Center (TIC) and University of Arizona (UA). The TIC provides wellness and social services to the urban AI community in Tucson, AZ.

Team members took part in 1-2 hour long interviews at a personal home or the TIC to share their perception of the urban AI food system. The lead author worked with these same individuals to create individualized 3-5 minute digital stories. The first author met with each member at local coffee shops for up to 4 hours individually to offer short DST training and editing sessions. After a complete draft was created, the first author developed a resource guide for each story based on the DST food system topics (Figure 1). The DST resources consisted of a digital story and an accompanying resource guide

that included definitions, activities to enhance food access or security, and/or discussion questions to guide learning opportunities. The first author met with team members to review and edit their draft and the accompanying handout. The sessions were documented with an audio recorder and hand-written notes. Participants were given a $20 gift card for their first interview and $40 gift cards for the 4-hour sessions.

(Insert Figure 1 here)

DST team members met the first author for a final 1-hour individual interview before the products were finalized. The interviews were conducted with each member to evaluate participants' perspectives on: 1) constructs of the SCT in the DST resources, 2) applicability of DST resources for the urban AI community, 3) cultural appropriateness of the DST resource for the urban AI community, 4) experience and perspective in making digital stories, and 5) DST resources influencing behavior change. A questionnaire was designed with the theoretical framework of the SCT to explore the influence of personal and environmental determinants on food behavior witnessed within the food system. Demographic data of team members was also collected. The interviews were collected with audio recordings and hand-written notes. Participants were given a $15 gift card for their final interview.

Evaluating application of DST resources. The first author evaluated the development and application of the DST resources through three 2-hour long focus groups. One focus group was conducted with the 5 DST team members. Two other focus groups were

conducted with AI community members recruited through TIC events. Inclusion criteria included AI adults, ages 18 and older, who self-identified as AI, and lived within Tucson city limits. Demographic data was collected.

During each focus group, the digital stories and handouts were shared and the participants were asked a series of questions. The focus group questions were developed by the first author based on SCT constructs and evaluation questions adapted from an elders' digital story CBPR project with TIC (14). The questions were also shared with a CAB that was formed to review the DST curriculum. Participants shared their perspectives on the same five questions explored in the individual interviews above. The PI documented the focus groups with audio recordings and hand-written notes. Participants in the focus groups received a $15 gift card and snacks were provided. A summary of the focus group analysis was shared with the DST team for feedback and validation.

Analysis. Deductive and inductive thematic analysis was used to analyze the evaluative data from the food system DST resources (15). Deductive analysis was applied for the interviews and focus groups because factors from the SCT were organized into constructs based on the theory (13). Inductive analysis was applied when data was initially placed into logical segments on paper and organized into themes and patterns. The following key themes emerged from inductive analysis: applicability, cultural appropriateness, and experience and perspective making or viewing the resources.

The first author created codes based on the key constructs of the SCT, a priori research concepts of food systems, and themes that were compared from the inductive analysis. A

coding book was developed by the lead author and a second analyst (Table 1). Both coded one focus group and two interviews and came to agreement on codes and definitions; codes were entered into NVivo 10 software as parent nodes (16). The lead author coded all data and a second analyst independently coded 20% of a random sample of the data. Consensus was reached for conflicting codes and new codes were added to the codebook as needed. A summary with key themes was developed and presented to the DST team for validation. The data collection protocols were approved by the UA Human Subjects Institutional Review Board.

(Insert Table 1 here)

Results

Five AI adults (3 females, 2 males) participated as DST team members and were interviewed; 24 AI adults (17 females, 6 males) took part in three focus groups. The median age of all participants was 45 years old. Demographic information is shared in Table 2. Key themes are summarized in Table 3 and elaborated upon below.

