Characteristics of food insecurity prevalence in North Philadelphia Federally Qualified Health Center target populations, a cross-sectional study

Kai Inguito
  Christiana Care Health Services Inc

Brandon Joa (✉ bjoa@villanova.edu)
  Thomas Jefferson University   https://orcid.org/0000-0001-6792-4193

James Gardner
  Temple University

Eric N. Fung
  Harvard University HSPH: Harvard University T H Chan School of Public Health

Laura Layer
  : Esperanza Health Center

Karen Fritz
  Drexel University

Research Article

Abstract

Background

The prevalence of food insecurity declined in the United States but paradoxically increased in the large metropolitan area of Philadelphia in the past decade, and compared to the general U.S. population, a greater percentage of households in Philadelphia are affected by food insecurity and dependent on programs such as SNAP. The objective of this study was to determine food insecurity prevalence and demographics of the populations near Philadelphia Federally Qualified Health Center (FQHC) clinics. In line with risk factors on the national level, we hypothesized that food insecure people in a low-income area of Philadelphia would be more likely to be older, female, Hispanic, and overweight or obese.

Methods

This cross-sectional study took place in North Philadelphia, a populous section of Philadelphia with a high concentration of poverty and many zip codes reporting 30–45% or more of the population below the federal poverty line. Students and clinicians affiliated with a local FQHC conducted surveys on residents (n = 379) within 1-mile radiuses of three FQHC sites using the validated food security tool, the Hunger Vital Sign™. Survey data were collected through door-to-door visits in the summer of 2019. We used multivariate logistic regression models to predict food insecurity with independent variables including age, sex, language preference, and BMI category.

Results

The percentage of food insecurity in the area surveyed was much higher (36.9%) than previously reported in both Philadelphia and nationwide. Contrary to our hypothesis, food insecure individuals were younger on average and more likely to be English-speaking; these individuals had statistically significant lower mean BMI and lower odds of being overweight or obese vs. normal weight, with no significant difference by sex.

Conclusion

These North Philadelphia areas had a high prevalence of food insecurity associated with normal and low BMI and demographics of younger, English-speaking individuals. Some of these findings may be related to local confounding factors such as employment or substance abuse status, demonstrating a need for public health and organizations to work together for more locally targeted research and interventions on food insecurity in impoverished urban settings.

Background

Food insecurity, which affects around 50 million Americans, is a condition in which people lack access to food due to insufficient money, geographical location, or other factors, and is a pressing problem especially in urban areas alongside obesity and malnutrition (1, 2). These issues may be related to the paucity of options for healthy food that people living in lower income urban areas can easily access, while calorie-dense and nutrient-poor options are more plentiful and convenient (3). The extent of these issues varies among demographic groups, leading to a variety of strategies that may best address each group; national data describe typical profiles of food-insecure persons (4), although these analyses do not take into account more specific regional differences, such as at the city and zip code level. Compared to the U.S. as a whole with a food insecurity prevalence of 11.8% (5, 6), Philadelphia is a major metropolitan area with higher rates of poverty, food insecurity (18.6%), and diseases related to food insecurity (7, 8). Despite government interventions, food security in this setting is in flux, and although food insecurity declined on a national level from 2012 to 2017, it increased by over 20% in Philadelphia at the same time (6, 9, 10). North Philadelphia is an area of Philadelphia known as an epicenter of the opioid epidemic (11), with many transient visitors arriving in the area for opioid use and exchange. In this particularly impoverished area, food insecurity rates have been estimated as high as 30% throughout its fifteen zip codes overall (8). This issue thus affects the health of many patients in Philadelphia health care facilities such as FQHCs.

The studies that yielded these national and municipal figures used tools that were derivations of the 18-question U.S. Household Food Security Survey Module promulgated by the USDA, and all these tools were demonstrated to have good sensitivity and specificity for determining individuals' food security status, in addition to measuring severity of food insecurity, relative to the standard survey (12). Thus, these figures may be accurately compared with each other when discussing food insecurity prevalence. When selecting a tool for determining food insecurity prevalence, we therefore considered validated tools derived from the standard USDA survey that would also be convenient to use for our population. The Hunger Vital Sign™ is a 2-question screening tool previously published by Hager et al (13) that is derived from the 18-question survey, is validated, and does not impose a high response burden. It has a high sensitivity for detecting food insecurity and is suitable for an objective of measuring and characterizing prevalence when severity is not a prioritized measurement.

