Exploring Definitions, Correlates, and Solutions to Food Insecurity during COVID-19: A Mixed Methods CBPR Study with the Baltimore Native Community

Tara L. Maudrie, PhD, MSPH (Sault Ste Marie Nation of Chippewa Indians), Cassandra J. Nguyen, PhD, Dane Hautala, PhD, Maisie Conrad, MSPH, Valarie Blue Bird Jernigan, DrPH, MPH (Choctaw Nation of Oklahoma), Kerry Hawk Lessard, MAA (Descendant of Ft Peck and Assiniboine Sioux Tribes), Jessica Dickerson, MSW (Lumbee Tribe of North Carolina), Victoria M. O'Keefe, PhD (Citizen of Cherokee Nation of Oklahoma and Member of Seminole Nation), and Joel Gittelsohn, PhD

Abstract: *A mixed methods community-based participatory research study was conducted with Native American Lifelines of Baltimore to: (1) understand prevalence, correlates, and lived experiences with food insecurity and (2) explore the effects of and potential solutions to food insecurity. An online survey was completed by 250 American Indian and Alaska Native adults, and a subset of survey respondents (N=11) completed interviews. Quantitative analysis revealed food insecurity prevalence of 28% and increased odds of food insecurity with higher levels of food stress and COVID-19 hardships. Qualitative inquiry revealed harmful long-term effects of food insecurity on eating behaviors and several food sovereignty-oriented solutions to food insecurity.*

INTRODUCTION

Since time immemorial the health and well-being of American Indian and Alaska Native (AI/AN) peoples has been supported by their reciprocal relationships with their environments (Satterfield et al., 2016; Devens, 1992). The arrival of settlers and onset of settler colonialism complicated these relationships through rapid changes to land and waterscapes and, in many cases, forced removal to reservations, often in unfamiliar territories (Joos, 1984; Satterfield et al., 2016; Devens, 1992; Cave, 2003; Bowes 2014; Bowes, 2016). Settler colonialism damaged ecosystems and disconnected AI/ANs from their food systems, homelands, and traditional food practices (e.g., hunting, cultivation, foraging of wild foods), limiting the ability of AI/ANs to pass on ecological knowledge to future generations (Warne & Wescott, 2019; Kuhnlein & Receveur, 1996; Conti, 2006). Disruption of traditional food practices caused food insecurity and increased reliance on government food rations, now referred to as the Food Distribution Program on Indian Reservations (FDPIR; Warne & Wescott, 2019). The disruption of AI/AN foodways, damage to environments, and policies of AI/AN removal and relocation (i.e., The Indian Relocation Act of 1956; Madigan, 1956) resulted in historical traumas and continued threats to food access and food security for AI/AN peoples (Satterfield et al., 2016). As a result of these practices and policies, as well as growing appeal of urban locations (e.g., for education and employment opportunities), the majority (76%) of AI/ANs now reside in urban areas (US Census Bureau, 2022), where the prevalence and experiences of food insecurity among AI/ANs are not well studied.

Food security, as defined by the US Department of Agriculture (USDA), is having adequate and consistent access to enough foods to live an active and healthy lifestyle (Coleman et al., 2020). Food insecurity (the opposite of food security) is an important determinant of health associated with increased risk for chronic health conditions including hypertension and type 2 diabetes (Abdurahman et al., 2019; Seligman et al., 2010), as well as poor dietary quality (e.g., low fruit and vegetable intake, high consumption of calorically dense foods; Leung et al., 2014; Heut, Rosol, & Egeland, 2012). Further, food insecurity has been associated with poor mental health (Wright et al., 2021), including symptoms of depression and anxiety (Leung et al., 2015; Sundermeir et al., 2021). Existing food security inequities were exacerbated by the effects of the COVID-19 pandemic (Lauren et al., 2021). In the United States, the COVID-19 pandemic resulted in

economic challenges (e.g., loss of employment), supply chain shortages, unprecedented demand for food assistance, and complications with safely accessing adequate foods, all of which increased risk of food insecurity even for previously food secure individuals (Lauren et al., 2021; Wolfson and Leung, 2020). A study of low-income adults during COVID-19 found that food insecure individuals were less likely to be able to comply with recommendations to purchase two weeks of food at a time and were more likely to experience COVID-19 hardships, like being laid off, reduced work hours, and not having enough money to pay bills (Wolfson & Leung, 2020).

Today, as a result of settler colonialism and systemic racism, food insecurity disproportionately affects AI/ANs (DeBruyn et al., 2020). A scoping review of food insecurity among AI/AN communities found estimates of food insecurity ranging from 16-77%, with variation in prevalence by Tribal nation, household characteristics, and rurality of residence (Nikolaus et al., 2022). A national analysis of Current Population Survey data found evidence that urban AI/ANs were more likely to experience food insecurity than their rural AI/AN relatives (Jernigan, 2017). However, the 2022 systematic review found inconsistent evidence of rural and urban differences, potentially due to a smaller number of studies focusing exclusively on urban AI/AN food security (Nikolaus et al., 2022). AI/AN communities and scholars have expressed concerns about the way food security is conceptualized and measured, and whether these mainstream definitions and measures align with their worldviews and priorities (Cidro et al., 2015; Sowerwine et al., 2019; Nikolaus et al., 2022; Maudrie, Clyma, et al., 2024; Maudrie, Caulfield, et al., 2024). Traditional and cultural foods hold deep spiritual and relational importance for many AI/AN communities, yet the spiritual and relational significance of access to these traditional foods and food practices are not considered in mainstream definitions and measures of food security (Cideo et al., 2015; Sowerwine et al., 2019; Maudrie, Caulfield, et al., 2024). In response to these limitations, scholars and AI/AN communities have called for the development of more holistic, culturally relevant measures of food security that recognize the importance of traditional food practices, food sovereignty, and the interconnections between food, identity, and well-being (Cidro et al., 2015; Maudrie, Caulfield, et al., 2024; Nikolaus et al., 2022). Efforts to develop such measures have emerged, including community-driven food security assessments that center Indigenous knowledges and priorities (Sowerwine et al., 2019), yet standardized measures that adequately capture AI/AN food security remain lacking. Addressing these gaps is critical to ensuring that food security research and policy better reflect the lived realities and needs of AI/AN communities.