(Insert Tables 2 AND 3 here)

SCT constructs

SCT constructs can guide behavior change strategies to enhance food access or build food security. Various SCT constructs emerged from the DST interviews with team members to illustrate the dynamic process of personal, environmental, and behavior factors influencing each other. One male participant interviewed shared an example of the SCT construct reciprocal determinism:

> They (my parents) did it when kids; I will do the same to follow them and eat healthy (environment). For a healthy body we need to listen to the elders' lecture (behavior change). Change your attitude more (personal factor). (Male, 20, interview)

After viewing the DST resources, focus group participants shared ways SCT constructs could help support DST resources by explaining relationships, food system functions, and ways to strengthen the stories, handouts, or strategies to improve food systems. During the focus group participants were asked to reflect on changes that could take place in the food system, and one female participant shared an example that included reciprocal determinism:

> I think gardening would be a good idea because fruits and vegetables are very expensive (environment). I think that's the only way our kids will get some of that (behavior). When they grow it (fruits and vegetables) they are more likely to eat it (personal and behavior). (Female 52, focus group)

Applicability

Overall, DST team members felt the DST resources would be applicable for the targeted audience because stories demonstrated role modeling and encouraged peer development. They felt the handouts would be helpful for educational outreach and could offer good resources and strategies to improve food access and food security. One participant shared that the resources supported people to think critically and gain new insight to take action:

> The handout will help others think of questions and of ideas of what we can do. It will help you think of places to go. It could target each age group. Make parents think about their children. Know resources and where to go. (Female, 62, interview)

Culturally appropriate and respectful

The DST team members discussed the connection of food to ceremonies and the value of traditional food and water. Stories illustrated aspects of culture applicable to other AIs, including history, colonialism, education, resilience, and social injustice experienced by AIs in Tucson. The team members felt their stories could also promote cultural awareness and competency in non-AIs. One team member shared an example of how the stories were culturally appropriate for the targeted audience:

> It (DST resources) relates to culture because that's part of when they are doing ceremonies or whatever culture. One of the things they have to do is feed the people, and how to get the food there. In every culture and every ceremony, the community has to come together to feed the people. (Male, 53, interview)

Experience and perspective

DST team members were comfortable during the interviews due to a prior relationship with the lead author who interviewed them (14). Four team members indicated they shared their stories for the benefit of young people, the community, and changing misconceptions on social media. One female interviewed shared, "This is my community, I would love for others to see this… I've seen them at the TIC, they know I am a real person in the community." (Female, 31, interview). The DST team members stated they enjoyed the experience because the lead author was on time to appointments, flexible with time, helped them choose photos, and assisted the older adults with editing software. A younger participant did his own editing and said there was a learning curve but he was happy he could apply his new skills and use them for other DST topics.

During the focus group with the DST team members, they expressed humor, amazement, and critiques of themselves of being on camera. All five team members said that the lead author did a great job with the resources and gave encouragement to them and shared how videos offered empowerment. The participants in the other two focus groups stated that the videos helped them reflect on history and impact of boarding school, racism, trauma, and colonialism on the family unit and successive generations. A male participant reflected on social injustice among AIs in South Tucson:

> I would say that growing up in south Tucson and also the reservation, it was very segregated and it still is… the City of South Tucson and the City of Tucson needs to

> apologize to the Indian community for everything that they have done to the Indian people. (Male, 65, focus group)

Discussion

Identifying the SCT constructs illustrated how behavior change is influenced by the DST resources and guides people to think about their behaviors, environment, and personal factors in relation to the food system. The DST questions helped initiate discussions for participants to think critically of their place in the food system. Building self-efficacy was an important construct in the DST resources. One female participant reflected on the video about Tucson's history with AIs and expressed agreement with the digital storyteller that despite the struggles people faced, they can get what they need, have to work hard and use the gifts with which they are blessed. The DST resources can influence others to make behavior changes because the stories are real and promote critical thinking to build personal knowledge and self-awareness.

The digital stories can motivate viewers to make changes in behavior and attitude by influencing social norms through examples of healthy lifestyles. Change can happen by promoting social cohesion, social interaction, and sharing resources. Some of the DST team members expressed building social knowledge about the food system could empower people to take action and change food beliefs. An important layer of change was to create environmental change, including policy that can strengthen the food system and address important factors such as socioeconomic and cultural resources.

This study highlights access to technology. If the DST resources rely heavily on social media, those who do not use Facebook or have email would not have access. At least half of the participants were not on social media and did not have email access. Future studies should investigate appropriate and effective methods for sharing the DST resources.

