

Food Insecurity in Hawai‘i Using a Population-Based Sample: A Data Brief

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Introduction

The United States Department of Agriculture (USDA) applies a definition of food insecurity that emerged in the 1990s from an expert working group of the American Institute of Nutrition: “Limited or uncertain availability of nutritionally adequate and safe foods or uncertain ability to acquire acceptable foods in socially acceptable ways” (Bickel et al., 2000). Food insecurity is a complex, multidimensional phenomenon that exists on a spectrum and can vary in severity from anxiety about having enough food in a household to disrupted eating patterns and reduced intake of food (Bickel et al., 2000). Generally, food insecure households are uncertain about having, or unable to acquire enough food to meet household needs, largely because of not having enough money for food. In 2018, the USDA estimated that 11.1% of households, or about 14.3 million people, had low or very low food security at some point in that year (Coleman-Jensen et al., 2019).

There are differences in who experiences food insecurity. One study found that nationally, 20.5% of Native Hawaiian and other Pacific Islander (NHOPI) adults face low or very low food security, which means they experience reductions in the quality, variety, and sometimes quantity of food available to them (Long et al., 2020). If marginal food insecurity is added to that number—that is, fears about getting enough food or limited selection of food because of not having enough money—a full third of NHOPI adults in the United States (US) report food insecurity. This is about twice as high as the general population of the US (Long et al., 2020).

Locally between 2016 and 2018, the USDA estimated that 8.0% of Hawai‘i households were food insecure (Coleman-Jensen et al., 2019). Another estimate of food insecurity rates by county reported 8.7% of Kaua‘i County residents, 10.3% of Maui County residents, 10.5% of Honolulu County residents, and 11.8% of Hawai‘i County residents were food insecure in 2017 (Gundersen et al., 2019). An older study by the State of Hawai‘i Department of Health (HDOH) reported that one in five residents lived in a food insecure household during the years 1999-2000 (Baker et al., 2001). Certain communities—Waimānalo, the Wai‘anae Coast, Puna, Ka‘a‘wa to Wailua, and Moloka‘i—were all calculated to have food insecurity levels exceeding 30% of the population. Results from this study also highlighted certain vulnerable groups: the poor, children, Native Hawaiians, other Pacific Islanders and Filipinos, as well as those who were uninsured or of unknown insurance status (Baker et al., 2001). **These results indicate the need to consider variation in food security status by location and by household characteristics**, as estimates are higher for certain counties and for certain types of households compared to others.

Food insecurity by demographic and socioeconomic characteristics

Racial and ethnic disparities in food insecurity are observed for other groups as well. In a study using surveillance data from 15 states, Blacks and Hispanics were much more likely to report worry or stress about having enough money to buy nutritious food (Njai et al., 2017). The study also reported that those with less than a high school education were more likely to worry about food than those with a four or more years of college (Njai et al., 2017). Many findings from another national study that examined US adults, but this time with diabetes, mirrored those reported by Njai et al. Compared to men and Whites, women, Blacks, and Hispanics were more likely to be food insecure. Younger adults (18-44 years) and those with less than a high school education were also more likely to be food insecure compared to older

adults and those better educated (Knight et al., 2016). **These findings highlight the importance of examining variation in food security status by demographic and socioeconomic characteristics.**

Food insecurity and chronic disease

Consequences of food insecurity are myriad. Results from the 2014 Gallup World Poll individuals aged 15 years and older in over 130 countries showed that **food insecurity was strongly and negatively associated with subjective well-being** (Frongillo et al., 2017). Importantly, the association was independent of other measures of living conditions, meaning that household income, shelter and housing situation, and employment status could not explain the observed association. There was also an association between food insecurity and poor physical health (Frongillo et al., 2017). Results from the HDOH report in 2001 also reported associations between poor physical and mental health with food insecurity (Baker et al., 2001).