Urban and rural AI/ANs face many of the same health challenges, however, social inequities unique to the urban AI/AN experience further complicate the health needs and challenges of urban AI/ANs (Weaver, 2012; Maudrie et al., 2021). Examples of challenges faced by urban AI/ANs include extremely underfunded and often inaccessible healthcare, invisibility in data and as a cultural group within cities, and decreased access to cultural resources (Urban Indian Health Commission, 2007; Maudrie et al., 2021; Weaver, 2012; Trahant, 2018). Further, many urban AI/AN peoples are unable to access food support programs specifically for AI/AN peoples, including FDPIR (Maudrie et al., 2021; Castor et al., 2006). The COVID-19 pandemic complicated many existing health challenges for urban AI/ANs, including food security, mental health, stress, and access to healthcare and medications (D'Amico et al., 2020; Cordova-Marks et al., 2020). A study of urban AI/ANs across Alaska, Kansas, Minnesota, and New Mexico found that 38% experienced food insecurity during the COVID-19 pandemic, underscoring the pandemic's significant impact on food security in urban AI/AN communities (Nelson et al., 2024). Despite the many food access challenges faced by AI/ANs, during the COVID-19 pandemic the food sovereignty efforts of AI/AN communities have captured national attention as a potential solution to food insecurity (Maudrie et al., 2023). Food sovereignty was originally defined in the Declaration of Nyeleni as "the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems" (Sélingué, 2007). Food sovereignty has a rich history in Indigenous communities and demonstrates the "survivance" and resilience of Indigenous food systems, even in the face of the COVID-19 pandemic.

As defined by Vizenor, an Anishinaabe writer, "Survivance is an active sense of presence, the continuance of native stories, not a mere reaction, or a survivable name. Native survivance stories are renunciations of dominance, tragedy and victimry" (Vizenor, 2009). Despite numerous challenges, urban Native communities embody survivance as they flourish in spaces designed to exclude and ignore their very existence (Vizenor, 2009). One such community is the Baltimore Native community, composed of nearly 25,000 AI/AN peoples living in the Baltimore metro area (Urban Indian Health Institute, 2018). Like all cities in the United States, Baltimore has been home to AI/ANs since time immemorial; however, in the last 100 years, many AI/ANs have moved to Baltimore for varying reasons (McLeod, 2017). Although Baltimore was never designated as relocation city under the Indian Relocation Act of 1956, many AI/ANs moved to Baltimore in search of jobs and education (McLeod, 2017). Today the Baltimore Native community represents

over 100 distinct Tribal affiliations. In addition to their tribal affiliations, members of this community often proudly claim "Baltimore Native" as a sign of their belonging to a community that does not replace their individual Tribal identities, but builds upon their kinship ties (Fixico, 2000). Despite anecdotal observations of behaviors that indicate food insecurity, there are no published food security data specific to the Baltimore AI/AN community.

This paper describes a sequential explanatory mixed methods community based participatory research (CBPR) study conducted in partnership with Native American Lifelines (NAL), an urban Indian Health Program in Baltimore. The purpose of this study was twofold: (1) to examine the prevalence, correlates, and lived experiences of food insecurity among Baltimore AI/ANs during the COVID-19 pandemic, and (2) to explore the impacts of food insecurity and identify potential solutions, including food sovereignty, for AI/ANs in Baltimore.

MATERIALS AND METHODS

In early 2019, author Tara Maudrie and NAL formed a research partnership. Through this partnership, food security was identified as a priority for action and a CBPR study was planned. The details of this partnership and the effects of the COVID-19 pandemic on the methodology of this study are described elsewhere (Maudrie, Nguyen, et al., 2022). The study employed a sequential explanatory mixed methods study design, in which an initial quantitative inquiry is followed by a qualitative exploratory phase that expands on quantitative findings (Ivankova, Creswell, & Stick, 2006). Participants provided written or oral consent and human subjects approval was granted through the Johns Hopkins University Institutional Review Board (IRB: 00013176) and community partner approval through a memorandum of understanding between Tara Maudrie and NAL.

Phase 1: Quantitative Survey

Survey Participants

Participant recruitment occurred from February to March of 2021. Due to the ongoing COVID-19 pandemic precautions (e.g., physical distancing, virtual events rather than community gatherings), participants were recruited with phone calls from a contact list (provided by NAL) or through a survey link distributed through NAL's social media. Inclusion criteria included: 1) being a self-identified member of an American Indian or Alaska Native Tribe, 2) being an adult (over

the age of 18), and 3) living in Baltimore City or the Baltimore metro area (within 50 miles of Baltimore City).

Measures

Food Security. Food security was assessed using the 10-item U.S. Department of Agriculture's Adult Food Security Survey Module (USDA, 2012). The 10-item survey module assesses a household's ability to acquire food and food conservation behaviors they may have engaged in over the last 30 days. This module categorizes participants' food security status as: High Food Security, Marginal Food Security, Low Food Security, and Very Low Food Security. In line with food security literature and reporting mechanisms (USDA, 2012), we combine high food security and marginal food security to represent being "food secure," while low food security and very low food security were combined to represent "food insecure." Food secure was coded as "0," while food insecure was coded as "1."