The DST resources were well received overall but the participants stated they could be expanded and include more photos in the videos, figures or diagrams in the handouts, and be more dynamic and visual for community members with low attention spans. They also suggested including viewpoints from different age groups, gender, and tribal backgrounds.

The DST team members mentioned positive outcomes of behavioral and personal factors from participating, including overcoming feeling nervous or reserved, facing social judgment, and hesitating to do interviews. Team members felt they could be more open and honest when making their digital stories due to their familiarity with the lead author. Other positive personal factors mentioned were the benefits by being reminded of history or past stories, sharing discussions with parents and elders, reflecting on historical photos, and thinking of past/current health outcomes and food systems critically.

Unexpected findings were critiques by focus group participants who stated the stories were good but not complete because they did not take into account the variation of culture or experiences among tribal groups. One male participant felt the experiences for AIs who lived in Tucson were all different based on their tribe. He shared his story of

South Tucson, a separate municipality from Tucson, that AIs did experience segregation with other races and also within tribal groups who lived in the city. Another participant shared that the DST video he viewed portrays an accurate reflection of AI culture but more perspectives on culture are needed if the resources are to capture the attention of a wider audience. This sentiment reaffirms the diverse ways urban AIs view culture. One female participant shared that AI people have adapted to new foods now considered part of their culture, and to eat more culturally based food they need recipes with ingredients they can find in the city. Future resources should include diverse cultural viewpoints to be more applicable and relevant.

Recommendations include creating a food system curriculum that incorporates the DST resources. More DST videos could be developed to expand viewpoints on the urban AI food system. The curriculum could incorporate activities that offer visual and experiential learning for community members. A policy guide is needed to help participants learn about policy development, policy memos, how to meet with city officials, and how to create a policy council. Future studies could also include a pre and post-test design to evaluate the food system curriculum's impact based on SCT constructs. The participants in the focus groups also mentioned creating opportunities to garden as a community, teaching children/youth how to garden, and having recipe demonstrations for food given to them by organizations in Tucson that promote food security.

A limitation of this study is the limited view of the urban AI experience expressed by the small sample recruited only from the TIC who participated in TIC events and know more

about health systems. This selective recruitment strategy was also a strength. The resources were meant to target the population served by the TIC, so having participants who are part of that population helped make the stories more locally relevant.

This study demonstrated how DST resources may positively influence the AI food system in Tucson through changes that can be observed by SCT constructs. The SCT framework offered a way to understand how health behavior is influenced by or impacts environmental and personal determinants. This study developed and evaluated DST resources among urban AIs to understand how such resources may support food system knowledge development, change health behavior, and initiate opportunities for conversing and transformation. The DST resources encouraged participants to engage in discussions about food history, social injustice, and personal empowerment. This study documented the perspective of urban AIs who indicated they wanted to create personal to environmental changes using cultural strengths, social support, and food systems policy. The findings from this study support the need to develop future interventions or policy that can address food access and security using DST as a key to target SCT constructs in the food system.