As a public health concern, food insecurity is associated with various chronic conditions including cardiovascular disease, developmental delays, asthma, depressed immune function and increased hospitalizations, etc., which the FQHC primary care practitioner must attempt to address and prevent (7, 14, 15). FQHCs have previously been helpful with gathering public health data (14) and can benefit public health research through closer contact with their surrounding patient populations, in addition to establishing continuity of care to serve patients with their specific, localized needs. In the United States, being black or Hispanic, being female, and being obese are demographic factors associated with greater risk for food insecurity; the complex interplay between behavioral and physiological mechanisms relating obesity and food insecurity is still under investigation (4, 16). In Philadelphia, people of Hispanic background, female, aged 40–59, and enrolled in SNAP (previously called food stamps) are more likely to be food insecure (17). Programs in the area include federal support such as SNAP and WIC (Special

Supplemental Nutrition Program for Women, Infants, and Children), and local initiatives such as the Food Trust and Metropolitan Area Neighborhood Nutrition Alliance or MANNA (18–20). These programs address affordability for healthy food, problems of location such as food deserts, and the connection between specific diseases and malnutrition through interventions such as subsidies and tailored diets (1, 17, 21). If food insecurity in a given area is associated with risk factors for a condition such as diabetes, for example, it is beneficial to address this association with strategies that target both issues simultaneously. In contrast, if food insecurity is unexpectedly associated with another concern such as substance use disorder, resources might be better spent targeting food insecurity in settings also addressing substance use.

To inform organizations' programming on food insecurity and contribute to a more accurate understanding of the ways food insecurity manifests in a low-income district of Philadelphia, we conducted a cross-sectional study of individuals located within one-mile radiuses of three sites of Esperanza Health Center (EHC), an FQHC in North Philadelphia, in 2019. We hypothesized that, in keeping with findings on a national level, people who were older, female, spoke Spanish, and overweight or obese would be more likely to be food insecure.

Methods

Teams of trained health professional students who participated in an EHC-sponsored program called The Summer Medical Institute (SMI) of Medical Campus Outreach Philadelphia performed door-to-door health screenings in North Philadelphia in the summer of 2019. Individuals on the streets and parks and homeless individuals were included in the screenings. Since these screenings occur every summer, food insecurity surveys were implemented in the summer of 2019 as part of these health screenings. We included the validated Hunger Vital Sign™ screening tool (22, 23), which was derived from the U.S. Household Food Security Survey Module of the U.S. Department of Agriculture (23), as well as height and weight measurements. This screening tool was selected because it was validated, convenient to use, and has a good sensitivity and specificity compared to the gold standard 18-question USDA survey (13). Using Cochran's formula, a sample size of 345 individuals was calculated for a 95% confidence interval. Sampling of respondents was random. To account for respondent schedules, surveys were also completed over the weekend, and residences were revisited if there had been no answer on a previous attempt.

After obtaining written consent, demographic information of survey respondents was collected. Demographics included age, sex, language(s) spoken, and zip code. To determine BMI, weight was measured via portable scales and height was obtained via measuring tape. If measurements were unable to be performed, self-reported weight and height were recorded. BMI was then categorized according to the standard World Health Organization groupings of underweight (< 18.5), normal (18.5-24.99), overweight (25-29.99), and obese (> 30) (24). The study sample recorded people in primarily three zip codes—19133 West Kensington, 19134 Kensington, and 19140 Hunting Park—all within a one-mile radius of the sites of EHC. Children screened through the FQHC outreach were not included in the study. Data

were de-identified prior to statistical analysis and reporting, and therefore the Thomas Jefferson University Institutional Review Board provided the study with exempt status. In accordance with the mission of EHC and FQHCs generally, our study methodology was designed to harmonize with assessment of other social determinants of health and the establishment of continuity of care.

Main outcome measure

The main outcome of interest was food insecurity, which is defined as not having reliable access to food. Food secure (FS) was designated negative and food insecure (FI) was designated positive. Food security and insecurity were determined through the USDA-derived validated 2-item screen, the Hunger Vital Sign™ screening tool, which asks people whether the following statements are "never true," "sometimes true," or "often true": Question 1, "Within the past 12 months we worried whether our food would run out before we got money to buy more," and, Question 2, "Within the past 12 months the food we bought just didn't last and we didn't have money to get more". Answering one or both of these statements with "sometimes" or "often" indicates a positive screen. The tool has been determined to have a sensitivity of > 95% and a specificity of 93% for the general national population, with a specificity of > 74% to > 86% for special groups depending on the target population's age, their income level, and whether they had children (22, 23). The surveyed neighborhoods included but were not limited to individuals over 60 (previously projected specificity 89%), individuals under the federal poverty line (specificity 80%), and people with children (specificity 80%), although we did not collect data on income level or children for the purposes of this study (23). Individuals who screened positive for food insecurity were given a list of local food resources and were offered a referral to SNAP, and all people screened regardless of food security status were referred to Esperanza Health Center to establish continuity of care if they did not already have a primary care practitioner. Interpreters were used to transmit information to participants who exclusively spoke Spanish.

Independent variables

Independent variables included BMI and the sociodemographic factors of age, sex, primary language, and zip code. Those who were bilingual English and Spanish speakers who indicated no preference for Spanish, i.e. not exclusively Spanish-speaking, were considered English speakers.