Food Stress. To obtain a more holistic understanding of individual's psychosocial relationship with food, we also assessed food stress as both a proxy for and an expansion of the concept of food security that was culturally adapted with Midwest Native communities (Maudrie, Aulandez, et al., 2022). Participants were asked if in the last 30 days if there "was not enough money for food," "the kinds of food I wanted were not available," "there was not enough time for shopping or cooking," and "it was hard to get to the store." Participants were given the response option of "No" (0) and "Yes" (1). These four items were summed into an index with higher scores indicating higher levels of food stress; responses ranged from experiencing 0 food stressors to 4.

COVID-19 Hardships. COVID-19 hardships were assessed using two questions from a national food insecurity web-based survey of adults (Wolfson & Leung, 2020). First, participants were asked, "During the early stages of the pandemic there was a general recommendation to purchase 2 weeks' worth of food at a time. Were you able to comply with recommendations to purchase two weeks' worth of food throughout the pandemic?" Participants were able to respond "No" (1) or "Yes" (0). Participants were also asked if they encountered any of the following challenges due to the COVID-19 pandemic: limited availability of household items (toilet paper, sanitizer, etc.), reduced access to healthcare, reduced access to medications, inability to pay bills, inability to pay rent or mortgages, difficulties working due to lack of childcare, inability to work due to them or a family member contracting COVID-19, inability to work due to illness other

than COVID-19, or none of the above. All responses, except for none of the above (which was coded as 0), were summed to give an overall indication of the number of COVID-19 hardships a person experienced. For analytic purposes, COVID-19 hardships were categorized into: No COVID-19 hardships (reported 0 hardships; coded as 0), Minimal COVID Hardships (reported 1 hardship; coded as 1), Moderate COVID Hardships (reported 2 hardships; coded as 2), and Severe COVID Hardships (reported greater than 3 hardships; coded as 3).

Sociodemographic characteristics. Participants were asked about their gender identity (male, female, non-gender binary, Two-Spirit), highest level of educational attainment (less than high school, high school diploma, high school equivalency degree or General Education Diploma, some college or vocational school, college graduate, advanced degree), household size, total household income in the last year, current employment status (working full time 35 hours or more per week; working part time less than 35 hours a week; unemployed or laid off and looking for work; unemployed or laid off and not looking for work; in school/student; retired; disabled and not able to work), and types of food sources utilized including food support programs (e.g., Supplemental Nutrition Assistance Program [SNAP], Special Supplemental Nutrition Assistance Program for Women, Infants, and Children [WIC], food pantries), subsistence practices (hunting, fishing, foraging, gardening), and food stores (grocery stores, gas stations, convenience stores).

Analyses

Prevalence of food insecurity was reported as a proportion of total respondents. Unadjusted and adjusted logistic regression models were used to assess correlates of food insecurity. Our model included the predictors: age, income, gender (compared male to female as reference group; 6 individuals identified as non-binary or Two-Spirit but were not included in logistic regressions), household income, educational attainment (compared to high school, GED, or less), COVID-19 hardships, and food stress. All factors were assessed in an unadjusted (Model 1) and adjusted models (Model 2: Adjusted for demographics; Model 3: Adjusted for demographics and COVID-19 hardships; Model 4: Adjusted for demographics, COVID-19 hardships, food stress, and food sources). All analyses used a significance level of $\alpha = 0.05$. The results of the logistic regression analysis are displayed using Odds Ratios (OR) and 95% confidence intervals. Analyses were conducted using Stata16 (StataCorp, 2019).

Phase 2: Qualitative In-Depth Interviews

Interview Participants

Eleven ($N = 11$) AI/AN adults who participated in the quantitative survey were selected to represent all four levels (very low, low, marginal, and high) of food security to participate in in-depth interviews. Participants were randomly selected from each of the four categories of food security. Participants were contacted via telephone from the contact information they provided in the quantitative survey.

Data Collection

As part of our CBPR process and in alignment with CBPR principles of co-learning and collaborative partnership, the interview guide used to facilitate in-depth interviews was developed with NAL (Israel et al., 2017). The interview guide included questions about experiences with food insecurity, food sovereignty, and other food-related issues and were informed by our community partner's observations of food insecurity-related behaviors (see Maudrie, Nguyen, et al., 2022 for full interview guide). NAL specifically was interested in understanding how community members conceptualized and understood food sovereignty to guide their ongoing program efforts. The lead author performed all interviews virtually via video conference in alignment with the COVID-19 precautions and preferences of our community partner and the Johns Hopkins University IRB at the time of data collection. While the broader interview questions remained the same, adaptive probing was used to explore each participant's experience, consistent with a semi-structured interview guide format. To ensure that the interviewer and interview participant had a mutual understanding of food security throughout the conversation, participants were asked to explain how they defined food security. After participants explained how they defined food security, the interviewer read the USDA definition of food security (USDA, 2022). Informed verbal consent was obtained from all participants prior to the interview. Throughout the data collection and analytic phases, the lead author composed memos to capture important themes, identify areas for future exploration, and to practice relational reflexivity.