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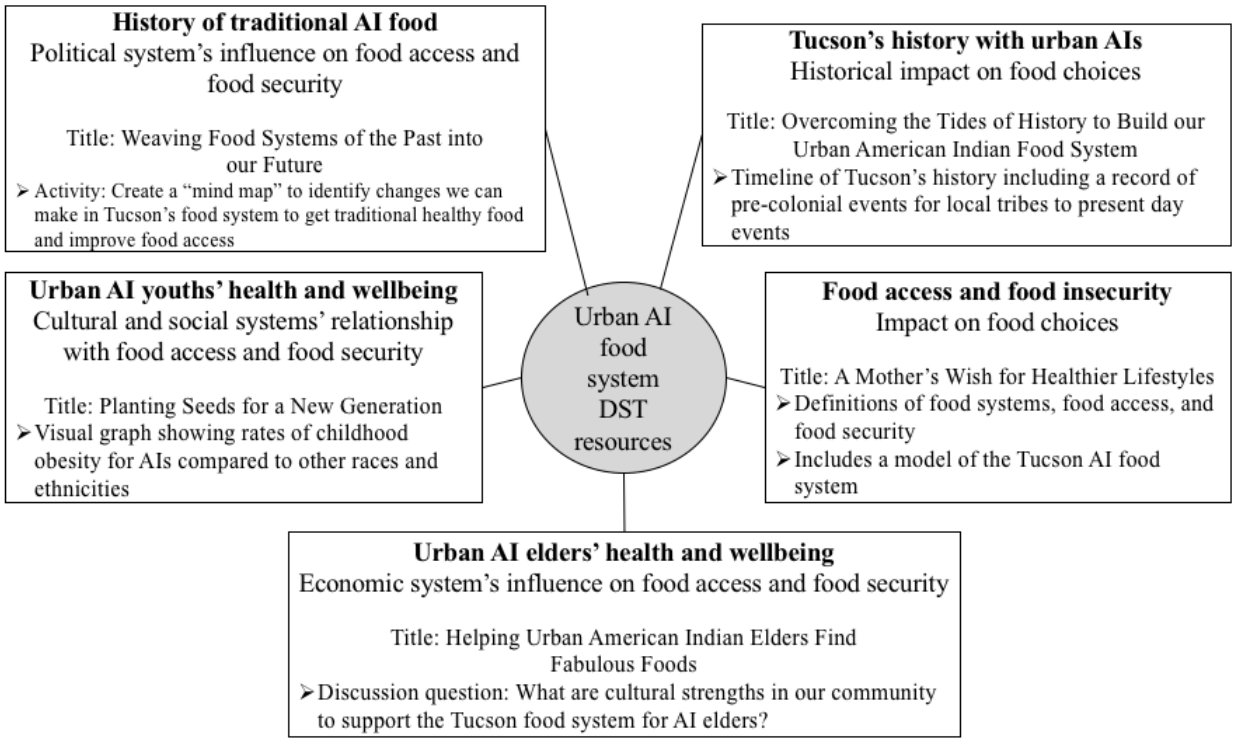

Figure 1. Topics, titles, and examples of digital storytelling (DST) resources

Table 1. Code book for analysis of DST resources

Themes	Patterns
Digital storytelling (DST)	Barriers; benefits; digital story envisioning; DST curriculum; DST production; DST project; DST theme; interpersonal development; setting; strategies; testimonials
Social cognitive theory constructs	Reciprocal determinism, behavioral capability, outcome expectations, self-efficacy, modeling, reinforcements
Technology	Barriers, promoters; technical skill level
Biophysical	Land resources
Culture	Barriers; cognitive skills; cultural roles, exposure; history; intergenerational; intertribal; loss; non-natives; strategies; strengths
Economics	Barriers; economic development; education; housing; income; jobs; social economics; strategies; workforce development
Education	Barriers; history; minority groups; school; strategies
Food input and output	Food access; food consumption; food insecurity; food systems; production & distribution
Health	Barriers; future health; health & food; health issues; health knowledge; insurance; losing loved ones; past health; strategies
Policy	Policy development, policy type, politics, resources, responsibility
Social system	Gender roles; intergenerational; people; personal influence; social influence; social space; social support; strategies; urban AIs

Table 2. Demographic characteristics of AI adult participants, 2017-2018

Characteristic	No. of Respondents	Value
Gender	23	
Female	17	74%
Male	6	26%
Age, y, mean (SD)	23	45 (SD 17)
18-29	6	26%
30-44	3	13%
45-59	6	26%
60 and older	8	35%
Education	23	
K-11th grade	3	13%
HS Graduate or GED	8	35%
Some college	12	52%
Income	23	
Less than $10,000	12	52%
$10,000 to $24,999	10	44%
$25,000 to $49,999	1	4%

Table 3. Summary of key themes and quotes from interviews and focus groups conducted with DST team members and AI adults