In US samples of adults, food insecurity is associated with higher odds of prediabetes (Walker et al., 2019), diabetes (Stupplebeen, 2019; Vaccaro & Huffman, 2017; Walker et al., 2019), chronic kidney disease in persons with either diabetes or hypertension (Crews & Novick, 2019), hypertension and high cholesterol (Seligman et al., 2010; Vaccaro & Huffman, 2017), lung disease (Gregory & Coleman-Jensen, 2017; Vaccaro & Huffman, 2017) and asthma (Gregory & Coleman-Jensen, 2017; Mangini et al., 2015; Stupplebeen, 2019). Additionally, a USDA study that analyzed five years of national data (2011-2015) found that, in working age adults (19-64) living at or below 200 percent of the federal poverty level (FPL), lower food security is linked with higher likelihood of multiple chronic diseases like cancer, coronary heart disease, stroke, and kidney disease (Gregory & Coleman-Jensen, 2017). Furthermore, Gregory & Coleman-Jensen (2017) found that compared to income status, low food security was more strongly predictive of developing a chronic illness.

Among older adults, those with food insecurity were also more likely to be found in the extreme lower (e.g. underweight) and upper (moderate-to-severe obesity) body mass index categories (Vaccaro & Huffman, 2017). Results from these national studies largely concord with findings from the 2001 HDOH report on food insecurity, in which **food insecurity in Hawai'i was associated with obesity, diabetes, asthma, and arthritis** (Baker et al., 2001).

Food insecurity is also related to poor disease self-management, among those with chronic conditions. One nationally representative study found that one in three chronically ill patients were unable to afford both food, medications, or both (Berkowitz et al., 2014). **Interestingly, this study showed that participation in public insurance and special supplemental nutrition assistance program for women, infants and children was associated with less food insecurity and cost-related medication underuse, highlighting the value of these programs** (Berkowitz et al., 2014). Other studies of national data have reported associations between food insecurity and diabetes, as well as cutting back on diabetes medications (Knight et al., 2016). Further research using a nationally representative sample has demonstrated associations between food insecurity and poor glycemic and LDL control, even after taking into account numerous confounding factors like age, sex, educational and insurance status (Berkowitz et al., 2013).

Food insecurity and behavioral/mental health

Studies have associated food insecurity with behavioral health issues. A review article on studies of food insecurity and health outcomes using US and Canadian populations found that food insecurity in children is associated with increased risks of cognitive issues, aggression, anxiety, behavioral problems, depression, and suicide ideation (Gundersen & Zilliak, 2015). Additionally, the review found links to increased rates of mental health problems and depression in young and working age adults, as well as higher likelihood for poor health and depression in food-insecure older adults (Gundersen & Zilliak, 2015).

A national study that investigated longitudinal early childhood data in the US identified significant mediation pathways suggesting that food insecurity may be an underlying mechanism for maternal depression in low income families (Wu et al., 2018). Food insecurity can also affect adolescent behavioral and mental health. Based on a national sample of adolescents age 13 to 17 in the US, food insecurity alone was associated with increased odds of mood, anxiety, behavior, and substance disorders, especially in low income and lower educational attainment households (McLaughlin et al., 2012).

One study of US adults age 20 and older whose household incomes fell at or below 130% of the FPL documented a dose-response relationship showing worsening food insecurity with higher depressive symptoms and a positive association with depression (Leung et al., 2015). However, these associations between mental health and food insecurity could vary based on participation in the Supplemental Nutrition Assistance Program (SNAP) (Leung et al., 2015). **Overall, there is a large body of evidence to suggest an association between food insecurity and mental health concerns across the lifecycle.**

Food insecurity and healthcare costs

Food insecurity is related to higher levels of health care expenditure and costs. In a national sample of US older adults, defined as age 50 or older, those deemed food-insecure had higher incremental healthcare costs than their food-secure counterparts, highlighting the financial burden of food insecurity with or without the presence of a chronic illness (Garcia et al., 2018). More specifically, analysis of national US data found that food insecurity is significantly associated with more emergency room visits, inpatient hospitalizations, and days hospitalized (Berkowitz et al., 2017). Furthermore, those experiencing food insecurity had significantly greater mean healthcare expenditures, \$6072, versus \$4208 for those who were not food insecure (Berkowitz et al., 2017). Another national US study found that chronic diseases can compound these effects: compared to food secure counterparts, individuals who were food insecure with diabetes expended \$4413.61 more annually, while those with hypertension and heart disease had more annual expenditures of \$2175.51 and \$5144.05 respectively (Berkowitz et al., 2018). In contrast, SNAP participation was linked with lower healthcare costs (Berkowitz et al., 2017).