Analyses

Qualitative thematic analyses utilized an applied content analysis approach with a mixture of deductive and inductive coding in alignment with commonly used mixed methods qualitative analytic approaches (Fereday & Muir-Cochrane, 2006; Proudfoot, 2023). The lead author

developed initial deductive codes using major components of the quantitative survey and significant observations from analytical memos. Authors Tara Maudrie & Maisie Conrad then coded three transcripts using the first draft of the codebook, while also open (inductive) coding to capture themes outside of the original codebook. The final draft of the codebook was then discussed with senior members of the research team (Victoria O'Keefe and Joel Gittelsohn), and the remaining transcripts were coded by lead author Tara Maudrie. Following focused coding, codes were grouped into similar concepts which became the basis of the qualitative themes. In line with AI/AN storytelling values and to preserve the context of participant experiences, a narrative approach is used to present qualitative findings specific to the experience of food insecurity (Blodgett et al., 2011; Quayle & Sonn, 2019), while the remainder of qualitative findings are presented thematically.

Reflexivity

In the spirit of qualitative research reflexivity and Indigenous protocols of accountability, we offer the following context for the authorship team of this paper and research study. The lead author, Tara Maudrie is an enrolled citizen of the Sault Ste Marie Nation of Chippewa Indians, who has been an urban Native person most of her life. Throughout the design, implementation, and subsequent analyses of this study, she was guided by deep respect and care for the Baltimore AI/AN community, who have welcomed her into their community with open arms and hearts. Her analyses and interpretations of the qualitative data was guided by her education and experience in qualitative research methodologies, as well as the cultural teachings and values she carries with her. Cassandra Nguyen is a White non-Indigenous woman who works on food security research and outreach efforts and whose role is to support her Indigenous colleagues in advancing food sovereignty, health, and wellbeing among AI/ANs. Dane Hautala is a white non-Indigenous man who works with Indigenous communities and organizations around building capacity for collecting, analyzing, and using quantitative data. Maisie Conrad is a non-Indigenous researcher with previous experience working in health equity research with Indigenous communities. Victoria O'Keefe is a Cherokee Nation citizen and member of the Seminole Nation of Oklahoma, who served as Tara Maudrie's PhD advisor. Her community and cultural values continuously shape her life as a Cherokee/Seminole woman, as well as her community-based work as a researcher and Clinical Psychologist. Valarie Blue Bird Jernigan is an enrolled citizen of the Choctaw Nation of Oklahoma, a Professor of Medicine, and an

intervention scientist focused on food sovereignty within Indigenous communities. Kerry Hawk Lessard is the Executive Director of Native American LifeLines and an applied medical anthropologist focused on the impacts of historical trauma on urban AI/AN health outcomes. She is the descendant of an Assiniboine (Ft Peck) Carlisle Indian Industrial School graduate, and her desire to honor and heal that legacy informs her work. Jessica Dickerson is an enrolled member of the Lumbee Tribe of North Carolina, as a Licensed Master Social Worker, she is devoted to serving Native communities in Baltimore and beyond through advocacy and trauma-informed care practices. Joel Gittelsohn is a mixed-race man who has worked in rural Native communities for most of his 30-year career as a researcher and served as Tara Maudrie's advisor during her Master of Science in Public Health program.

RESULTS

Quantitative Results

Over a quarter of the sample (28%) reported food insecurity at the time of survey (9.6% reported very low food security and 18.4% reported low food security). Of the majority who reported being food secure (72%), nearly all reported high food security (69.2%) and a small proportion reported marginal food security (2.8%). Basic demographics of survey participants are presented by food security status in **Table 1**.

In unadjusted models, greater number of COVID hardships and food stress increased the odds of food insecurity, while age and engaging in food subsistence practices decreased the odds of food insecurity. In Model 2, all demographic characteristics were simultaneously entered into the model. Age and higher levels of education, relative to high school/GED, decrease the odds of food insecurity, while income increased the odds of food insecurity. In Model 3, adding COVID-19 hardships, identifying as male and experiencing a greater number of COVID-19 hardships significantly increased odds of experiencing food insecurity, while age significantly decreased odds of experiencing food insecurity. In Model 4, adjusted for all variables, experiencing COVID-19 hardships and food stress increased the odds of food insecurity, while age and food subsistence practices decreased the odds of food insecurity. Logistic regression results are presented in the Appendix, Table A1.

Table 1
Characteristics of the Baltimore urban AI/AN sample by food security status (N = 250)

Sociodemographic factor	Total n	Food Insecure n (%)	Food Secure n (%)
		70 (28.0)	180 (72.0)
Age in years, *Mean (SD; Range)*	35.4 (7.1; 18-66)	29.6 (5.6)	37.6 (6.3)
Gender[a]			
Male	141	41 (29.1)	100 (70.9)
Female	103	26 (25.2)	77 (74.8)
Two Spirit/non-gender binary	2	1 (50)	1 (50)
Education[b]			
Less than high school, high school, GED	70	24 (34.2)	46 (65.7)
Some college, trade or technical school	66	13 (19.7)	53 (80.3)
College graduate or graduate school	109	32 (29.4)	77 (70.6)
Income[c]			
Less than $20,000	19	17 (89.5)	2 (10.5)
$20,000-$29,999	40	7 (17.5)	33 (82.5)
$30,000-$39,999	71	11 (15.5)	60 (84.5)
$40,000-$49,999	44	2 (4.5)	42 (95.5)
$50,000-$59,999	36	6 (16.7)	30 (83.3)
Greater than $60,000	31	23 (74.2)	8 (25.8)
Employment[d]			
Unemployed, student, homemaker	29	12 (41.4)	17 (58.6)
Part time employment	87	10 (11.5)	77 (88.5)
Full time employment	128	45 (35.2)	83 (64.8)
COVID-19			
Inability to purchase 2 weeks' worth of food at a time	180	33 (18.3)	147 (81.7)
No COVID hardships	47	3 (6.4)	44 (93.6)
Minimal COVID hardships	34	10 (29.4)	24 (70.6)
Moderate COVID hardships	127	21 (16.6)	106 (83.5)
Severe COVID hardships	42	36 (85.7)	6 (14.3)
Food Sources[e]			
Subsistence practices (gardening, hunting, fishing, foraging)	61	10 (16.4)	51 (83.6)
Nutrition support programs (SNAP, WIC, food pantries)	93	28 (30.1)	65 (69.9)

