

# Food Insecurity among American Indian and Alaska Native People: A Scoping Review to Inform Future Research and Policy Needs

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## ABSTRACT

Food insecurity, defined as insufficient access to nutritious foods, is a social determinant of health that may underpin health disparities in the US. American Indian and Alaska Native (AI/AN) individuals experience many health inequities that may be related to food insecurity, but no systematic analyses of the existing evidence have been published. Thus, the objective of this scoping review was to assess the literature on food insecurity among AI/AN individuals and communities, with a focus on the prevalence of food insecurity and its relations to sociodemographic, nutrition, and health characteristics. Systematic search and data extraction processes were used. Searches were conducted on PubMed as well as peer-reviewed journal and government websites. Of 3174 identified references, 34 publications describing 30 studies with predominantly AI/AN sample populations were included in the final narrative synthesis. Twenty-two studies (73%) were cross-sectional and the remaining 8 (27%) described interventions. The weighted average prevalence of food insecurity across the studies was 45.7%, although estimates varied from 16% to 80%. Most studies used some version of the USDA Food Security Survey Modules, although evidence supporting its validity in AI/AN respondents is limited. Based on the review, recommendations for future research were derived, which include fundamental validity testing, better representation of AI/AN individuals in federal or local food security reports, and consideration of cultural contexts when selecting methodological approaches. Advances in AI/AN food insecurity research could yield tangible benefits to ongoing initiatives aimed at increasing access to traditional foods, improving food environments on reservations and homelands, and supporting food sovereignty. *Adv Nutr* 2022;13:1566–1583.

**Statement of Significance:** This scoping review indicates that food insecurity is widespread in studies of American Indian and Alaska Native individuals and collaborations between researchers and communities are needed to advance the literature and improve food security for future generations.

**Keywords:** Native American, Indigenous, literature review, nutrition, food access, food sovereignty

## Introduction

Food insecurity, which is defined by a lack of consistent and dependable access to sufficient food in a household (1), is an established social determinant of health (2). Individuals in food-insecure households are at greater risk of poor physical health (3), mental distress (4), higher health care costs (5), and premature mortality (6). Approximately 1 in 9 households in the United States are food insecure, but prevalence

rises during periods of economic decline, such as the 2007 Great Recession and the ongoing coronavirus disease 2019 (COVID-19) pandemic (1, 7). Household characteristics, such as fewer years of formal education, lower household income, fewer adults in the household, and disability or chronic disease among adult and child household members, are related to an increased likelihood of food insecurity (3, 8). Further, food insecurity prevalence is not equally distributed

among racial and ethnic groups in the United States. The prevalence of food insecurity is consistently higher among households led by non-Hispanic Black (19%) and Hispanic (16%) adults when compared with non-Hispanic White (8%) households (1). However, differences are not well detailed for all racial/ethnic groups. Limited evidence is available characterizing food insecurity among American Indian and Alaska Native (AI/AN) individuals.

The AI/AN designation is an umbrella term that includes individuals representing more than 600 federal- or state-recognized tribes (9), who have been subject to both shared and unique historic and sociocultural influences on food security. Many AI/AN communities were forcibly relocated from traditional lands and compelled to rely on government food commodity programs, which historically comprised highly processed shelf-stable products, altering both individual and household dietary patterns and local food systems. Today, AI/AN individuals experience a disproportionate burden of chronic diet-related diseases (10–12), which may, in part, be driven by elevated food insecurity risk.

Food insecurity in AI/AN peoples was an explicit priority in the National Nutrition Monitoring and Related Research Act of 1990 (13), which established an annual reporting requirement to monitor food insecurity in the United States. Despite this requirement, AI/AN households are not identified in the annual Household Food Security in the US report (1). The decision to not disaggregate AI/AN respondents continued with the US Census Household Pulse Survey deployed to monitor food insecurity changes resulting from the COVID-19 pandemic (14). These methodological choices limit the availability of data on food insecurity among AI/AN households, rendering AI/AN people largely invisible in national discussions of food insecurity and related assistance reform. Furthermore, the lack of data on AI/AN food insecurity limits our ability to understand how food insecurity relates to downstream health inequities and to make sustainable progress towards addressing diet-related diseases.

Empirical evidence suggests that AI/AN-led households and individuals are at elevated risk of food insecurity. However, most existing research relies on small or regional samples (15, 16). Only 2 studies have independently analyzed the Current Population Survey data, a publicly available, nationally representative quantitative survey that serves as the basis for the annual US report on household food security; the prevalence of food insecurity varied across these studies from 16% to 26% of households surveyed (17, 18). To date, no systematic review of food insecurity among AI/AN

populations has been published in the research literature. The synthesis of findings in a systematic review provides both insight into the varied experience of food insecurity in AI/AN communities and information about upstream contributing and downstream consequential factors.

The objective of this scoping review was to synthesize the research on food insecurity among AI/AN individuals and communities to identify areas for future research as well as public health policy needs. The 3 primary questions that guided all stages of the review process were as follows:

- 1) What is the state of the literature on food insecurity among AI/AN individuals and communities?
- 2) What is the estimated prevalence of food insecurity among AI/AN individuals and households?
- 3) How does food insecurity relate to sociodemographic, food, and health characteristics among AI/AN individuals?

## Methods

The protocol followed recommendations in the Cochrane Handbook for Systematic Reviews of Interventions (19) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (20). Systematic searches and extractions were used to map the literature and identify key concepts and research opportunities. In PubMed/Medline, a search for peer-reviewed literature published after 1990 was conducted using 2 sets of keywords: 1) (“Food secur\*” OR “Food insecur\*” OR “Food access” OR “Food sovereign\*” OR “Food sufficien\*” OR “Food insufficien\*” OR “Hunger” OR FSSM OR “Food assistance” OR “Nutrition assistance” OR “Commodit\*” OR “Food Distribution Program on Indian Reservations” OR “Food Justice” OR “Food Equity” OR “Supplemental Nutrition Assistance Program” OR “SNAP” OR “Food Stamp\*”) and 2) (“Native American\*” OR “Alaska Native\*” OR “American Indian\*” OR “Native” OR “Tribal” OR “Reservation” OR “Urban Indian\*” OR “Indian country” OR “AI/AN” OR “AIAN”). The “\*” symbol serves as a wildcard that stands in for any letters to finish the word. Additional searches were conducted with the keyword “food security” on the website for the *Journal of Indigenous Research*, and the keywords “Alaska Native\*” OR “American Indian\*” on the website for the *Journal of Hunger and Environmental Nutrition*. Targeted searches for gray literature were conducted using the terms listed above on the websites for the USDA, Indian Health Service (IHS), and Urban Indian Health Institute. Citations selected for full-text review were also used for a reference list search (backward reference search) and cited reference search (forward reference search). All searches were conducted and logged between February 2021 and April 2021.

## Study selection

Two research team members independently screened the same full list of titles and abstracts from the search results. Articles included in the review 1) presented data that were collected after 1990; 2) presented results for samples restricted