Data brief purpose

The purpose of this data brief is to provide estimates of food insecurity experienced by people living in Hawai'i using a population-based sample. In addition, this brief presents estimates by a number of factors that may contribute to variation in the levels of food insecurity experienced by certain groups of people including, for example, location of residence and race/ethnicity.

Methods

Sample

Data were collected from the Hawai‘i Behavioral Risk Factor Surveillance System’s (BRFSS) annual survey. BRFSS is a large, ongoing telephone survey of randomly selected cell and landline phones conducted nationally by the US Centers for Disease Control and Prevention (CDC). The Hawai‘i portion of the survey is managed by the HDOH (State of Hawai‘i Department of Health, 2020). The sample used here was comprised of 2,760 individuals from across the state over the age of 18. An analytic sample was created to exclude 102 observations missing data on the main food measures and/or demographic variables. There were no statistically significant differences observed between the included/excluded group on the main outcome, food insecurity ($p = .156$). The final sample was based on 2,658 individuals. Data were weighted to account for complex sample design and for non-response. Results are presented by percentage and represent the estimated proportion of the population in Hawai‘i with a given characteristic or condition.

Measures

Food insecurity and other food measures

Questions related to food were asked during the first six months of 2018. One item measuring food insecurity asked participants whether the following statement was often true, sometimes true, or never true: “The food that (I or we) bought just didn’t last and (I or we) didn’t have money to get more.” Responses from the often true and sometimes true categories were combined, which has been found to approximate food insecurity in other studies (Urke et al., 2014). This constituted our principal measure of food insecurity.

There were additional items in the survey that reflected food insecurity. One item asked participants how true (often, sometimes, or never) a statement was regarding nutritious meals (“(I or we) couldn’t afford to eat balanced meals”). “Often true” and “sometimes” true responses were combined together, dichotomizing the answer. Regarding food assistance, participants were asked whether in the past 12 months anyone in the household was eligible for SNAP, previously known as “food stamps” (yes/no), and whether they had accessed any free food services in the previous 12 months, including soup kitchens, food pantries, churches, or shelters (yes/no). We treat each of these questions as different indicators of food insecurity. However, it should be noted that very little validation work has been done to confirm the measurement properties of these measures. Nonetheless, variation in these measures by different characteristics/conditions could identify which groups in the state are most at risk of experiencing food insecurity.

Demographic information

The core BRFSS questions asked for the number of adults and children living in the household, which was summed to create an aggregated household size. Age was provided continuously, which was categorized into broad age groups. Participants were asked for their sex at birth (male/female), their ethnicity following HDOH guidelines (Caucasian; Native Hawaiian; Filipino; Japanese; other Asian, including Chinese due to sample size; other Pacific Islander, including Micronesian; or “other”); marriage status (married/cohabitating; divorced/widowed/separated; or never married), highest level of educational attainment (less than a high school diploma; high school diploma or equivalent; some college or vocational school; or, four-year college diploma or higher), homeownership status (own; rent;

or other arrangement), employment status (employed for wages; self-employed; unemployed; student or homemaker; retired; or, unable to work), household income (<\$15,000; \$15,000-24,999; \$25,000-34,999; \$35,000-49,999; \$50,000-74,999; \$75,000-124,999; \geq \$125,000; or don't know/refused), and, delayed medical care due to cost (yes/no). Lastly, a dichotomous household poverty variable was estimated using 2018 guidelines from the Department of Health & Human Services (DHHS; DHHS, 2019) based on reported household income and household size.