Statistical analysis

First, we calculated mean age and mean BMI with standard deviation (SD) for both the food insecure and the food secure groups. We also conducted a two-sample t-test to determine whether differences in mean age by case status were significant. Second, we calculated crude odds ratios and p-values using Fisher's exact tests to compare food insecurity between categorical groups for both sex and language. The dependent variable was whether or not a respondent was food insecure. A p-value ≤ 0.05 was considered statistically significant. Third, we conducted a logistic regression to assess the odds ratio of food insecurity with regard to weight, comparing the widely accepted four BMI categories: underweight (< 18.5), normal weight (18.5-24.99), overweight (25-29.99), and obese (> 30). We considered "normal

weight" as the reference group. Finally, we developed a multivariate logistic regression model to assess the association between food insecurity and the covariates age, sex, language, and BMI category. We used Stata, Version 17 (Copyright 1985–2021, StatCorp LP) to conduct all mathematical analyses.

Results

Researchers attempted to contact 2488 houses and passersby for screening and surveys, and 1611 individuals of the total houses knocked did not answer. Of the 877 responders who interacted, 498 declined to participate in the food insecurity survey and 379 completed the survey. These response rates were consistent with those for health screenings in previous years and those of similar published studies (see (25)). Of those who completed the survey, 140 screened positive for food insecurity while 239 were negative. See Table 1 and Fig. 1. Overall, 36.9% of respondents screened positive for food insecurity, compared to 18.3–18.6% in Philadelphia and 11.8% in the general U.S. population (6, 11, 17). See Fig. 2.

Table 1
HVS questionnaire responses.

		Question 1		
		Never	Sometimes	Often
	Never	*239*	**16**	**3**
Question 2	Sometimes	**7**	**46**	**16**
Italics = FS **Bold** = FI	Often	**3**	**7**	**42**

1. Question 1: "Within the past 12 months we worried whether our food would run out before we got money to buy more."
2. Question 2: "Within the past 12 months the food we bought just didn't last and we didn't have money to get more."

Figure 1. **Sample population selection.**

Figure 2. **North Philadelphia food insecurity prevalence compared with national and Philadelphia data.**

We grouped survey participants by self-reported zip code and determined rates of food insecurity within each zip code, as well as the rates of all other zip codes combined. Food insecurity rates ranged from 29.8–39.9% by zip code, with an even higher prevalence among those not reporting a local zip code at 46.0%. See Fig. 3.

Figure 3. **Food insecurity prevalence by zip code.**

Food insecure individuals were younger on average (47.6 ± 13.5 years) than those who were food secure (52.5 ± 15.1 years) (p = 0.002). There was no difference statistically for sex, as the crude odds ratio of being food insecure for male vs. female was 1.31 [95% CI: 0.84, 2.03]; p = 0.240). However, food insecure

individuals were more likely to speak English or both (vs. Spanish speakers with OR 1.61 [95% CI: 1.03, 2.52]; p = 0.032). Comparing the BMI, there was a lower mean BMI for food insecure individuals, 27.8 ± 6.0 (n = 123), than that of food secure individuals, 29.46 ± 6.20 (n = 214) (p = 0.016). Furthermore, using BMI categories, individuals with normal weight (BMI 18.5-24.99) had a greater association with food insecurity than either overweight (vs. normal, OR 0.52 [95% CI: 0.29, 0.92]; p = 0.025) or obese (vs. normal, OR 0.58 [95% CI: 0.34, 0.99]; p = 0.047), and underweight was also associated with food insecurity (OR 3.31 [95% CI: 0.33, 33.13]; p = 0.309). See Table 2.

Table 2
Characteristics of food secure and insecure respondents

Characteristic					OR (95% CI)	*p-value*
Age (years)	*FI number*	*Age*	*FS number*	*Age*	*OR*	*p-value*
	139	47.6 ± 13.5	235	52.5 ± 15.1	N/A*	0.002
Sex	*FI number*	*% FI*	*FS number*	*% FS*	*OR (M/F)*	*p-value*
Male	69	40.4%	102	59.6%	1.31 (0.84, 2.03)	0.240
Female	71	34.1%	137	65.9%		
Language	*FI number*	*% FI*	*FS number*	*% FS*	*OR (Eng/Spa)*	*p-value*
English or both	82	41.6%	115	58.4%	1.61 (1.03, 2.52)	0.032
Spanish	55	30.7%	124	69.3%		
Weight - Continuous (BMI)	*FI number*	*BMI*	*FS number*	*BMI*	*OR*	*p-value*
	123	27.8 ± 6.0	214	29.5 ± 6.2	N/A*	0.016
Weight - Categorical (BMI)	*FI number*	*% FI*	*FS number*	*% FS*	*OR (vs. normal)*	*p-value*
Underweight (< 18.5)	3	75%	1	25%	3.31 (0.33, 33.13)	0.309
Normal weight (18.5-24.99)	39	47.6%	43	52.4%	REF	
Overweight (25-29.99)	39	32.0%	83	68.0%	0.52 (0.29, 0.92)	0.025
Obese (> 30)	42	32.1%	89	67.9%	0.58 (0.34, 0.99)	0.047

1. *OR* crude odds ratio, *Age* mean age with standard deviation, *SD* standard deviation, *FI* food insecure, *FS* food secure, *REF* referent group. Characteristics represent crude associations.
2. *OR was calculated for categorical variables. OR was not calculated for age, as it is not categorical.
3. Chi-square test for BMI regression p = 0.046