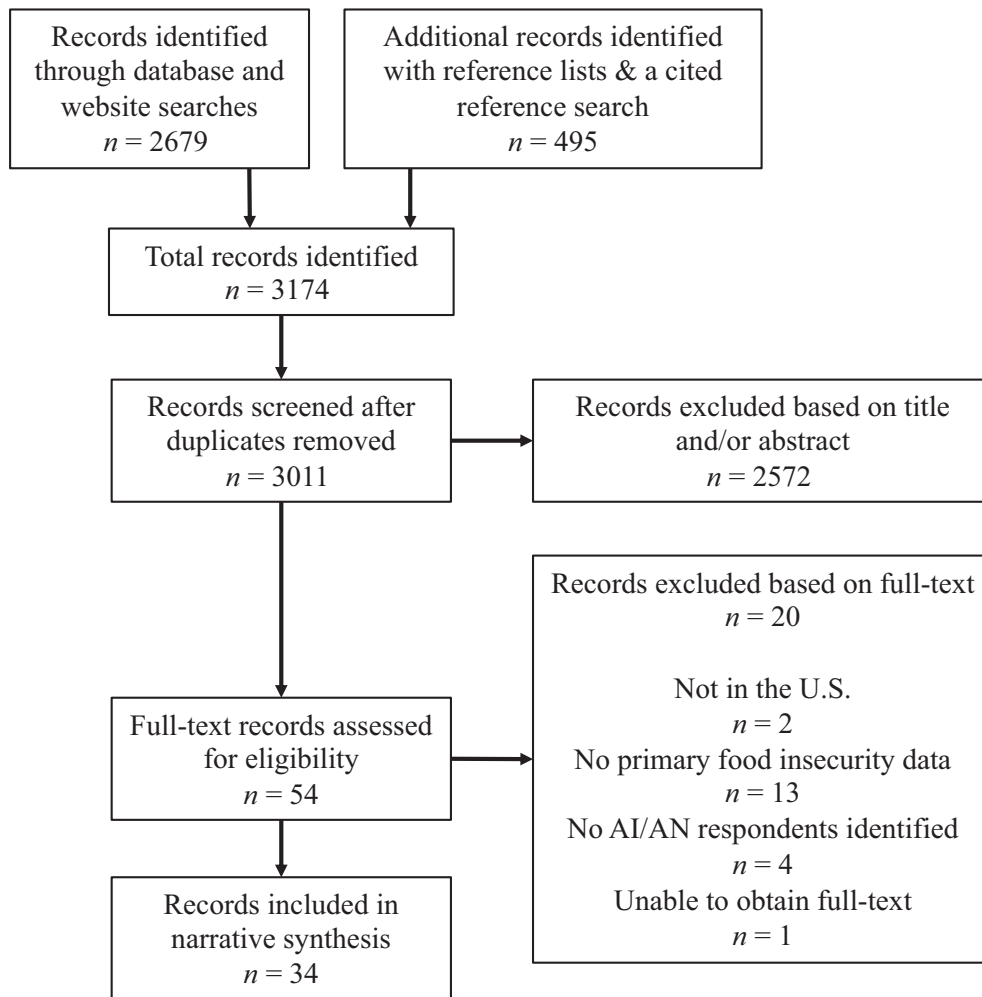
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Abbreviations used: AI, American Indian; AN, Alaska Native; CBPR, community-based participatory research; COVID-19, coronavirus disease 2019; IHS, Indian Health Service; SNAP, Supplemental Nutrition Assistance Program; WIC, Special Supplemental Nutrition Assistance Program for Women, Infants, and Children.



**FIGURE 1** Study selection flow diagram. AI/AN, American Indian/Alaska Native.

to respondents who identified as AI and/or AN or were living on an AI reservation; 3) recruited respondents who resided within the United States; 4) measured individual-, household-, and/or community-level food security assessed using questionnaires, interviews, and/or other reports of subjective experiences; and 5) were written in English. If the title or abstract indicated that the article did not meet these criteria, it was removed from further consideration. A third research team member compared the 2 independent screening results and generated the list of articles for full-text review. The full texts of these articles were screened using the same inclusion criteria.

Initial database searches yielded a total of 3174 articles that matched search criteria (Figure 1). After examining titles and abstracts, 3120 articles were excluded from consideration in this review. The full texts of the remaining 54 articles were reviewed. One article was not accessible for full-text examination (21). A total of 34 articles reporting on 30 unique studies met the inclusion criteria (Figure 1) (15–18, 22–51). When separate articles reported on the same study, the article published later was included in the final synthesis.

If details were given in the initial article but omitted in the later article, these details were used to supplement the study description.

#### Data extraction

Data were independently extracted from articles by 2 research team members. The independent data extractions were reviewed by a single member of the research team and reconciled by comparing the data extractions with the original research articles. A standard form was used to extract details from each article. These details included authors, year published, literature type, author(s) discipline, study design, study objective, month(s) and year(s) of data collection, sample size, recruitment method(s), sample eligibility criteria, geographic location of study, tribal or community involvement, use of a community-based participatory research (CBPR) approach, measures of food insecurity, sample sociodemographic characteristics, food insecurity prevalence estimate(s), relations of sociodemographic and health characteristics with food insecurity, and statistical methods used.

**TABLE 1** Study quality assessment criteria and coding schema<sup>1</sup>

Criteria	Unmet/unmentioned responses (score = 0)	Partially met responses (score = 1)	Completely met responses (score = 2)
A priori aim/hypothesis specific to food insecurity	No mention of food insecurity in aim/hypothesis	Implications of food insecurity in aim/hypothesis (e.g., hunger or difficulty affording food)	Explicit mention of food insecurity in aim/hypothesis
Study population clearly specified and defined	No mention of the population the sample is meant to represent	Population partially and/broadly defined	Population clearly defined
Participant recruitment	Convenience or purposive sampling	N/A	Random sample or census
Sample size, <i>n</i>	<100	≥100 and ≤999	≥1000
Sufficient sample reporting	No report of response rate or nonresponse bias evaluation	Report response rate or nonresponse bias evaluations	Report response rate and nonresponse bias evaluations
Reliable and valid measures of food insecurity	Measures without prior pilot or validity/reliability testing	Measures with limited testing or tested in different population	Measures with validity/reliability testing in related population

<sup>1</sup>N/A, not applicable.

### Quality assessment

Each study that included quantitative food insecurity survey data was assessed for quality by 2 independent research team members. Six criteria were used to assess quality based on methods previously used (52) that are grounded in the *Methods Guide for Effectiveness and Comparative Effectiveness Reviews* (53). The 6 criteria (shown in Table 1) consisted of establishing a study's incorporation of an a priori aim/hypothesis, a specific study population, rigorous participant recruitment, sufficient sample size and sample reporting, and reliable and valid measures of food insecurity. Each criterion was scored from 0 to 2, with 0 = unmet/unmentioned, 1 = partially met, and 2 = completely met. Scores for each criterion were added together, resulting in a quality assessment score ranging from 0 to 12 for each study.

### Synthesis

To characterize studies, descriptive statistics, including averages and percentages, were calculated for data extracted and quality assessment scores. A weighted food insecurity prevalence estimate was calculated by multiplying each study's reported prevalence by the study's sample size, after which all resulting values were summed and the result divided by the number of studies. This weighted estimate was calculated based on all studies that reported food insecurity survey data. Characteristics potentially associated with food insecurity were broadly categorized as sociodemographic, nutrition or physical activity, practices and contexts of food, and health. Within each category, each study's relevant findings were compared, and the strengths and limitations of reported results were assessed. Studies that collected qualitative data were reviewed independently, and a descriptive synthesis that explored themes and compared findings was conducted.

### Author positionality

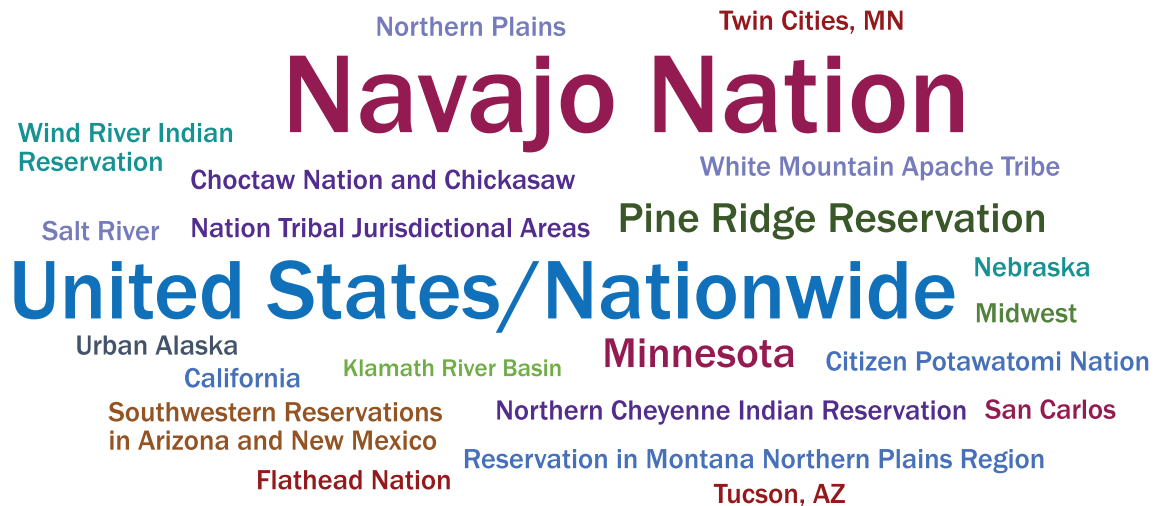
The review and described procedures were led by a Research Assistant Professor in the Elson S. Floyd College of Medicine

at Washington State University who has prior systematic review experience as well as expertise in food security and community nutrition. In early 2021, this researcher mentored 2 AI (specifically, Diné and Apsaalooke) graduate students in the School of Public Health at the University of Washington in the relevant study design, data collection, and synthesis processes. The resulting synthesis, interpretation, and final research article were reviewed and revised by a larger group of Indigenous and non-Indigenous scholars who are members of the Indigenous Collaborative for Health, Agriculture, Nutrition, Growers, and Environmental Sovereignty (also known as I-CHANGES) at Washington State University. These scholars provide interdisciplinary expertise on topics including health disparities, food systems, research design, intervention science, demography, economics, community engagement, and traditional foods, as well as offer a wealth of diverse lived experiences. Indigenous scholars were affiliated with various tribal nations and Alaskan communities, each with unique cultural practices and climatic circumstances, further adding to the diversity of perspectives. Although a replicable systematic protocol was followed for all phases of this review, it is expected that their diverse perspectives enhanced the synthesis of findings and interpretation of our results.