[a] 4 individuals missing gender data
[b] 5 individuals missing education data
[c] 9 individuals missing income data
[d] 6 individuals missing employment data
[e] Expressed as percentage of participants who reported using that food source by food security status

Qualitative Results

In-depth interviews were conducted with 11 participants, who represented 8 Tribal affiliations, with several participants representing more than one Tribal affiliation. These participants also represented a range of current employment statuses and a diversity of income

levels. Interviewee ages ranged from 19-66 years of age (average = 38 years of age). These participants also represented a range of food security categories (n = 3 very low food security, n = 2 low food security, n = 1 marginal food security, n = 5 high food security). Our qualitative results are presented in two major sections; first, we present lived experiences with food security, and secondly, we present community-generated food sovereignty priorities.

Lived Experiences with Food Security

Following in the rich tradition of Indigenous storytelling and narrative approaches used in qualitative research (Sandelowski, 1991; Barton, 2004), findings related to lived experiences with food security are presented through a narrative approach, highlighting the stories of two participants, one participant was identified as food secure (marginal food security) at the time of the survey, while the other was identified as food insecure (very low food security). This approach was used as the perspectives offered by each of these participants build on their previous responses and to tell a story of how their perceptions of food security are informed by their own experiences with food insecurity. However, it is important to note that the themes demonstrated by these two participants aligned with perspectives shared by other qualitative interview participants.

Participant 1: Very Low Food Security. Margaret (pseudonym) was in her early thirties at the time of her interview. She described that she grew up close to her Tribal reservation in another state and moved to the Baltimore metro area in adulthood. In early 2021, she was classified as having very low food security based on her responses to the USDA food security module (USDA, 2011), and she described multiple prolonged experiences with food insecurity throughout her childhood and adolescence. When describing how she conceptualized food security, she focused on the concept of socially acceptable ways to gather food as defined by US society and how her conceptualization as an AI/AN person differed from societal definitions. She said, “It's commonly known that the cheapest way you can eat is going to McDonald's. . . I think if you feed your kids McDonald's, it's not really socially acceptable. You would be shamed for that, despite the fact that that may be the only thing you can afford. . .It would not be socially acceptable if I were to stop somewhere in Maryland on the side of the road or the street and pick stuff, I would go as far as saying if you’ve run over a deer there's no point in wasting it. . . I didn't even know until recently, that people call it foraging. And I'm like, no, that's just like getting food. Like why does it have to be labeled foraging?”

Throughout the interview, she discussed a lack of healthy food availability and the long-term effects of food insecurity on her eating behaviors and long-term food acquisition habits. Despite her mother's attempts to access Tribal food programs and mainstream nutrition support programs (e.g., SNAP, WIC), they often relied on family members to provide food for them. She described feeling the need to pay retribution for the unhealthy foods that made up most of her diet through food restriction. She shared, "When I was in middle school [and experiencing self-described food insecurity], I simply, I was not eating at all. . . When I got the opportunity to eat [during times when others would provide them food] I would do it more probably than I should. . . I probably had some sort of eating disorder, where I just did not eat for a while at a time. . . That used to be the value that I had back then, just don't eat because I'm eating all these unhealthy foods, I need to counteract that by not eating at all." She described the lasting effects of food insecurity on her food acquisition habits by saying, "And I would also say that the effects of that [experiencing food insecurity] lingered, rationing even until now. . . I do find myself buying food more than anything because I can. I can finally go out and buy all those things that you know, I never could afford when I was younger, so I buy foods that I want now. Rationing is still something that I do to kind of save money. . . It has definitely had a lasting effect. . . It's really about keeping in mind when I get paid next. And how can I make my food last as long as possible without having to go and buy more."

Participant 2: Marginal Food Security. Jane (pseudonym) was in her early twenties at the time of her interview, also grew up near her home Tribal reservation in a different state and moved to Baltimore in her teenage years, and also described shortcomings of the USDA definition of food security (USDA, 2022b). She said, "I think food security. . . I think it should be more than just like a caloric needs met. . . It should also include culturally relevant foods, but I know that food security isn't always connected to culturally relevant foods. . .The whole cultural aspect is, like we [my people] have creation stories for certain crops and things, so making sure that our food is safe for the sake of the food and not just for our sake is important." Sharing a memory from her childhood, which she self-described as being consistently food insecure, she discussed how as a child her hunger and fullness cues were not respected by well-meaning adult caregivers. She said, "I even remember this in my own daycare, if you finished your whole plate, you were celebrated and like, you're really encouraged to finish your whole plate. But like kids. . . the kids have those. . . satiety cue[s]. They haven't lost it yet. It's like innate for them. So they stopped eating when they're full, but they basically get bullied into eating the whole plate and then they get celebrated

for it." She went on to describe the long-term impacts of experiencing food insecurity in childhood and adolescence, explaining that experiencing food insecurity and familial pressure to overeat food when it was available impacted her ability to regulate her hunger and fullness, and that her concern for the environment impacted her eating behaviors. "I have a tendency to want to finish everything on my plate, regardless of whether I'm full. . . because like my family would always say, you know, we, you have to be thankful for this food, so you have to eat it. . . It's something that I've actually been like struggling to try to acknowledge and address in myself because I don't want to overeat, it hurts. It doesn't feel good, but I just have it ingrained in my mind. I'm like, you're being wasteful. This is not good for the environment." Similar to the previous participant, Jane described the long-term impacts of food insecurity on her eating behaviors; however, this participant illuminated that her experiences encouraged over-eating behaviors linked to her concern and connection to the environment.