To further isolate predictive variables after controlling for confounding, a logistic regression model (shown in Table 3) considering language and other covariates simultaneously showed an association for English or both (vs. Spanish, OR 1.30 (95% CI: [0.82, 2.05]; p = 0.262). Again, compared to the normal weight reference group, both overweight (vs. normal, OR 0.58 (95% CI: [0.32, 1.06]; p = 0.076) and obese (vs. normal, OR 0.62 (95% CI: [0.35, 1.09]; p = 0.096) were not associated with food insecurity, whereas underweight demonstrated association (OR 3.27 (95% CI: [0.32, 33.29]; p = 0.317). The *p*-value of this chi-square test overall was 0.010. See Table 3.

Table 3
Regression analysis of food insecurity and covariates.

Characteristic	OR (95% CI)	*P*-value
Age	0.98 (0.97, 1.00)	0.035
Sex (male)	1.19 (0.77, 1.85)	0.428
Language		
English or both vs. Spanish	1.30 (0.82–2.05)	0.262
Weight (BMI)		
Underweight (< 18.5)	3.27 (0.32–33.29)	0.317
Normal weight (18.5-24.99)	REF	
Overweight (25-29.99)	0.58 (0.32–1.06)	0.076
Obese (> 30)	0.62 (0.35–1.09)	0.096

1. *OR* odds ratio. *REF* referent group.
2. Chi-square test p = 0.010

Discussion

Unexpected characteristics

This cross-sectional survey showed that prevalence of food insecurity was much higher in the neighborhoods surrounding the clinics (36.9%) compared to Philadelphia and the United States (see Fig. 2). In addition, there was variability in rates of food insecurity by zip code. Respondents had various reasons for remaining in the area without reporting residence in one of the three pictured zip codes, including homelessness and transient visiting. (See Fig. 3.)

At the extremes of poverty, measures of a community's health may differ in many regards compared to what is expected in well-resourced areas. Even if considering a very conservative specificity of 75% for the Hunger Vital Sign compared to the 18-question survey and other screens derived from this, differences in validated screening tools would not account for the higher food insecurity prevalence we report in this

area. This is because the percentage differences in food insecurity prevalences between the study area and other surveyed areas far exceeds the possible 25% variability for a 75%-specific tool. With a most conservative estimate, this area has a food insecurity prevalence at least double the national level and over 50% higher than Philadelphia overall. Poverty clearly modifies food insecurity and likely has a strong effect on the rates seen in this area (26). We thus suggest that confounders such as high rates of opioid use, extreme poverty, and homelessness contributed to this high rate of food insecurity, especially among those not reporting a local zip code or who were visiting from outside those three zip codes (27). These results, on a smaller level, are evocative of much-discussed statistics such as the nearly 20-year life expectancy gap between zip codes within Philadelphia (11). A previous study had already noted that prevalence of food insecurity in the greater Philadelphia region has sometimes been underestimated due to confounding (17). Additionally, food insecurity prevalence in the greater Philadelphia area appears to be increasing, as demonstrated in a 2017 study using a showing 15–18% food insecurity (6, 10).

In contrast to the expected populations of food insecure individuals in Philadelphia and the country as a whole (28), those who were food insecure in our study were younger on average and English-speaking, but not more likely to be a certain sex (see Table 2). Confounding factors such as employment and substance abuse status may explain some differences in findings between food insecurity in the study population from previous municipal and national studies, potentially contributing to food insecurity through less-considered mechanisms.

Age

For instance, our data showed that younger people were more likely to be food insecure, unlike the national data, and the study area has a larger proportion of young people and a smaller portion of the population age 65 and older (10.5%) (27). Younger people may be more susceptible to issues such as violence and drug abuse that affect food security and contribute to high mortality and a low life expectancy in the area (27), hence the smaller population of elderly individuals. The study area exhibits some of the highest rates of opioid abuse and illegal drug selling in Philadelphia (29), the area is known nationally as a hub for drug distribution (11), and these activities were observed on the streets when collecting survey data. Opioid use is more common among English-speaking individuals who are younger (30), which could account for the higher rates of food insecurity in contrast with older and Spanish-preferring individuals. Increasing rates of opioid use among young people, coupled with a trend towards greater numbers of homeless youth, could thus be related to the increased incidence of food insecurity among younger members of this population compared to the predominantly older food insecure groups in other samples. Opioid dependence and other psychiatric comorbidities could also contribute to these population members not remaining in housing and social support systems that would otherwise provide food security, and other study populations have shown a strong association between opioid use and food insecurity (31). For obvious reasons, we were not able to screen individuals in the study population for ongoing substance use while conducting the survey of food insecurity.