## Results

### Study characteristics

Of the 30 studies, most ( $n = 25$ , 83%) used quantitative survey methods. Qualitative methods were reported in one-third ( $n = 10$ ) of the studies (16, 26, 44–51); 5 of these collected both quantitative and qualitative data, commonly referred to as mixed methods (16, 26, 46, 47, 51). Therefore, a summary of the qualitative findings is also included. Among all studies, cross-sectional study designs were the most common ( $n = 22$ , 73%) (15–18, 28–32, 34, 35, 37, 38, 40, 42–44, 47–51). Eight studies described interventions (26, 27, 33, 36, 39, 41, 45, 46), of which 4 were randomized controlled trials (26, 27, 36, 41). Two studies used data from the Current



**FIGURE 2** Word cloud of geographic settings for studies included in scoping review. The font size in the word cloud reflects the frequency of each setting across included studies. Navajo nation = 7, United States/nationwide = 4, Pine Ridge Reservation = 2, Minnesota = 2, and all other settings = 1. Locations have been distilled to identify settings that overlapped across studies, as possible. When the name of the tribal nation and/or reservation was not provided by study authors, no efforts were made to deduce the location and instead the broader description of the setting was used.

Population Survey (17, 18), a publicly available nationally representative quantitative survey that is the basis for the annual US report on household food security (1).

The aims of most of the studies ( $n = 19$ , 63%) focused on describing food insecurity in specific AI/AN communities or subpopulations (15–18, 27–32, 35, 37, 39, 42–44, 47, 49, 51), which included citizens of tribal nations (39, 49), low-income households (29, 43), or families with children (27, 37, 42). In other studies, AI/AN respondents were compared with other racial and ethnic groups in the United States (18, 29). However, food insecurity was not always explicitly integrated into the study's aim or objective. Instead, some studies sought to measure health perceptions, status, and/or behaviors and included household food security as an explanatory variable (26, 34, 41, 45). Further, a subset of articles measured food insecurity as a part of their assessment of federal assistance programs (38, 40, 48) or of novel health and nutrition interventions (33, 36, 46).

The eligibility criteria used for recruitment within studies were reported in almost all articles, although were not reported in 4 articles (17, 31, 35, 51). Most studies ( $n = 17$ , 57%) required at least a subset of their participants to self-identify as AI/AN and/or as tribal members (15, 16, 18, 28–30, 33, 34, 39–41, 43, 44, 47–50). In addition, most studies ( $n = 20$ , 67%) required participants to live within a specific geographic location (28, 30, 32–34, 37, 39, 41, 44, 47, 49) and/or have children enrolled in schools or other organizations providing services in a specific region (26, 27, 36–38, 42, 43, 45, 46, 48). For example, 1 study required participants to have at least 1 child who attended a primary school on the reservation (42), while another required participants to live within a 50-mile radius of a local medical facility (33). Participation in a food or financial assistance

program and/or some indicator of low socioeconomic status were also frequently used eligibility criteria ( $n = 10$ , 33%) (18, 29, 34, 37, 38, 40, 43, 45, 46, 48), increasing the homogeneity of participants while also restricting the representativeness of the sample to the larger AI/AN communities.

Studies were conducted in diverse geographic settings, with a few locations serving as the site for more than 1 study. **Figure 2** displays these diverse geographic settings, and the font size of each name corresponds to the number of studies conducted within that community. Navajo Nation was one of the most common geographic locations for studies ( $n = 7$ , 23%) (33, 36, 38, 39, 42, 48, 49). Geographic characteristics were also broadly categorized by the rurality of each study's location. Studies most frequently focused on rural communities ( $n = 16$ , 53%) (16, 27, 28, 30–33, 36, 38, 39, 41, 42, 44, 48, 49, 51). However, 6 studies included both rural and urban communities (17, 18, 26, 29, 35, 50). Only 3 studies focused exclusively on urban areas (34, 43, 47).

### Quality of studies

Twenty-five studies used quantitative food insecurity survey data and were evaluated for quality. Most articles explicitly mentioned food insecurity in their aim or hypotheses ( $n = 20$ , 80%) (15–18, 26–32, 35–37, 39, 42, 43, 46, 47, 51). Fewer than half of the articles clearly defined their population of interest by describing the community they engaged with and/or outlining the eligibility criteria used for recruitment ( $n = 12$ , 48%) (18, 26, 27, 30, 32–34, 39, 41–43, 47). The predominant approach to participant recruitment was convenience sampling ( $n = 14$ , 56%) (15, 26, 30–37, 41, 43, 46, 47). Sample sizes ranged from less than 100 respondents in 5 studies (20%) (28, 32, 42, 43, 46) to samples exceeding 1000 individuals in 2 studies (8%) (17,

18), although sample sizes typically ranged from 100 to 1000 ( $n = 18, 72\%$ ) (15, 16, 26, 27, 29–31, 33, 34, 36–41, 47, 51). Survey response rates were reported in fewer than half of studies ( $n = 12, 48\%$ ) (16, 27, 28, 30, 33, 36, 38–42, 51). No studies included nonresponse bias evaluations. Most articles did not describe any validity or reliability testing procedures with a similar population for the food security questionnaires used ( $n = 17, 68\%$ ) (15–18, 26–29, 32, 33, 35, 38, 40–43). Among the remaining articles, the nature and extent of validity and reliability testing varied. For example, 1 study tested for cultural appropriateness with Navajo-speaking staff and distributed a pilot survey to a diverse sample (39), while another study incorporated feedback from focus groups to adjust surveying method (46).

Involvement of tribal community(s) and use of CBPR approaches were evaluated in all 30 studies. Seven studies (28%) reported numerous tribal consultations during the study (16, 26, 28, 30, 32, 33, 36, 45, 46, 49, 50). Forms of community engagement included community advisory boards ( $n = 5, 20\%$ ) (16, 32, 33, 45–47), steering committees ( $n = 2, 8\%$ ) (30, 33), and approvals from tribal administration to conduct research ( $n = 9, 36\%$ ) (15, 16, 26–28, 30, 33, 35–37, 39, 40, 43, 44, 49, 50). The authors of 2 studies explicitly acknowledged the respective tribes' ownership of the data produced from their research activities (35, 46). However, the remaining studies that described primary data collection ( $n = 7, 23\%$ ) (31, 34, 38, 41, 42, 48, 51) did not mention any tribal or community involvement or approvals processes for the research.

### Community-based participatory research

Five studies explicitly noted their use of a CBPR approach (16, 33, 45–47), which is a method that facilitates collaborative interventions from both the researchers and community stakeholders (54). However, the specific methods used to implement the CBPR approach varied across studies. For instance, 1 team engaged with community advisory boards, steering committees, institutional review boards, tribal health boards, tribal councils, the local IHS, and school boards (33). In contrast, another study that incorporated CBPR tenets included the local university, tribal community members, and food and nutrition stakeholders (32). Only 1 of the studies that used a CBPR approach mentioned inviting tribal partners to serve as co-authors on the final research publication (16).

### Prevalence of food insecurity

The overall weighted average for food insecurity prevalence among the 25 studies deploying food security questionnaires was 46% (Table 2). The baseline prevalence of food insecurity reported in the 6 intervention studies was used for this calculation (26, 27, 36, 39, 41, 46). For the 1 study that reported food insecurity estimates separately for adults and children, the prevalence among adults was used. Food insecurity estimates ranged from as high as 80% (36) to 16% (17). Over half of studies ( $n = 14, 56\%$ ) stratified food insecurity into categories defined by low or very low food

security, or with or without hunger (15, 16, 27, 28, 32–36, 40–43, 51). The weighted average prevalence of low food security was 27% and of very low food security was 26%.