Key themes	Summary of key theme	Quotations from interviews or focus groups
SCT constructs in DST resources	Personal experiences, knowledge, and relatives and acquaintances that helped their stories of behavior, or health strategies.	"Then my mom passing away…if she had just taken care of herself and not drank so much alcohol (outcome). I don't want that for me (self-efficacy), I don't want to have to worry of what I am consuming because of diabetes. I am always being part of these different groups and classes and seeing that there are different ways to cook foods from friends (modeling)." (Female, 31, interview)
DST resources are applicable for the urban AI community	Showcased real stories; participants agreed the stories were valid, especially in the portrayal of AI history in Tucson. Lessons are applicable and empowering for the audience they targeted.	"Especially when he said I think it would be good for younger boys because they see…like he was saying the drinking and suicide…well that's the way I guess that's the way we're supposed to go, but he's saying get up and go against the tide. That was very empowering for younger men, I think it would be." (Female, 63, focus group)
DST resources are culturally appropriate and respectful	Resources follow AI storytelling traditions and encourage participants to share stories of their culture and history.	"For example…We grew up here on S. Myer and that house is still there…We had an outdoor stove so my grandmother would put on a pot of beans before she went to work and so my job and my grandfather's was to stir the beans all day…And then if we burned them my grandmother would say there's no dinner…So that's something that's really interesting because people think that we grew up and everything was so nice and easy. But it wasn't easy, it was hard." (Female, 64, focus group)
Experience and perspective in making or viewing digital stories	Resources offered a platform to share stories and put thoughts into action. DST team members shared what inspired their stories and reflected on history, food, health, sense of loss, and current health.	"I had thoughts, but there was no outlet or I couldn't relate to anyone so I just kept it to myself. Or I talked to kids about it, or my wife, or aunts and uncles. But it was just talk, not something that was pushed forward." (Male, 53, interview)

SCT=Social cognitive theory; DST= digital storytelling

APPENDIX D: DST Interview and Focus Group Guides

DST Interview Guide

1. Could you tell me a little bit about yourself and where you are from?
2. What are your thoughts when you hear the words food systems? How would you define that in your own words?
    a. What about food access? What about food security?
3. What are your thoughts when you hear the words American Indian or Indigenous food systems? How would you define that in your own words?
4. Do you think the Tucson food systems are different from American Indian food systems? If so, how?
    a. How would you describe the food systems for American Indians in Tucson?
5. Can you share a story of a time when you or your family couldn't access healthy food or food security was threatened?
    a. What action did you take to address this issue? Did any skills, previous experience, or feeling in control of your behavior help the action you took?
    b. What thoughts went through your mind when you confronted this issue? Did your knowledge, expectations, or attitudes influence your thoughts about how to address the issue?
    c. What outside support did you get or seek to address the issue? Did you get any social support or support from the surrounding environment?
6. Do you and/or your family include Native food as part of your diet?
    a. What foods? How often is it part of your diet? Please describe your traditional food shopping experience. Where do you go?
7. In your own thoughts, what do you consider healthy foods?
    a. Do you feel you eat enough healthy foods on a daily basis?
8. Do you know where your food comes from?
9. What are the challenges in our community that may prevent you and your family from eating healthy foods?

10. What are the strengths in our community that may support you and your family to eat healthy foods?
11. If you had all the resources you needed to create the ideal food systems that supported you and/or your family to eat healthy, what would you want your food systems to look like for this urban American Indian community?

DST Feedback Interview Guide

1. What are some of the main themes or ideas that come out from your digital story?
    a. Did you observe any connection between behavior (i.e. skills), personal factors (i.e. knowledge/attitude), and environmental factors (i.e. social support) that support food access or food security?
2. What was helpful about the handout to help explain the main themes or ideas? What was not helpful or missing from the handout?
3. Is this digital story resource useful and appropriate for the overall urban AI community?
    a. Is it culturally appropriate and relevant?
    b. Do you feel the digital story resource has the potential to support and influence other AI community members to access healthy food or promote food security? How so?

Now I would like to ask you questions about your experience in making your digital story(ies)

4. How would you describe the process of developing your story?
    a. What surprised you?
    b. What was the most interesting?
    c. What was the least interesting?
    d. What was challenging?
5. Have you ever thought about food systems, food access, or food security before making your digital story?
6. Have you ever thought about Indigenous or American Indian food systems before making your digital story?
7. Did you feel comfortable making the video?

8. Is there anything that you would change about the process (not just the product) to make the experience better?
9. What are some suggestions for future resources or digital stories that can be created?