Women not more food insecure than men

Women were not more likely than men to be food insecure, a finding related to several factors such as already existing programs and other social determinants of health. Typically, women are thought to be at greater risk for food insecurity due to several issues including greater likelihood of being severely impoverished and having primary caregiver responsibilities for children (32), but the study area demonstrates social determinants that may raise the food insecurity risks for men to similar levels as those of women. High unemployment (14.5%), violence, and drug usage, contributing to a large life expectancy disparity of over 9 years between men (65.7) and women (74.9), all present a burden preventing men from achieving food insecurity (27). Men affected by food insecurity are also not targeted by programs such as WIC, for example, that are designed to aid women.

Language

Regarding language, besides the opioid use population being predominantly English-speaking, the health center historically specializes in treating patients from Spanish-speaking backgrounds who live in the surrounding areas. As already discussed, opioid use is more common among English-speaking individuals (30), who will likewise be affected by the factors surrounding drug abuse. With this more locally specific information, local organizations should tailor resources particularly for food security and primary care to other vulnerable populations such as those with histories of drug abuse with more attention to English-speaking males.

Weight

The majority of the food secure and insecure study population was overweight, consistent with local and national trends (4). However, when comparing underweight, normal weight, overweight, and obese individuals, the underweight and normal weight individuals were more likely to be food insecure in our study. Underweight and normal weight may have been risk factors for food insecurity because of perceived distance from grocery stores and other sources of food, whether nutritious or not. Typically, obesity is associated with food insecurity either because of consumption of high calorie foods or limited education and other resources (33), but in the study area, there were few establishments where individuals could procure nutritious food, relating in part to violence and drug usage deterring business activity. Further, of any individuals surveyed who may have used opioids, adverse nutritional effects along with opportunity costs to drug usage such as missed grocery shopping or visiting food banks could contribute to lower weight (34). Our hypothesis that younger, female, Spanish-speaking, and overweight and obese individuals would be more likely to be food insecure was thus shown to be incorrect, and revisions to the FQHC food security and future data collection strategies should reflect a more current and accurate characterization of food insecurity risk factors.

In the final regression analysis (Table 3), with the exception of age, the covariates sex, language, and BMI category did not individually achieve significance at the 0.05 level. However, we included all of these variables in the model because they are predictors of food insecurity. The wide confidence intervals and larger p-values may be an artifact of an underpowered study. Even so, the logistic regression further demonstrated that in this study area with a large population of Spanish speakers, individuals who were

English-speaking were at a marginally significant greater risk of food insecurity. The regression also supported an association between lower BMI and food insecurity, with underweight and normal weight individuals at greater risk of being food insecure. Although there was a small sample of 4 underweight individuals, we included those in the underweight category because the presence of underweight individuals precluded a positivity violation. We also did not collapse this underweight population into one BMI < 25 category with the normal weight population to avoid introducing confounding. Because of the small sample size, although it was not surprising that underweight individuals were more likely to be food insecure than not, we cannot make any definitive claims on the current population's distribution. This study was underpowered for underweight subjects, and future research should include collecting more data on food insecurity and underweight individuals in this population. What was most interesting, however, was the greater association between normal weight and food insecurity contrary to national trends of obesity being associated with food insecurity. Normal weight in this population was thus a strong risk factor for food insecurity after considering age, sex, and language in our regression model which demonstrated strong significance overall.

Strengths and limitations

Strengths of this study include ability to study previously overlooked populations whose characteristics may have been collapsed into larger demographic data; comparison between predictive values for interrelated food security variables; demonstration of partnership potential between nonprofits, medical education, and public health research; and the use of a validated tool to evaluate food insecurity prevalence. Implementing recommendations and programming for food insecurity from the state and federal levels may reach unintended populations and therefore fail to meet food needs most effectively if diverse situations in smaller localities remain unaddressed. The differences in expected results on the more local zip code level compared to those of municipal, state, and federal studies demonstrate a need for more precise and specific public health research particularly when addressing social determinants of health. Local public health departments and FQHCs, sometimes in cooperation, may work to address this need. Moreover, the work of students was an integral component for gathering and interpreting data while interfacing with the community to give out resources and connect to social service agencies. This study may therefore serve as a model and proof of concept for partnership between FQHCs and medical education for collecting, assessing, and implementing results from data on social determinants of health to contribute to public health knowledge.

Regarding limitations, there was a possibility for selection bias and reporting bias to have affected the study results given the low response rate, and generalizability of results may be limited to similar low-income urban areas in the Northeastern U.S. Response rates were consistent with those for health screenings in previous years and response rates for some similar published studies. Further, since demographic information was not collected for non-respondents, true rates of food insecurity may be higher than recorded due to issues such as fear of stigmatization. In contrast, there may be lower rates of food insecurity if people were unable to be reached because of factors such as stable employment, as much of the screening was performed during weekdays. Previous studies have also noted discrepancies

between reported and expected food insecurity rates, generally noting that self-reported rates are lower than expected (17). Other descriptors such as race, socioeconomic status, and access to transportation may also have been relevant but were not able to be directly considered in our model.

This study underscores the necessity for programming to be localized and for data collection to be specific to the characteristics of areas around clinical sites. Furthermore, clinics and public health agencies should consider confounding barriers to achieving food security so that they may address these issues simultaneously for greatest effect.