As exploratory analyses, weighted average prevalence estimates were calculated for subsets of studies that shared design, setting, or sample characteristics. Among studies that used random, census, or representative sampling strategies, the weighted prevalence of food insecurity was 25% (17, 18, 27–29). Studies conducted in rural settings produced an elevated average prevalence of food insecurity (57%) (16, 27, 28, 30–33, 36, 38, 39, 41, 42, 51). For the 3 studies that recruited AI or AN adults living in urban settings, the weighted average prevalence of food insecurity was 69% (34, 43, 47), although 2 of these studies focused on low-income households or women participating in the Special Supplemental Nutrition Assistance Program for Women, Infants, and Children (WIC). The weighted average prevalence of food insecurity was 44% among studies that restricted households to those with children (17, 26, 27, 33, 34, 36–38, 42, 43, 46), and this estimate decreased to 41% when studies that were limited to vulnerable households (i.e., those participating in food or financial assistance programs or screened as experiencing food insecurity or having low incomes) were removed (17, 26, 27, 33, 34, 37, 42).

Most studies ( $n = 17, 68\%$ ) used 1 of 3 standard USDA Food Security Survey Modules (Table 3), with 9 using the 6-item (15, 16, 27, 29, 32, 36, 40, 41, 47), 2 using the 10-item (39, 43), and 7 using the 18-item version (17, 18, 28, 34, 35, 42, 51). Table 2 shows the individual items in each of these varying versions of the USDA Food Security Module. Among the remaining 8 studies, it was common for authors to adopt a subset of 3–5 items from these standard modules for lower participant response burden (26, 30, 31, 33, 37, 46). One study developed a novel questionnaire that combined standard items from the USDA Food Security Survey Modules with a new item that queried whether children in the home were hungry when they went to sleep at night (38).

Most ( $n = 15, 60\%$ ) studies used a 12-mo time reference when measuring food insecurity (15–18, 26–31, 34, 35, 43, 47, 51). Two studies followed standard guidelines in converting questions to a 30-d time reference (33, 41). In contrast, another study used the 30-d reference for items related to adult experiences of food insecurity and a 12-mo reference for child-specific items (37). One study used a 3-mo time reference (38). The final 6 articles did not identify a time reference for their food security measurement (32, 36, 39, 40, 42, 46).

### Sociodemographic correlates of food insecurity

Most studies ( $n = 15, 60\%$ ) evaluated associations between sociodemographic characteristics of study participants and food insecurity (15–18, 26–29, 31, 32, 37, 39, 42, 47, 51). Education was the most frequently assessed sociodemographic characteristic ( $n = 12, 48\%$ ) and was often operationalized as the last formal education milestone achieved or years of schooling completed (15, 16, 18, 26–28, 31, 32, 39, 42, 47,

**TABLE 2** Summary of quantitative studies ( $n = 25$ ) included in the review by year of publication and alphabetical order of first author's last name<sup>1</sup>

First author (year) (ref) and quality score	Study objective	Sample size, setting, eligibility criteria	Sociodemographic characteristics	Prevalence of food insecurity
Pandey (2001) (38) Quality score: 3	To monitor the impact of the 1996 federal welfare reform legislation over a period of 5 y	Sample: 350 Setting: Salt River, San Carlos, and Navajo Criteria: Former or current welfare families with children	Race: NR Gender: 95% women Age: mean 38 y Education: 72% high school or less Marital status: 42% never married Employment: 15% currently employed Income: NR	45%
Brown (2007) (31) Quality score: 6	To explore the relations and environmental connections between food insecurity and health-associated outcomes and food characteristics of AI households	Sample: 187 Setting: Reservation in Montana Northern Plains region Criteria: NR	Race: 89% AI or AN Sex: 72% female Education: 23% completed high school or GED; 48% some college or Associate's degree Marital status: NR Employment: NR Income: 68% earned <\$30,000 Race/ethnicity: 100% AI	44%
Gundersen (2008) (17) Quality score: 8	To portray the extent, depth, and severity of food insecurity among AIs	Sample: 1143 Setting: Nationwide Criteria: NR	Gender: NR Age: mean 36.1 (0.4) to 51.0 (0.6) y Education: 21–22% <sup>2</sup> Marital status: 36–66% married <sup>2</sup> Employment: NR Income: NR	16–28% <sup>2</sup>
Whiting (2009) (51) Ward (2008) (24) Whiting (2007) (25) Quality score: 8	To assess the relative effects of background characteristics, food insecurity, and use of actual food acquisition strategies on stress levels among reservation residents	Sample: 445 (survey); 70 (interviews) Setting: Northern Cheyenne Indian Reservation Criteria: NR	Race: NR Gender: 56% women Age: 46% 25–44 y old Education: 37% completed high school Marital status: 50% married Employment: 36% full-time employment Income: NR	72%
Dammann (2011) (34) Quality score: 5	To examine racial/ethnic differences in relations between food-related environmental, behavioral, and personal factors and low-income women's weight status using Social Cognitive Theory	Sample: 367 Setting: Nationwide Criteria: NR	Race/ethnicity: NR Gender: NR Age: mean 36.6 ± 11.4 y Education: 43% less than high school Marital status: NR Employment: 83% unemployed Income: 51% <\$5000/y	73%
Bauer (2012) (27) Quality score: 9	To better understand the prevalence and consequences of food insecurity among AI families with young children	Sample: 432 Setting: Pine Ridge Reservation Criteria: All kindergarten children and caregivers	Race: NR Gender: NR Age: NR Education: 46% high school or less Marital status: 49% married Employment: 48% unemployed Income: 50% <\$15,000/y	40%

(Continued)

**TABLE 2** (Continued)

First author (year) (ref) and quality score	Study objective	Sample size, setting, eligibility criteria	Sociodemographic characteristics	Prevalence of food insecurity
Ray (2012) (42) Quality score: 8	To investigate the relation of food security to produce intake and behaviors, health status, and diabetes risk among women 18 y and older with a least 1 child less than 18 y old enrolled in primary school living on a Navajo reservation. To understand how different socioeconomic factors affect food security for the Citizen Potawatomi Nation in Oklahoma	Sample: 42 Setting: Greasewood, AZ Criteria: Adult women with ≥ 1 child less than 18 y old attending a primary school on the reservation	Race: 97% AI/AN and 2% NHPI Gender: NR Age: 42 ± 12 y Education: 76% graduated high school Marital status: 45% married Employment: NR Income: NR Race: NR Sex: NR Age: NR Education: 50% high school or less Marital status: NR Employment: 54% unemployed Income: 48% earned \$39,999/y or less	58%
Bennett (2013) (28) Quality score: 7		Sample: 91 Setting: Citizen Potawatomi Nation in OK Criteria: Households with ≥ 1 member of the tribe that lived within 3 zip codes	Race: NR Sex: 53% male Age: 52% 18–40 y old Education: 35% less than high school Marital status: 43% married Employment: NR Income: 46% 100–199% FPL	35%
Blue Bird Jernigan (2013) (29) Quality score: 7	Estimate the prevalence of food insecurity in low-income AIs/ANs and Whites; examine the association between food insecurity and obesity in low-income AIs/ANs and Whites	Sample: 592 AI/AN adults and 7371 White adults Setting: CA Criteria: Household incomes ≤ 200% the FPL	Race: NR Sex: 84% female Age: mean 36.2 ± 14.2 y Education: NR Marital status: NR Employment: NR Income: NR	39%
Mullany (2013) (37) Quality score: 5	To identify factors associated with food insecurity and household eating patterns among AI families with young children	Sample: 425 Setting: 4 reservations in AZ and NM Criteria: Adult (≥ 18 y) heads of household with children 0–5 y old living in study site	Race: NR Sex: 84% female Age: mean 36.2 ± 14.2 y Education: NR Marital status: NR Employment: NR Income: NR	45% of adults and 29% of children
Parcilla (2014) (39) Quality score: 9	"What are the levels of food insecurity on the Navajo Nation?" "What factors are associated with food insecurity in this setting?" "What is the association between food insecurity and obesity among adults?"	Sample: 276 Setting: 10 communities in Navajo Nation (AZ, NM, and UT) Criteria: Main food preparer/shopper, ≥ 18 y old, tribal member in household, residency within Navajo Nation for ≥ 1 mo, no plans to move off the reservation for 1 y, not pregnant	Race: NR Sex: NR Age: NR Education: NR Marital status: NR Employment: NR Income: NR	77%
Chambers (2015) (33) Quality score: 4	To test the feasibility of a family-based, home-visiting diabetes prevention/management intervention for AI youth with or at risk for type 2 diabetes	Sample: 255 Setting: 3 Navajo communities and the White Mountain Apache Tribe Criteria: Lived within 50-mile radius of local medical facility; youth had 1 of the following: diagnosis of prediabetes or type 2 diabetes or at risk for diabetes	Race: NR Sex: 56% boys Age: median 13.2 y Education: 92% currently in school Marital status: NR Employment: NR Income: NR	38%