DST Curriculum Focus Group Guide

1. What are your thoughts when you hear the words food systems?
    a. What about food access?
    b. What about food security?

<Show the digital story and share handouts>

2. What are some of the main themes or ideas that come out from the digital story?
3. What was helpful about the handout to help explain the main themes or ideas? What was not helpful or missing from the handout?
4. How did the digital story explain ways to negotiate food systems when considering the following factors:
    a. What are behaviors (i.e. skills, etc.) in the digital story that influence ***taking action*** to access healthy food and promote food security?
    b. What are personal factors (i.e. knowledge/attitude) in the digital story that influence ***thoughts*** about food access and food security?
    c. What are environmental factors (i.e. social support) in the digital story that ***support*** food access and food security?
5. Is this digital story resource useful and appropriate for the overall urban AI community?
    a. Is it culturally appropriate or relevant?
6. What are some suggestions for future resources or digital stories that can be created?
7. Do you feel it has the potential to support and influence you to access healthy food or promote food security? How so?

<Repeat questions 2-7 for each digital story that is viewed>

APPENDIX E: HUMAN SUBJECTS APPROVAL

Research
Office for Research & Discovery

Human Subjects
Protection Program

1618 E. Helen St.
P.O.Box 245137
Tucson, AZ 85724-5137
Tel: (520) 626-6721
http://rgw.arizona.edu/compliance/home

Date:	March 30, 2017
Principal Investigator:	Carmella B Kahn
Protocol Number:	1703309058
Protocol Title:	Promoting healthy food access and food security in urban American Indians through adaptations to the local food systems and digital storytelling
Level of Review:	Exempt
Determination:	Approved

Documents Reviewed Concurrently:

Data Collection Tools: *Kahn_Digital story team_Feedback Interview questions.doc*
Data Collection Tools: *Kahn_Digital story team_Interview questions.doc*
Data Collection Tools: *Kahn_Focus Group questions_digital story resources review.doc*
HSPP Forms/Correspondence: *CarmellaKahn_NewF200_finalsigpg3.23.17.pdf*
HSPP Forms/Correspondence: *Kahn_Appendix_Native American Research.docx*
HSPP Forms/Correspondence: *Kahn_Application Human Research_UPDATED.docx*
HSPP Forms/Correspondence: *Kahn_F107.doc*
Informed Consent/PHI Forms: *Kahn_Digital story team_Consent Form_UPDATED v2017-03-24.docx*
Informed Consent/PHI Forms: *Kahn_Digital story team_Consent Form_UPDATED v2017-03-24.pdf*
Informed Consent/PHI Forms: *Kahn_Focus Group_Consent Form_UPDATED v2017-03-24.docx*
Informed Consent/PHI Forms: *Kahn_Focus Group_Consent Form_UPDATED v2017-03-24.pdf*
Other Approvals and Authorizations: *Kahn_Tucson Indian Center_Site Authorization.pdf*
Participant Material: *Kahn_Digital Story Team_Sign Up Sheet.docx*
Participant Material: *Kahn_Receipt of compensation_UPDATED.doc*
Recruitment Material: *Kahn_Digital story team_Flyer.docx*
Recruitment Material: *Kahn_Focus Group_Flyer.docx*
Recruitment Material: *Kahn_Oral_email_letter recruitment .docx*

This submission meets the criteria for exemption under 45 CFR 46.101(b). This project has been reviewed and approved by an IRB Chair or designee.

- The University of Arizona maintains a Federalwide Assurance with the Office for Human Research Protections (FWA #00004218).
- All research procedures should be conducted according to the approved protocol and the policies and guidance of the IRB.
- Exempt projects do not have a continuing review requirement.
- Amendments to exempt projects that change the nature of the project should be submitted to the Human Subjects Protection Program (HSPP) for a new determination. See the Guidance

on Exempt Research information on changes that affect the determination of exemption. Please contact the HSPP to consult on whether the proposed changes need further review.

- You should report any unanticipated problems involving risks to the participants or others to the IRB.
- All documents referenced in this submission have been reviewed and approved. Documents are filed with the HSPP Office. If subjects will be consented, the approved consent(s) are attached to the approval notification from the HSPP Office.