Conclusion And Future Directions

We conclude that the demographic characteristics and prevalence of food insecure people in this low-income area of North Philadelphia are different from and higher than those on a national level, contributing to an extremely high prevalence of food insecurity in the area. Food insecurity was associated with lower age, preference for English, and normal weight, perhaps reflecting increased local rates of homelessness and substance abuse.

Such disparities between neighborhoods should alert clinics, public health officials, and policymakers to the need to address public health issues such as food insecurity at a more specific neighborhood level. The results of this study may inform local FQHCs and local and federal outreach programs with data for better strategies for combating food insecurity in North Philadelphia and other inner city populations in the U.S. This study was able to determine prevalence of food insecurity and noted that multiple covariates contributed to food insecurity risk in our final regression model, though it was underpowered for isolating some risk factors. Thus, future studies should examine the individual predictive values and effect sizes of age, sex, language, and BMI for food insecurity and consider a larger sample size, focusing especially on the relationship between underweight, food insecurity, and potential substance abuse. Studies should collect information on factors such as participation in SNAP, employment status, income level, race, proximity to grocery stores and access to transportation, and family living arrangements. Zip codes could be categorized by socioeconomic status to determine associations between zip codes, socioeconomic status, and food insecurity. Additionally, studies could develop tactful ways to screen for drug abuse in relevant populations facing food insecurity, perhaps incorporating food insecurity data from local gathering points such as needle exchanges (17, 18).

FQHCs and similar clinics have potential for partnerships with public health departments in performing such research (14, 28), obtaining data that more accurately reflect the characteristics of their patient populations at the zip code and neighborhood levels. Further, an individual who screens positive for food insecurity, when given information on resources alongside the potential for a medical home (35), can have that need addressed on a more consistent basis through continuity of care. As in our study design, food insecurity surveys could be administered alongside screenings for associated health conditions, such as hypertension, diabetes, and obesity (15, 16, 36). With our method of data collection, this study also represents the most recent possible set of data for this population prior to the COVID-19 pandemic,

so future comparative studies may address how the pandemic has affected food insecurity and how possible mechanisms for changes, such as increased opioid use, lower employment, etc., have manifested.

Abbreviations

HVS Hunger Vital Sign[TM], *FQHC* Federally Qualified Health Center, *FI* Food Insecure, *FS* Food Secure, *SNAP* Supplemental Nutrition Assistance Program, *OR* Odds Ratio, *CI* Confidence Interval, *BMI* Body Mass Index

Declarations

Ethics approval and consent to participate

All screened participants provided written consent, and data were de-identified and aggregated before analysis. Therefore, the ethics committee, Thomas Jefferson University Hospital IRB (IRB identification number 01NR/02NR), waived the need for approval of this study.

Consent for publication

Not applicable, as this research did not contain data from any individual person.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

Funding

The authors received publication support for this project from the Jefferson Open Access Fund and the Villanova Scholarship Open Access Reserve Fund. Funders contributed solely to article processing charges and did not have any role in designing or carrying out this study.

References

1.   Gundersen C, Ziliak JP. Food Insecurity And Health Outcomes. Health Aff (Millwood). 2015 Nov 1;34(11):1830–9.

2.   Murthy V. Food Insecurity: A Public Health Issue. Public Health Rep. 2016 Sep 1;131(5):655–7.

3.   Auchincloss AH, Mujahid MS, Shen M, Michos ED, Whitt-Glover MC, Diez Roux AV. Neighborhood health-promoting resources and obesity risk (the multi-ethnic study of atherosclerosis). Obes Silver Spring Md. 2013 Mar;21(3):621–8.

4.   Hernandez DC, Reesor LM, Murillo R. Food insecurity and adult overweight/obesity: Gender and race/ethnic disparities. Appetite. 2017 Oct 1;117:373–8.

5.   Lubrano A. Food insecurity is up significantly and reveals racial divide, USDA report finds [Internet]. https://www.inquirer.com. [cited 2021 Dec 21]. Available from: https://www.inquirer.com/news/hunger-food-insecurity-children-black-latino-people-of-color-poverty-20210908.html

6.   Coleman-Jensen A. Household Food Security in the United States in 2016. US Dep Agric Econ Res Serv. 2016;44.

7.   Even Very Low Levels of Food Insecurity Found to Harm Children's Health [Internet]. Center for Hunger Free Communities. 2020 [cited 2021 Dec 21]. Available from: https://drexel.edu/hunger-free-center/research/briefs-and-reports/even-very-low-levels-of-food-insecurity/

8.   Lubrano A. Hunger in Philly: "It's a pain in my belly" [Internet]. Philabundance. 2018 [cited 2022 Feb 19]. Available from: https://www.philabundance.org/hunger-in-philly-its-a-pain-in-my-belly/

9.   Scully K, Knowles M. Philadelphia Hunger Increases [Internet]. Drexel University Center for Hunger-Free Communities, Children's HealthWatch. 2020 [cited 2021 Dec 21]. Available from: https://drexel.edu/hunger-free-center/research/briefs-and-reports/philadelphia-hunger/