(Continued)



**TABLE 2** (Continued)

First author (year) (ref) and quality score	Study objective	Sample size, setting, eligibility criteria	Sociodemographic characteristics	Prevalence of food insecurity
Gray (2015) (35) Bliss (2004) (22) Quality score: 5	To identify basic relations between food security, cultural identification, physical health, mental health, and nutrition within a subgroup of the AI/AN population, specifically Northern Plains Indians	Sample: 458 adults Setting: Northern Plains (North and South Dakota, Minnesota, Montana, and Wyoming) Criteria: NR	Race: 100% AI Age: mean 37.0 ± 14.1 y Gender: NR Education: 40% high school/GED or less Marital status: NR Employment: 43% full-time employment Income: 53% \$20,000/y or less	26%
Blue Bird Jernigan (2017) (18) Quality score: 9	To analyze the food insecurity trends of AI/AN adults compared with other racial and ethnic groups in the United States	Sample: 1513 AI/AN adults Setting: United States Criteria: Households under 185% FPL or those who screened at risk of food insecurity	Race: NR Sex: 50% female Age: 39 ± 0.6 y Education: 26% less than high school Marital status: 44% married Employment: NR Income: 45% > 185% of poverty level	25%
Blue Bird Jernigan (2017) (30) Quality score: 6	To assess food insecurity and prevalence of obesity, diabetes, and hypertension among AIs in the Chickasaw Nation and Choctaw Nation of Oklahoma	Sample: 513 AI adults Setting: Choctaw Nation and Chickasaw Nation tribal jurisdictional areas Criteria: ≥ 18 y old, live within study areas, and self-identify as AI/AN	Race: NR Sex: 75% female Age: mean 44 y old Education: 64% at least some college Marital status: NR Employment: 77% employed Income: 58% earned <\$40,000/y	56% inadequate quantity and 62% inadequate quality
Berryhill (2018) (15) Quality score: 5	To determine levels of food security among American Indians living in the Midwest and possible correlations between food security levels and various health outcomes, diet, and demographic variables	Sample: 362 Setting: Midwest Criteria: ≥ 18 y old, self-identify as AI, and willing to complete survey	Race: NR Sex: NR Age: median 39–41 y <sup>2</sup> Education: NR Marital status: 51% married Employment: NR Income: NR	58%
Kahn (2018) (47) Quality score: 6	To document urban AI adult food access, food security, BMI, and barriers and strategies in using Tucson, Arizona's food system to explore social determinants of health that impact food availability and accessibility	Sample: 275 (survey) and 89 (qualitative stages) Setting: Tucson, AZ Criteria: ≥ 18 y old, self-identify as AI, and resided in Tucson, AZ	Race: NR Sex: 64% female Age: 49% <45 y old Education: 55% some college or more Marital status: NR Employment: NR Income: 69% earned <\$25,000/y	71%

(Continued)

**TABLE 2** (Continued)

First author (year) (ref) and quality score	Study objective	Sample size, setting, eligibility criteria	Sociodemographic characteristics	Prevalence of food insecurity
Adams (2019) (26) Tomayko (2017) (23) Quality score: 6	To describe sociodemographic factors and health behaviors among AI families with young children and determine predictors of adult/child weight status among these factors	Sample: 450 Setting: 1 urban area and 4 rural American Indian reservations Criteria: Child between 2 and 5 y old and a primary caregiver, ability to provide data, and a working cell phone	Race: NR Gender: 95% female Age: mean 31.4 ± 8.5 y Education: 52% some college Marital status: 24% single Employment: NR Income: 58% earned <\$20,000/y	61%
Pindus (2019) (40) Quality score: 6	To describe FDPIR participant characteristics and program operations	Sample: 849 households Setting: FDPIR sites across the United States Criteria: All FDPIR participating households in September 2013	Race: NR Gender: 62% women Age: 56% between 45 and 74 y old Education: NR Marital status: 77% single Employment: NR Income: average \$1144 monthly income	56%
Porter (2019) (41) Quality score: 4	To share data on adult health status in the Wind River Indian Reservation	Sample: 176 adults Setting: Wind River Indian Reservation Criteria: Lived in the study site, ≥ 1 family member enrolled in a tribe, ≥ 1 adult willing to participate in 2-y study, interested in maintaining a home food garden	Race: NR Sex: 63% female Age: 85% 20–59 y old Education: NR Marital status: NR Employment: NR Income: NR	65%
Sowerwine (2019) (16) Quality score: 7	"Can promoting access to native foods reduce hunger and food insecurity in Native American communities?"	Sample: 711 Setting: 4 tribes in the Klamath River Basin Criteria: Tribal members and descendant households	Race: NR Sex: 63% female Age: Median 55 y Education: 25% some college Marital status: NR Employment: NR Income: NR	63%
Byker Shanks (2020) (32) Quality score: 5	"Does dietary quality of residents of the Flathead Nation vary based on food security status and demographic factors?"	Sample: 80 Setting: Eight communities on the Flathead Nation Criteria: 18 y of age and residents of the Flathead Nation	Income: 43% below the FPL Race: 73% Native American Sex: Female Age: NR Education: 82% high school graduates Marital status: NR Employment: NR Income: 51% less than \$25,000	51%
Johnson-Jennings (2020) (46) Quality score: 3	To examine the feasibility of gardening as an obesity intervention among a school-aged Indigenous population at risk for homelessness	Sample: 27 adults and 7 children (focus groups), 7 children (survey), and 6 adults (interviews) Setting: Minnesota Criteria: Adults and children at risk of homelessness	Race: NR Sex: NR Age: Children ranged from 5 to 11 y old Education: NR Marital status: NR Employment: NR Income: NR	100%

(Continued)

**TABLE 2** (Continued)

First author (year) (ref) and quality score	Study objective	Sample size, setting, eligibility criteria	Sociodemographic characteristics	Prevalence of food insecurity
Jones (2020) (36) Quality score: 5	To assess the impact of FVRx on changes in health behavior, BMI, and household food insecurity among children enrolled in the first 4 y of implementation	Sample: 212 children Setting: Health care facilities on the Navajo Nation Criteria: Families with a pregnant woman ("maternal group") or a child <6 y of age ("pediatric group")	Race: NR Sex: 50% female Age: 3.96 ± 1.87 Education: NR Marital status: NR Employment: NR Income: NR	80%
Waich (2020) (43) Quality score: 5	To understand the links between intake of traditional foods, food security, and diet quality in low-income AN women living in an urban center	Sample: 73 Setting: Urban, AK Criteria: AN women ≥ 18 y old, neither pregnant nor lactating, and enrolled in WIC	Race: NR Sex: NR Age: 88% between 18 and 39 y old Education: 65% no college experience Marital status: 62% single Employment: NR Income: 69% <\$25,000/y	51%

<sup>1</sup>AI, American Indian; AN, Alaska Native; FDP/IR, Food Distribution Program on Indian Reservations; FPL, Federal Poverty Line; FVRx, Fruit and Vegetable Prescription Program; GED, General Educational Development; NHPI, Native Hawaiian or Pacific Islander; NR, not reported; ref, reference; WIC, Special Supplemental Nutrition Assistance Program for Women, Infants, and Children.  
<sup>2</sup>anges reflect differences for households with and without children.