The two participants represented above provide insight into the long-term psychological impacts of coping with food insecurity that were not captured through our quantitative survey. Participants described disconnection from their hunger and satiety cues and struggling to maintain healthy relationships with food long-term, either emphasizing urges to restrict and ration foods, or to overeat as to not waste foods. Further, participants clearly articulated how their conceptions of food insecurity as AI/AN peoples diverged from the USDA definition (USDA, 2022). Therefore, this suggests the USDA food security module (USDA, 2012) may not capture aspects of food security that are important to this urban AI/AN community.

Community-Generated Food Sovereignty Priorities

Our community research partner, NAL, was particularly interested in generating solutions to food insecurity and to understand community priorities for food sovereignty to inform their programming. Participant suggestions from the 11 in-depth interviews were distilled into three themes, presented using the three sisters growing analogy. The Three Sisters, corn, beans, and squash, are a complementary growing technique used by many AI/AN peoples. The reciprocity-based relationships demonstrated by the Three Sisters illustrate that each individual component of the system provides unique strengths and encourages mutual flourishing for the entire system. Similarly, the three priorities offered by participants share synergy for simultaneously addressing food security and food sovereignty.

Cultural Food Access (Corn). The first identified priority was cultural food access, which is represented by corn. Corn grows straight and tall and provides a structure for the beans to grow on so that they are not competing for space and sunlight among the squash vines. Just as corn provides structure and strength for the system, cultural food access has unique significance and importance for the Baltimore AI/AN community. A 32-year-old female participant (very low food security) described this by saying, "Recently in our Tribal newspaper, they started advertising seed[s] for heirloom crops. . . I think about like, how cool would it be to market growing your own food in the way that, 'Hey, um, we'll send you this seed so you can start learning how to grow this. And it'll be the same thing that your ancestors hundreds if not thousands of years ago ate'. To me, that the reason that's so fascinating, because that's something that you could stay connected to your Tribe through the food, even if you don't currently reside there right now." Cultural food access not only provides physical nourishment through food but a sense of belonging and connection that transcends geographic location.

Community Events and Education (Beans). The second identified priority was community events and education which represents beans within the three sisters system. Beans grow up the corn stalks, while fixing nitrogen in the soil, which enhances the availability of nutrients in the soil, not only for themselves but for their sisters' squash and corn. The same 32-year-old female shared, "There are people who are very talented at making traditional foods. . . So, you know, maybe like looking at some people['s] like talents and willingness to share as a way to kind of reinvigorate this motion towards food security, food sovereignty, whatever we want to call it. . . When I think about if I ever have kids, like I would want my own kids to know about the things I did with my grandma involving food. . . If I had a child in this area, I don't think that's something I could teach them easily." As described by project participants, community events and education efforts, including knowledge sharing, is reinvigorating for the overall goal of food security and food sovereignty and provides opportunities for intergenerational knowledge sharing.

Partnerships (Squash). The third identified priority was partnership with other community organizations, which represents the final sister, squash. As squash grows, it builds a long prickly vine with large broad leaves that cover the ground. The prickly vine and broad leaves help to protect the system from pests and to retain moisture in the soil, protecting the integrity of the system for mutual flourishing. A 47-year-old female identified at the time as having very low food security said, "I think it [food sovereignty] would look like partnerships with different community organizations, community neighborhood associations, churches, universities, other

businesses, coming together with [the] Indigenous community, where we would have better access to fresh foods, non-perishables, and things like that. On a regular basis, like you know once, twice a week and some places will do that. Like once or twice a year, they'll do something and you'll see the effect of that time. But then what happens after that? You know?" A 23-year-old female (marginal food security) expanded on the idea of community partnership by describing a potential partnership with the Black Food Security Network in Baltimore. She said, "So it [the Black Food Security Network] was kind of like a system that really benefited everybody and they do super amazing work. I think it would be really cool if like those farmers could also like re-introduce or introduce some like Indigenous crops into their fields and then sell those to like the black church food security network. And then we'd have like local traditional foods for anybody around who wants them and for Native people." Like the role of squash in the three sisters growing technique, partnership and kinship with other organizations provides protection for the Baltimore Native community by providing food relief for their community through existing structures. Participants expressed gratitude and thankfulness for the forms of food aid received throughout the pandemic including food boxes distributed through NAL's partnership with a Black food sovereignty movement (Maudrie et al., 2021), and local Tribal food drives. Many participants expressed that their conceptualization of food sovereignty included sustainable partnerships with other community organizations in Baltimore City, as well as re-matriation of Indigenous traditional foods through these partnerships.

DISCUSSION

Our mixed methods CBPR study revealed high levels of food insecurity, conceptions of food security among AI/AN peoples which differ from that proposed by the USDA, as well as harmful long-term effects of food insecurity on eating behaviors. While several previous studies have documented food insecurity in urban AI/AN communities, through both quantitative (Dong et al., 2023; Jernigan et al., 2017; Tomayko et al., 2017) and qualitative approaches (Stotz et al., 2022; Cidro et al., 2015), this study is one of few to utilize mixed methods to holistically understand the impacts of food insecurity and how to operationalize food sovereignty in an urban Native community. Although AI/AN populations have been disproportionately impacted both by COVID-19 and food insecurity (and food insecurity may have even been worsened during the pandemic), our cross-sectional study and a national study of AI/AN food security were not able to

directly link the impacts of the COVID-19 pandemic to food insecurity (Nelson et al., 2024). However, a study of food security on the Blackfeet Tribal Nation community found through a longitudinal study that food insecurity increased during the COVID-19 pandemic (John-Henderson et al., 2022). Our qualitative data illuminated conceptualizations of food security which incorporate access to traditional foods and the ability to participate in traditional food practices (including foraging, hunting, and growing). While our qualitative data provided rich insight into how food security impacts mental health and eating behaviors, our quantitative measures did not capture all aspects of food security (e.g., foraging; although hunting, fishing, and gardening were captured) that participants deemed as important. The four-item food stress measure may have captured aspects of food-related mental distress specific to food acquisition (e.g., money, time, access, availability) but did not assess psychological impacts of food insecurity.