10.   How Hungry Is America? FRAC's National, State, and Local Index of Food Hardship — August 2018 [Internet]. Food Research & Action Center. [cited 2022 Feb 19]. Available from: https://frac.org/research/resource-library/hungry-america-fracs-national-state-local-index-food-hardship-july-2018

11.   Philadelphia Department of Public Health. Close to Home: The Health of Philadelphia's Neighborhoods | Department of Public Health [Internet]. City of Philadelphia. [cited 2021 Dec 21]. Available from: https://www.phila.gov/documents/close-to-home-the-health-of-philadelphias-neighborhoods/

12.   Bickel G, Nord M, Price C, Hamilton W, Cook J. Guide to Measuring Household Food Security. USDA Food and Nutrition Service, Office of Analysis, Nutrition, and Evaluation; 2000.

13.   Hager ER, Quigg AM, Black MM, Coleman SM, Heeren T, Rose-Jacobs R, et al. Development and validity of a 2-item screen to identify families at risk for food insecurity. Pediatrics. 2010 Jul;126(1):e26-32.

14.   Wright B, Ugwi P, Nice AJ. Organizational scope of practice: assessing the primary care and public health activities of health centers and health departments in Iowa. Popul Health Manag. 2015 Apr;18(2):137–45.

15.   Sun Y, Liu B, Rong S, Du Y, Xu G, Snetselaar LG, et al. Food Insecurity Is Associated With Cardiovascular and All-Cause Mortality Among Adults in the United States. J Am Heart Assoc. 2020 Oct 6;9(19):e014629.

16.   Robson SM. Food Insecurity and Cardiometabolic Risk Factors in Adolescents. Prev Chronic Dis [Internet]. 2017 [cited 2021 Dec 22];14. Available from: https://www.cdc.gov/pcd/issues/2017/17_0222.htm

17.   Mayer VL, Hillier A, Bachhuber MA, Long JA. Food Insecurity, Neighborhood Food Access, and Food Assistance in Philadelphia. J Urban Health Bull N Y Acad Med. 2014 Dec;91(6):1087–97.

18. Karpyn A, Manon M, Treuhaft S, Giang T, Harries C, McCoubrey K. Policy solutions to the "grocery gap." Health Aff Proj Hope. 2010 Apr;29(3):473–80.

19. MANNA [Internet]. MANNA. [cited 2021 Dec 21]. Available from: https://mannapa.org/

20. The Food Trust [Internet]. [cited 2021 Dec 21]. Available from: http://thefoodtrust.org/

21. Mayer VL, McDonough K, Seligman H, Mitra N, Long JA. Food insecurity, coping strategies and glucose control in low-income patients with diabetes. Public Health Nutr. 2016 Apr;19(6):1103–11.

22. Gattu RK, Paik G, Wang Y, Ray P, Lichenstein R, Black MM. The Hunger Vital Sign Identifies Household Food Insecurity among Children in Emergency Departments and Primary Care. Children. 2019 Oct 2;6(10):107.

23. Gundersen C, Engelhard EE, Crumbaugh AS, Seligman HK. Brief assessment of food insecurity accurately identifies high-risk US adults. Public Health Nutr. 2017 Jun;20(8):1367–71.

24. Flegal KM, Kit BK, Graubard BI. Body Mass Index Categories in Observational Studies of Weight and Risk of Death. Am J Epidemiol. 2014 Aug 1;180(3):288–96.

25. Santos MP, Brewer JD, Lopez MA, Paz-Soldan VA, Chaparro MP. Determinants of food insecurity among households with children in Villa el Salvador, Lima, Peru: the role of gender and employment, a cross-sectional study. BMC Public Health. 2022 Apr 11;22(1):717.

26. Cook JT, Frank DA. Food security, poverty, and human development in the United States. Ann N Y Acad Sci. 2008;1136:193–209.

27. Philadelphia Department of Public Health. Division of Chronic Disease and Injury Prevention Data Lab [Internet]. 2022. (PhilaStats). Available from: https://philadelphiapublichealth.shinyapps.io/philastats/

28. Palakshappa D, Strane D, Griffis H, Fiks AG. Determining Food-Insecure Families' Resource Access with Health System and Public Data. J Health Care Poor Underserved. 2019;30(1):265–79.

29. Philadelphia Department of Public Health. Opioid Misuse and Overdose Report: Philadelphia, PA. 2020.

30. National Academies of Sciences, Engineering, and Medicine, Health and Medicine Division, Board on Health Sciences Policy, Committee on Pain Management and Regulatory Strategies to Address Prescription Opioid Abuse. Pain Management and the Opioid Epidemic: Balancing Societal and Individual Benefits and Risks of Prescription Opioid Use [Internet]. Phillips JK, Ford MA, Bonnie RJ, editors. Washington (DC): National Academies Press (US); 2017 [cited 2021 Dec 21]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK458660/

31. Men F, Fischer B, Urquia ML, Tarasuk V. Food insecurity, chronic pain, and use of prescription opioids. SSM - Popul Health. 2021 Mar 9;14:100768.