51). Of the 12 studies that assessed level of formal education, 5 (42%) reported that food insecurity was significantly associated with lower levels of formal educational attainment (26, 28, 39, 42, 47). The second most common sociodemographic characteristic assessed was participation in food-assistance programs ( $n = 10$ , 40%) (18, 26, 27, 31, 32, 37, 39, 42, 47, 51), which included WIC ( $n = 5$ , 20%) (26, 27, 32, 39, 42), the Supplemental Nutrition Assistance Program (SNAP;  $n = 5$ , 20%) (18, 27, 32, 39, 51), the Food Distribution Program on Indian Reservations ( $n = 6$ , 24%) (27, 31, 32, 39, 42, 51), the free and reduced-price National School Lunch Program ( $n = 1$ , 4%) (32), local food programs ( $n = 5$ , 20%) (37, 39, 42, 51), and the School Breakfast Program ( $n = 1$ , 4%) (32). Studies varied in their reports of statistical significance when testing the association of food insecurity with any of these food-assistance programs, but 6 studies reported food insecurity was significantly related to participation in 1 or more programs (18, 26, 27, 32, 42, 47).

Other commonly assessed sociodemographic characteristics were age ( $n = 9$ , 36%) (16, 18, 26, 32, 37, 39, 42, 47, 51), household income ( $n = 7$ , 28%) (16, 18, 27, 28, 31, 32, 47), and employment among adult(s) in the household ( $n = 5$ , 20%) (26–28, 39, 51). Among the 9 studies assessing age, 4 (44%) reported a significant relation between older age and food insecurity (37, 39, 42, 47). In contrast, 1 study found that younger respondents were more likely to be food insecure (16). Lower self-reported household income was significantly related with food insecurity in all 7 studies in which it was assessed (16, 18, 27, 28, 31, 32, 47). Three of the 5 studies evaluating employment reported a significant relation between food insecurity and unemployment (27, 28, 39). A small subset of studies also reported significant relations between food insecurity and larger household sizes (1 of 4 studies) (42), greater number of children in the household (1 of 7 studies) (37), and households headed by 1 individual (2 of 6 studies) (26, 47). Six studies also assessed the relation of food insecurity with gender of respondents (18, 32, 37, 39, 47, 51), but no statistically significant differences were identified.

### Nutrition and dietary behavior correlates of food insecurity

Seven studies (28%) evaluated the relation between dietary intake and/or behaviors with food insecurity (15, 26, 27, 32, 42, 47, 51). Five studies (63%) assessed consumption of specific food groups, such as fruits and vegetables (15, 26, 27, 42, 47). Most of these studies reported no significant difference in fruit and/or vegetable intake among food-insecure compared with food-secure households (15, 26, 27, 42, 47), although a few found lower intakes of vegetables among food-insecure adults (26, 42). One study evaluated whether food-insecure households differed from their food-secure counterparts by nutritional quality or dietary diversity according to 24-h dietary recalls, and no significant differences were identified (32). Other dietary characteristics observed in food-insecure households included higher intake of fried potatoes and sugar-sweetened beverages for both children and adults (26), higher intake of pizza and fried chicken among children (27),

**TABLE 3** Items included in each of the 3 USDA Food Security Survey Modules and coding of response options as insecure or secure

Item	Affirmative (insecure) response(s)	Negative (secure) response(s)
10-Item Adult Food Security Survey Module		
HH2. (I/We) worried whether (my/our) food would run out before (I/we) got money to buy more in the last (12 months/30 days). Was that often, sometimes, or never true for (you/your household) in the last (12 months/30 days)?	Often true, sometimes true	Never true, don't know
HH3. The food that (I/we) bought just didn't last, and (I/we) didn't have enough money to get more. Was that often, sometimes, or never true for (you/your household) in the last (12 months/30 days)? <sup>1</sup>	Often true, sometimes true	Never true, don't know
HH4. (I/we) couldn't afford to eat balanced meals. Was that often, sometimes, or never true for (you/your household) in the last (12 months/30 days)? <sup>1</sup>	Often true, sometimes true	Never true, don't know
AD1. In the last (12 months/30 days), did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food? <sup>1</sup>	Yes	No, don't know
AD1a. How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months? In the last 30 days, how many days did this happen? <sup>1</sup>	Almost every month, some months but not every month; $\geq 3$ d	Only 1 or 2 mo; 1–2 d
AD2. In the last (12 months/30 days), did you ever eat less than you felt you should because there wasn't enough money for food? <sup>1</sup>	Yes	No, don't know
AD3. In the last (12 months/30 days), were you ever hungry but didn't eat because there wasn't enough money for food? <sup>1</sup>	Yes	No, don't know
AD4. In the last (12 months/30 days), did you lose weight because there wasn't enough money for food?	Yes	No, don't know
AD5. In the last (12 months/30 days), did (you/you or other adults in your household) ever not eat for a whole day because there wasn't enough money for food?	Yes	No, don't know
AD5a. How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months? In the last 30 days, how many days did this happen?	Almost every month, some months but not every month; $\geq 3$ d	Only 1 or 2 mo; 1–2 d
Additional 8 items in 18-item Household Food Security Survey Module		
CH1. (I/we) relied on only a few kinds of low-cost food to feed (my/our) child/the children because (I was/we were) running out of money to buy food. Was that often, sometimes, or never true for (you/your household) in the last (12 months/30 days)?	Often true, sometimes true	Never true, don't know
CH2. (I/We) couldn't feed (my/our) child/the children a balanced meal, because (I/we) couldn't afford that. Was that often, sometimes, or never true for (you/your household) in the last (12 months/30 days)?	Often true, sometimes true	Never true, don't know
CH3. (My/Our child was/The children were) not eating enough because (I/we) just couldn't afford enough food. Was that often, sometimes, or never true for (you/your household) in the last (12 months/30 days)?	Often true, sometimes true	Never true, don't know
CH4. In the last (12 months/30 days), since (current month) of last year, did you ever cut the size of (your child's/any of the children's) meals because there wasn't enough money for food?	Yes	No, don't know
CH5. In the last (12 months/30 days), did (CHILD'S NAME/any of the children) ever skip meals because there wasn't enough money for food?	Yes	No, don't know
CH6. How often did this happen—almost every month, some months but not every month, or in only 1 or 2 months? In the last 30 days, how many days did this happen?	Almost every month, some months but not every month; $\geq 3$ d	Only 1 or 2 mo; 1–2 d
CH7. In the last (12 months/30 days), (was your child/were the children) ever hungry but you just couldn't afford more food?	Yes	No, don't know
CH8. In the last (12 months/30 days), did (your child/any of the children) ever not eat for a whole day because there wasn't enough money for food?	Yes	No, don't know

<sup>1</sup>Items used in 6-item Food Security Survey Module.

and poorer nutritional health and greater nutritional risk (24, 51).

### Practices and contexts of food correlated with food insecurity

Many articles ( $n = 11$ , 44%) described the relations of household food insecurity to food practices or to the psychosocial and/or environmental contexts of food (15, 16, 27, 31, 32, 36, 37, 39, 42, 47, 51). Most of these studies ( $n = 8$ , 73%) evaluated potential barriers to household food security

(16, 27, 31, 32, 37, 39, 42, 47). Transportation barriers, such as lack of access to a vehicle, limited public transportation, or long distances to food retailers, were significantly related to higher odds of food insecurity in the 4 studies in which it was reported (16, 31, 37, 47), but limited kitchen equipment (i.e., no refrigerator or cooking stove) was not found to be related to food security (32). Other statistically significant barriers observed among food-insecure households included perceived expensiveness and quality of healthy foods for most studies in which this variable was assessed (27, 37, 39,

42), but 1 study found no relation between these items and household food security (31). Four studies assessed family food patterns or the frequency of purchasing foods from grocery stores, convenience stores, and other food outlets, but findings of significant relations between these behaviors and household food insecurity were inconsistent (15, 31, 37, 39). The relations between household food security and use of traditional food practices and/or Native food acquisition were reported in 4 studies (16, 27, 31, 51). Among these 4 studies, traditional practices of going to other community members' homes for meals (a Lakota tradition called *ti ole*) were related to greater likelihood of food insecurity in 1 investigation (27), whereas greater consumption of foods traditional to the Northern Cheyenne was related to lower likelihood of food insecurity in a separate study (24, 51). In a separate study, a significant decrease was observed in household food insecurity among families that participated in the Navajo Fruit and Vegetable Prescription Program, which included health coaching and vouchers for free healthy foods (36).