Our sampling approach for qualitative interviews was designed to include participants experiencing food security as well as those experiencing food insecurity; however, most participants described being food insecure at some point in their life. This aligns with previous research showing that food security is a transient state for many individuals (Ryu & Bartfield, 2012; Liese et al., 2021). Participants expressed that experiencing food insecurity in childhood/adolescence continues to impact their mental health, eating behaviors, and food acquisition habits many years later.

While one participant acknowledged that their eating behaviors may have even been indicative of an eating disorder, other participants described disordered eating behaviors (e.g., binge-restriction cycles or restrictive behaviors) without naming them as such. The negative impact of food insecurity on disordered eating behaviors has been documented by previous research with non-AI/AN communities (Becker et al., 2017; Stinson et al., 2018) and remains a serious public health concern. Further, national data shows that during the COVID-19 pandemic there were large increases in the number of hospitalizations due to eating disorders and in eating disorder symptoms, potentially due to reduced access to care and treatment, and social isolation (Devoe et al., 2022). This is of particular concern for AI/ANs who already faced high rates of food insecurity, inadequate access to eating disorder treatment, and whose communities have long been the target of weight-focused concerns and interventions (Nikolaus et al., 2022; Hahn et al., 2023; Story et al., 2003; Broussard et al., 1991). Although data on eating disorders in AI/AN communities is limited, the long-term effects of food insecurity and eating disorders should be

explored and addressed in future interventions that consider the nutritional needs of individuals, but also their mental, emotional, and spiritual relationships with food.

In recent years, food sovereignty has been heralded as an answer to food insecurity and other food system inequities, but for many AI/ANs who live in urban spaces, it has been difficult to imagine food sovereignty for their communities, particularly for communities without a land base, like the Baltimore community (Maudrie et al., 2023). Community members have expressed uncertainty to our community partner about how food sovereignty could be operationalized in the context of an urban Native setting. Perhaps this uncertainty is in part due to the popular notion that food sovereignty means a community must be completely self-reliant (Hoover, 2017). However, other food sovereignty experts, knowledge holders, and researchers have challenged the over emphasis of self-reliance in food sovereignty movements (Shoemaker Interview, 2014; Maudrie et al., 2023; Nguyen et al., 2023). Participant perspectives on community priorities challenge commonly held definitions of food sovereignty by focusing on the ability of communities to care for one another rather than complete self-reliance. Our findings are aligned with other qualitative work in urban Indigenous communities which support that Indigenous food sovereignty can also be about reclaiming and reconnecting with land, and traditional and cultural food skills, as well as relationship building with one another (Cidro et al., 2016). Together, our findings on lived experiences with food security and community-generated food sovereignty priorities offer a path forward beyond the COVID-19 pandemic, providing broader insights into food insecurity and the impact of mental health on eating-related behaviors.

One major strength of this study is the mixed methods approach, which gave us a richer understanding of the impacts and experiences with food insecurity than quantitative or qualitative methods alone; however, there are some limitations to consider. Our recruitment approach was confined to social media and telephone for the quantitative survey because of the COVID-19 pandemic. In person recruitment was not possible given the stage of the COVID-19 pandemic in Winter and Spring of 2021, which shifted NAL's events from primarily in-person to virtual. This recruitment strategy may have unintentionally underrepresented Elders (who may not be comfortable using social media), as well as community members who may have limited telephone or internet access, and these special populations may be more vulnerable to food insecurity due to limited mobility or financial resources. Further, our use of non-probability sampling methods means our results may not be generalizable to all Baltimore AI/ANs, and our food insecurity estimates may not reflect the true prevalence of food insecurity in the Baltimore AI/AN

community. The USDA 10-item food security module used in our survey did not assess food insecurity for children in the household, which limits our ability to fully understand food security for all age groups. Our quantitative survey did not explore mental health or psychosocial relationships with food (beyond the 4-item food stress measure), but mental health and aspects of psychosocial nutrition came up repeatedly in interviews, indicating that mental health may intersect with food security and other food-related issues. Future studies should explore the intersection of mental health and food insecurity. Further, due to limited financial resources, only a portion of the qualitative transcripts were coded by multiple coders, which could have improved our qualitative rigor and internal reliability (Morse, 2015). Finally, the data presented in this paper were collected in 2021, and results should be interpreted with careful and thoughtful consideration of evolving social and economic contexts. However, we believe the perspectives shared by those with lived experience of food insecurity and the community-driven solutions for food sovereignty remain highly relevant, offering valuable insights that can inform current and future efforts to address food security in AI/AN communities.

The results of this study continue to inform the efforts of NAL to address nutrition and food access for AI/ANs in the Baltimore metro area. In summer 2022, NAL partnered with Hungry Harvest, an organization that addresses food access and food waste through produce delivery. As an example of our ongoing collaboration, a mobile market provided fresh, free produce to 25 community members during a a 2022 research presentation. The results of this study shaped the lead author's dissertation research, which aimed to explore culturally relevant ways to address and measure holistic approaches to nutrition that includes physical, emotional, spiritual, and relational nourishment from food (Maudrie, Clyma, et al., 2024; Maudrie, Caulfield, et al., 2024).