32. Forson PW, Counihan C. Taking Food Public: Redefining Foodways in a Changing World. Routledge; 2013. 654 p.

33. Dhurandhar EJ. The Food-Insecurity Obesity Paradox: A Resource Scarcity Hypothesis. Physiol Behav. 2016 Aug 1;162:88–92.

34. Swegle JM, Logemann C. Management of Common Opioid-Induced Adverse Effects. Am Fam Physician. 2006 Oct 15;74(8):1347–54.

35. Franz BA, Murphy JW. The Patient-Centered Medical Home as a Community-based Strategy. Perm J. 2017 Jul 3;21:17–002.

36. Venci BJ, Lee SY. Functional limitation and chronic diseases are associated with food insecurity among U.S. adults. Ann Epidemiol. 2018 Mar;28(3):182–8.

Figures

Figure 1

Sample population selection. Out of 2488 attempted contacts, 1611 did not answer, and 877 responded, 498 individuals declined to participate in the food insecurity survey, while 379 individuals agreed to participate. 140 individuals screened positive and 239 screened negative.
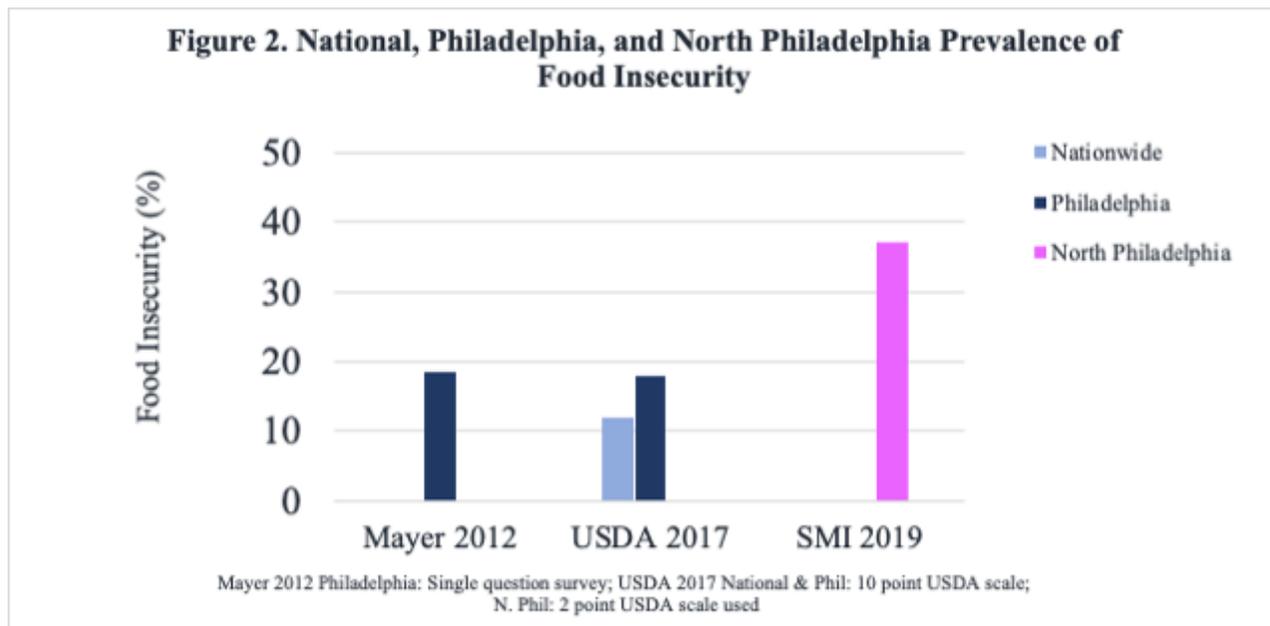

Figure 2. National, Philadelphia, and North Philadelphia Prevalence of Food Insecurity

Mayer 2012 Philadelphia: Single question survey; USDA 2017 National & Phil: 10 point USDA scale; N. Phil: 2 point USDA scale used

Figure 2

North Philadelphia food insecurity prevalence compared with national and Philadelphia data.

(A) Using a one-question screen in 2012, Mayer et al found FI prevalence of 18.6% in Philadelphia (17).

(B) Using the ten-question USDA survey and in a report by Hunger Free America, FI prevalence in 2017 was 11.8% nationally and 18.3% in Philadelphia (6).

(C) Using the two-question Hunger Vital Sign^{TM} survey, our study found FI prevalence in the screened area in North Philadelphia in 2019 was 36.9%.

Figure 3

Food insecurity prevalence by zip code.

(A) 19133 (n = 68) had a FI prevalence of 30.9%, 19134 (n = 158) prevalence of 39.9%, and 19140 (n = 84) prevalence of 29.8%.

(B) Out of respondents from all other zip codes (n = 63), 46.0% were FI.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- STROBEchecklistv4crosssectional.doc