### Health status correlates of food insecurity

Eleven articles (44%) reported on the relations of physical and/or mental health with food insecurity (15, 26, 27, 29–31, 35, 39, 42, 47, 51). Measures of weight or obesity were the most common way that researchers operationalized health, but these measures were not consistently related to household food insecurity (26, 27, 29, 30, 39, 47). Relations of food insecurity with other chronic conditions were described in some studies (15, 30, 31, 42, 51), and a relation between food insecurity and diabetes risk and/or self-reported diabetes diagnoses was supported by 3 articles (30, 42, 51). Four studies assessed the degree to which food insecurity was related to mental health outcomes (15, 31, 35, 51). One study found that food-insecure adults reported higher stress levels (51), and 2 articles observed a greater likelihood of reported depression among food-insecure households (15, 35).

### Qualitative findings

Nine studies used qualitative or mixed methods to explore food insecurity experiences and related topics such as nutrition, food-provisioning behaviors, food-assistance programs, and/or diet-related health conditions. Most studies ( $n = 5$ , 56%) used mixed methods, combining data from 2 or more sources, which predominantly included surveys in combination with interviews, focus groups, asset mapping, or photovoice. Sociodemographic characteristics of the recruited study samples were diverse, ranging from caregivers and/or their children (45, 46, 48, 50), to elders (44), to unspecified AI/AN adults or tribal members (16, 47, 49, 51). Geographic regions were represented relatively equally, with qualitative studies conducted in various reservations or community settings in the Great Plains, West Coast, and Southwest areas.

In interviews with caregivers of young children living in Nebraska, food insecurity was identified as a key driver of low purchases of fruits, vegetables, and other healthy

foods. Transportation expenses incurred by travelling to food retailers reduced discretionary funds available, so inexpensive, less healthy, processed items were considered more attainable (50). Transportation challenges were also identified by Navajo women participating in WIC as a key barrier to food security (48). Long distances separated these women from healthy food retailers as well as from members of their extended family, who otherwise frequently play a large role in guiding and supporting food provisioning. Navajo adults were most likely to rely on their family for financial or food support before reaching out to other sources of support in their community (49). Adults interviewed in the Klamath River Basin also reported that family plays an integral role in maintaining food security (16). This role extends beyond simply sharing food to also include sharing of knowledge about Native foods and traditional food-acquisition practices. Opportunities for cultural sharing and social support were also identified as important by AI adults living in Tucson (47). However, salient barriers to food security were identified at individual, social, and environmental levels. Variability in resources at each of these levels was also important for adults living in the Navajo Nation, where limited employment opportunities and unmaintained roads exacerbated food insecurity risk (49).

Opportunities to improve food security were also frequently explored in the qualitative studies in which Lakota elders identified food preservation and gardening across familial generations as opportunities to not only ensure food security but also to provide financial income (44). Strategies used by past generations were noted by adults on the Northern Cheyenne Indian reservation as an integral way to cope with low food security, particularly given the reduced utility of SNAP benefits (previously termed "Food Stamps") in local food retail outlets with high food prices (51). Resilience and creativity were exemplified by the ways that Navajo adults managed food shortcomings (49). These management approaches included growing food, using various means of transportation, and making personal sacrifices to ensure all family members were fed (49). AI/AN children living in a transitional housing center in Minnesota reported that contributing to their family's food supply and taking on a responsibility to contribute were valued by their families and communities (45). The collaboration between children, caregivers, and staff at this transitional housing facility continued to grow, and a culturally relevant intervention was developed to focus on gardening, nutrition, and health; elders interviewed reported that this effort served to revitalize traditional ecological knowledge and improve food security (46).

### Discussion

The objective of this review was to synthesize the research on food insecurity in AI/AN individuals and communities to identify public health policy needs and areas for future research. Although a wide range of food insecurity prevalence estimates were reported, even the lowest estimate of 16% exceeds the national food insecurity prevalence of

10.5% for all US households (1). Furthermore, the weighted prevalence from included studies suggests that nearly half of AI/AN participants sampled experienced food insecurity. This implies that an estimated 3.1 million AI/AN individuals in the United States (55) may not have dependable access to enough food to sustain an active and healthy life. In a subset of studies, food insecurity was related to household characteristics as well as to poor dietary intake and diminished mental and physical health. Results of this review illuminate several factors that should be considered in future food insecurity research and policies involving AI/AN communities. These considerations include the following: 1) optimizing research for study quality and cultural rigor, 2) respecting Indigenous data sovereignty, 3) recognizing the historical and modern systems that increase food insecurity risk, 4) capturing and addressing the unique characteristics of rural and urban AI/AN communities, 5) acknowledging the meaning and value of traditional foods, 6) pursuing research questions important to AI/AN communities, and 7) learning from culture-focused initiatives to inform policies that are intentional and restorative.

The quality of the studies resulted from the research approaches used, including study design, sampling methods, and survey questionnaires selected. Most (83%) studies were quantitative, and cross-sectional designs predominated. The limitations of cross-sectional designs preclude assessing the temporality of relations between food security and the correlates tested. Most studies also used convenience sampling methods, which may result in samples that do not represent the target populations due to issues of selection bias and sampling error. Furthermore, most studies did not report validity or reliability statistics related to their use of food insecurity surveys in their sample populations. Unique contextual and population characteristics may impact the accuracy of survey instruments (56), which may compromise the quality of food insecurity estimates produced. Many scholars have expressed concerns about the cultural validity of using common food security surveys with AI/AN or First Nations respondents due to the lack of consideration of traditional food systems and sources as well as common food-sharing practices (16, 30, 57, 58).

In addition to these issues, studies with AI/AN populations should also consider the cultural contexts of methodological choices, such as the way eligibility criteria are applied. Eligibility criteria can impact the generalizability of results to broader AI/AN populations. Only a subset of studies required participants to identify as AI/AN and/or as tribal members. It was more common for geographic location or local service use to be used as eligibility criteria, with proximity to an AI reservation used as a proxy to recruit AI/AN participants. However, this may lead to the inclusion of many non-AI/AN respondents. For example, 1 study only required participants to be 18 y of age and residents of the Flathead Nation (32). However, the Flathead Nation, like many others, is a “checkerboarded” reservation. These checkerboard patterns derive from the General Allotment Act of 1887, also known as the Dawes Act (59), which

“divided up” land among individual tribal members, with any remaining “surplus” land “opened up to white settlement” (59). Another study involving AI households with young children did not require adult respondents to identify as AI due to the potential complexity related to discrepancies in AI identity within a household (26). Although recruitment for this study was conducted on reservations and in urban programs that provided services to AI/AN households, over 10% of adults did not identify as AI. By not centering AI/AN background as an eligibility criterion, the resulting sample may not accurately reflect AI/AN peoples’ experiences.

Data sovereignty is another important consideration when conducting studies on food insecurity in AI/AN communities. Data sovereignty involves the right of a nation to govern and take ownership of their own data and is a natural extension of tribes’ inherent rights to govern their peoples, lands, and resources (60, 61). This is of particular importance given that food insecurity data for AI/AN communities have not been represented in national reports (14, 18), and access to disaggregated responses is prohibitively costly or necessitates analytical expertise, thereby limiting the data available to inform federal programming. The concept of data sovereignty emphasizes the need to view all research, data, and evaluation practices through an Indigenous lens (61). The Urban Indian Health Institute has published best practices for data collection that include inclusive categorization of AI/AN respondents, collection of tribal affiliation, and use of mixed methods (61). Adopting these recommendations for data collection can foster a better understanding of AI/AN experiences for non-AI/AN individuals and produce better, more equitable, and more accurate research on AI/AN peoples’ experiences of food insecurity.

Historical traumas inflicted on AI/AN populations must be acknowledged to understand the ways in which modern-day structural biases, social inequities, and discrimination contribute to experiences of food insecurity. Many AI communities and tribes have been forcibly removed and relocated from their ancestral lands and placed on reservations and allotments, which have often been nonarable and marginalized with risk for degradation and challenging to recover for sustainable uses. As a result of this loss, some lands have been privatized by non-Natives, which has magnified the destruction of cultural and traditional food systems (16). Food insecurity that stemmed from these dramatic changes to AI/AN food systems was further exacerbated by decades of oppressive government policies and involuntary cultural assimilation among AI/AN communities.

AI/AN populations in rural areas suffer disproportionately limited access to resources and infrastructure [e.g., roads, electricity, water, broadband (29, 31, 33), and community centers] that likely contributes to food insecurity risk. For example, one-third of Navajo Nation residents do not have access to electricity or running water (62). Families living on reservations also face barriers to sufficient health care, which can include long travel distances to health clinics, lack of affordable transportation, poor road conditions, long

wait times for open appointments, few health care providers per capita, and cultural/linguistic barriers within health care settings (33). These barriers to health care, along with similar impediments limiting access to healthful food and education, contribute to food insecurity. Although none of the included research quantitatively evaluated these relations, community-level factors were a salient concern often voiced in qualitative and mixed-methods studies.