While our study is consistent with other research demonstrating that food security is an urgent priority for urban AI/AN peoples in one city, more research is needed to document food security among urban AI/ANs across the United States and beyond the COVID-19 pandemic. Further, sustainable solutions and policy changes are needed to ameliorate food insecurity in urban AI/AN communities. We learned from participants that the USDA definition of food insecurity did not adequately reflect their conceptions; therefore, mainstream food security modules may provide an incomplete picture of food security for AI/ANs. Future work should explore defining and measuring food security through AI/AN worldviews and perspectives. Finally, our study found important mental health implications of experiencing food insecurity, including long-term effects on eating behaviors and disordered eating patterns. Future AI/AN food security research should

consider including questions to screen for disordered eating, as well as qualitatively and quantitatively exploring the impacts of mental health on nutrition. Future research and community-engaged efforts should continue to explore food sovereignty-oriented solutions to food insecurity in urban Native communities.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Institutional Review Board of Johns Hopkins University (protocol IRB00013176; approved 1/19/2021).

AUTHOR INFORMATION

Tara L. Maudrie, MSPH, PhD (Sault Ste Marie Nation of Chippewa Indians), is an Assistant Professor, School of Social Work, M-PACT (Michigan Program for Advancing Cultural Transformation in the Biomedical Health Sciences) Scholar, at the University of Michigan in Ann Arbor, MI.

Cassandra J. Nguyen, PhD, is an Assistant Professor of Cooperative Extension in the Nutrition Department, Agriculture and Natural Resources at the University of California, Davis in Davis, CA.

Dane Hautala, PhD, is an Assistant Scientist in the Department of International Health and Center for Indigenous Health at the Johns Hopkins Bloomberg School of Public Health at the Great Lakes Hub in Duluth, MN.

Maisie Conrad, MSPH, is a Research Associate in the Department of International Health and Center for Indigenous Health at the Johns Hopkins Bloomberg School of Public Health at the Great Lakes Hub in Duluth, MN.

Valarie Blue Bird Jernigan (Choctaw Nation of Oklahoma), DrPH, MPH, is a Professor of Medicine and Director of the Center for Indigenous Health Research and Policy at Oklahoma State University, Center for Health Sciences in Tulsa, OK.

Kerry Hawk Lessard (Descendant of Ft Peck and Assiniboine Sioux Tribes), MAA, is Executive Director of Native American Lifelines in Baltimore, MD.

Jessica Dickerson (Lumbee Tribe of North Carolina), MSW, is a Medical Case Manager at Native American Lifelines, Baltimore, MD.

Victoria M. O'Keefe (Citizen of Cherokee Nation of Oklahoma and Member of Seminole Nation), PhD, is an Associate Professor in the Department of International Health and Center for Indigenous Health at the Johns Hopkins Bloomberg School of Public Health in Baltimore, MD.

Joel Gittelsohn, PhD, is a Professor in the Department of International Health and Center for Indigenous Health at the Johns Hopkins Bloomberg School of Public Health in Baltimore, MD.

APPENDIX

Table A1

Logistic regression models of the association between food insecurity with demographic characteristics, COVID-19 hardships, food stress, and food sources in a sample of AI/ANs in Baltimore City (n=250)

Variable	Model 1: Unadjusted OR (95% CI)	p-value	Model 2: Adjusted for Demographics (N=238)	p-value	Model 3: Adjusted for demographics, COVID hardships (N=238)	p-value	Model 4: Adjusted Odds Ratio[a] demographics, COVID hardships, food stress, food sources (N=238)	p-value
Age	0.78 (0.72-0.83)	0.00**	0.72 (0.66-0.79)	0.00**	0.71 (0.64-0.79)	0.00**	0.87 (0.80-0.95)	0.00*
Gender[a]								
Male	1.21(0.68-2.15)	0.51	1.80 (0.82-3.95)	0.14	2.95 (1.14-7.61)	0.04*	3.47 (0.88-13.71)	0.08
Income[b]	1.09 (0.90- 1.33)	0.39	1.41 (1.08-1.84)	0.01*	1.00 (0.74-1.37)	0.99	0.99 (0.62-1.57)	0.95
Education[c]								
Some college	0.47 (0.22-1.02)	0.06	0.22 (0.08-0.66)	0.00**	0.44 (0.13-1.57)	0.21	3.61 (0.44-29.22)	0.23
College graduate or more	0.78 (0.41-1.49)	0.46	0.41 (0.17-1.01)	0.05	1.36 (0.46-3.98)	0.58	3.76 (0.58-24.49)	0.17
COVID-19 Hardships	3.47 (2.28-5.27)	0.00**			5.52 (2.92-10.39)	0.00**	4.15 (2.13-8.09)	0.00**
Food Stress	4.25 (2.98-6.07)	0.00**					7.96 (3.50-18.12)	0.00**`
Food Sources								
Subsistence Practices	0.43 (0.20-0.90)	0.02*					0.09 (0.01-0.87)	0.04*
Nutrition Support Programs	1.20 (0.68-2.12)	0.53					0.30 (0.00-16.95)	0.49

[a] Reference group: Female (Two-Spirit/Non-gender binary dropped from analysis due to small cell sizes); 4 individuals missing gender data

[b] 9 individuals missing income data

[c] Reference group: High school, GED or less; 5 individuals missing education data

*p value <0.05;

**p value <0.01