Household income, employment status, and formal educational level were often related to food insecurity in included studies. The unemployment rate for AI/AN individuals is considerably higher than that of the general US population (63). These inequities are often even more prevalent in reservation areas. For example, the Northern Plains reservation has unemployment and poverty rates that are 5 and 2 times higher, respectively, than the average among all US households (31). Importantly, these household-level characteristics are impacted by upstream structural and systems-level inequities that serve as barriers to tribal job development and opportunities, including the sheer remoteness and isolation of reservations, lack of physical and legal infrastructure, multiple governments with taxing and regulation jurisdiction, overdevelopment of natural resources, and lack of access to modern technology (64).

Place of residence—rural or urban—may be a mediating force on food insecurity in AI/AN populations. The barriers to food access present on rural reservations include limited access to transportation, walkability concerns, and lack of internet and phone service (31, 47, 51). These issues and the long distances that often must be traveled to access food sources may be precipitating factors underlying food insecurity in rural AI/AN communities. Both AI/AN urban and rural communities were represented in studies in this review. However, most studies investigated rural communities specifically, which may be because of the unique barriers to food access experienced by rural- and/or reservation-living AI/AN households. Three studies focused on the Navajo Nation, which covers over 27,000 square miles of land and is almost entirely classified as providing low food access (over one-third of residents have to travel  $\geq 10$  miles to access a supermarket) (65). Food environments such as this, which are common in tribal areas across the United States (66), force communities to primarily rely on gas stations, small retail outlets, and convenience stores for food (39).

Although rural living presents various challenges to accessing food, rural households may also experience greater access to traditional foods (16) and more convenient access to relatives' households (48), which could contribute to a lower risk of food insecurity than in urban-dwelling households. In fact, the weighted prevalence estimate of food insecurity was higher in studies restricted to urban areas than those limited to rural residences. Further, among studies that included both types of households and compared them, AI/AN households in urban areas were more likely to report food insecurity than their rural counterparts in half of the reports (18, 23). High risk of food insecurity among AI/AN

households in urban settings may, in part, stem from limited access to and high costs associated with culturally relevant foods, separation from familial and community sources of support, and exclusion from programs focused on AI/AN households, like the Food Distribution Program on Indian Reservations. In a study of AN women in an urban setting in Alaska, a range of food choices were available to households but were not always financially accessible; moreover, access to traditional foods was difficult (43).

When assessing food insecurity in AI/AN communities, it is important to consider the relation that many AI/AN peoples have with traditional foods. Although the analytical approach has typically been to determine correlations between food insecurity and chronic illnesses, it is also valuable to understand the meaning of food for households and communities. Using this lens, many studies highlight the way that food in AI/AN communities is often associated with one's earliest memories, plays a key role in cultural practices and ceremony, and is an important component in techniques to promote healing. Further, the revitalization of food systems is seen as a route to the revitalization of culture and the restoration of community well-being (16). One study described a Lakota tradition, *Ti ole*, which is the practice of sharing meals with others in your home to address hunger within the community (27). Many AI/AN cultures feature traditional healthy foods that are frequently consumed. For example, the Diné (Navajo) culture relies on blue corn meal, dried steam corn, and sumac berries as part of their diet and livelihood. However, AI/AN households and communities face many barriers to accessing traditional foods, including reduced land access, disrupted transmission of knowledge, unfavorable federal and local policies, environmental toxins, climate change, and uneven recognition of treaty rights. Yet, understanding and encouraging food-sharing practices and addressing barriers to accessing traditional foods can facilitate powerful social connections among families and communities (51). Recognizing the importance of community and food for many AI/AN peoples suggests that food security may be a shared community-level concept and responsibility.

The present review illuminated several potentially valuable avenues for future research. First, further investigation is needed regarding the validity of using established food security questionnaires with AI/AN respondents. Concerns expressed by scholars about this issue (16, 30, 57, 58) should be evaluated by assessing validity in national datasets or through the collection of mixed-methods data. Second, specific AI/AN subpopulations and communities should be prioritized for food security research. Specific groups of interest include urban and rural households, which may have unique precipitating forces of food insecurity, as well as children and elders, who are often of great importance in AI/AN communities. Further, although representation of AI/AN people in national reports and datasets is important to inform federal discourse and allocate program funding, community-level or regional studies may be more capable of reflecting the diversity of historical, geographical, and

cultural influences within the hundreds of federal- and state-recognized tribes in the US (9). Third, longitudinal assessments of food insecurity and health outcomes in AI/AN respondents are warranted. These 2 factors may be self-reinforcing through a cyclic process (67), and longitudinal studies can provide evidence of temporality to better inform interventions. Finally, and possibly of greatest value, would be the development and evaluation of interventions to effectively alleviate or prevent food insecurity. The high prevalence of food insecurity among AI/AN households demonstrates the need for community-based initiatives. Two studies reported improvements in food security as a product of interventions that incorporated cultural values and changes to foods available (36, 46). This type of research may serve as the basis for future multilevel interventions that involve the community and address upstream systemic influences on food insecurity such as policies, systems, and environmental characteristics.

Effective policies to address the high prevalence of AI/AN food insecurity should be a priority, especially those that focus on changing food systems, not individuals (68). However, for some AI/AN individuals, the term “policy” has a negative connotation and may evoke federal policies that permitted widespread historical mistreatment of AI/AN families by the US government (69). In response to the resulting mistrust, community engagement processes may use decolonized methodologies (70) and examinations of organizational culture (71) to develop intentional and acceptable policies that draw on the resilience of AI/AN communities and cultures. Examples include creating food system projects that incorporate culturally based strategies that support aspects of Indigenous theories of change (47) and expanding or initiating programs directly related to indicators of Indigenous food sovereignty (72), which challenge existing food systems that limit access to healthy foods (47, 68).

Fortunately, several community-based initiatives demonstrate how AI/AN food security might be supported through projects that center around harvest, traditional foods, and education. For instance, the Qhest Life Gardens, initiated by the Coeur d’Alene Tribe, hosts gardening sites in the same location where federal and community-sourced nonperishable food is distributed. The tribe’s overarching mission is to create food security and sovereignty on the Coeur d’Alene Reservation through revitalization of gardening, poultry raising, and beekeeping in the community (73). In the Osage Nation, community-led discussions led to the establishment of Harvest Land, an ecological park and farm; upgrades to Osage Ranch, the Nation’s commercial ranch; and other projects to empower tribal members to engage with the local food system (74). Similarly, the Muckleshoot Food Sovereignty Project (75) and the Indigenous Food Lab (76) offer classes and demonstrations to educate and build skills that support revitalization and a return to traditional foods and food practices. These initiatives are only a few examples of the many promising efforts in AI/AN communities to restore connections between AI/AN peoples and healthful

traditional foods. AI leaders in agriculture have developed a vision wherein community-based programs such as these could be supported by 10 regional hubs across the United States to create sustained food system changes that support nutrition and economic vitality (68).

This review has several limitations. First, the databases searched did not include theses or dissertations. Furthermore, 1 potentially relevant study did not have the full text available online (21). However, the available summary indicated the study focused on students at a tribal college. Evidence suggests that postsecondary students may have unique food insecurity risks (52, 77) and may be less comparable to the community-dwelling samples of the other studies in the review. Additional sources of literature may have expanded the comprehensiveness of the review and support additional insights on the topic of AI/AN food insecurity.

In conclusion, this scoping review demonstrates that food insecurity is a public health priority for AI/AN peoples in various tribes and in both urban and rural communities. Future studies could improve the quality of the literature and advance our understanding of AI/AN food insecurity by applying rigorous surveying approaches and best practices for AI/AN data collection (61). Clear upstream barriers to food security are apparent that may be addressed through interventions, initiatives, and policies at both the national and community level. Many tribes and AI/AN communities have developed community-based approaches to support food security through cultural revitalization and pursuit of food sovereignty. There are opportunities for researchers to collaborate with AI/AN communities to contribute to the literature by testing intervention effects while supporting the creation of new stories of restoration and revitalization of AI/AN food systems. Although a heterogeneous group, many AI/AN communities have strengths and values that supported their prosperity prior to colonization, which can be a source of food security today and for future generations.

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