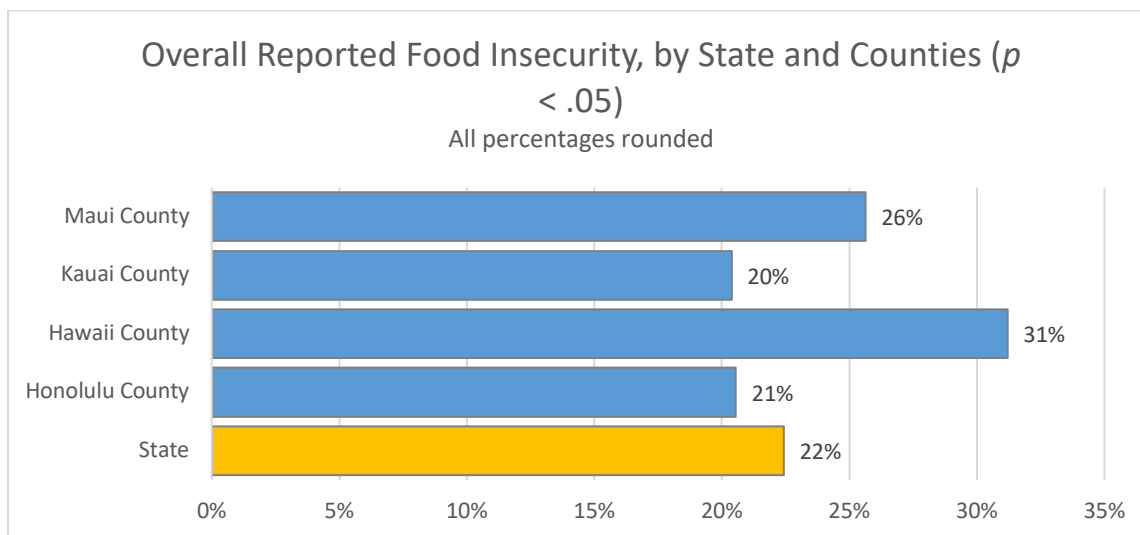
Analysis plan

We estimated the prevalence of food insecurity among adults living in Hawai'i, then compared differences in food insecurity (i.e., food secure versus food insecure) by various demographic factors (adults in household, children in household, total household size, age, age groups, sex at birth, ethnicity, marriage status, education level, homeownership status, employment status, household income, medical care delay, and household poverty) and food-related variables (SNAP use, nutritious food access, and free food access). We also looked at differences by county to account for differences in setting. We then stratified our analyses by county level; any stratified analysis yielding prevalence estimates with relative standard errors $\geq .30$ were suppressed (reported as "n/a" in the bar charts below). Differences were measured using t-tests for continuous variables and chi-square tests for categorical variables. Below we present the differences among those who reported being food insecure. Stata 15.2 (StataCorp, College Station, TX) was used to conduct all analyses and account for BRFSS complex survey design. Differences were deemed significant at a $p < .05$ level.

Results

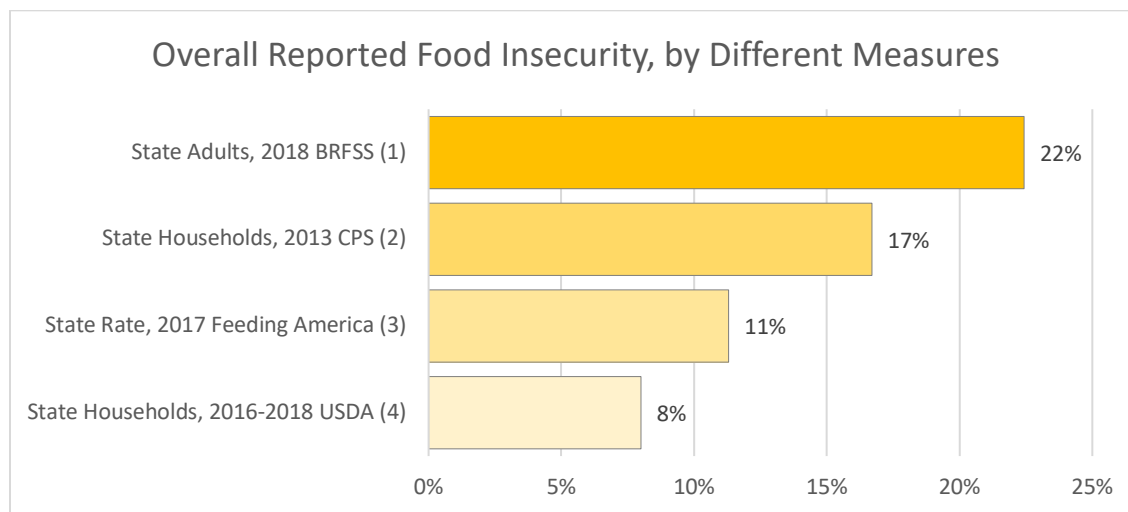
Overall Food Insecurity, State and County

Overall state food insecurity was estimated to be 22%, with statistically significant differences by county ($p < .05$). Kauai County had the lowest overall food insecurity at 20% while Hawai'i County had the highest food insecurity at 31%.



Overall Food Insecurity, Comparison of 2018 BRFSS data with other surveys

Overall state food insecurity was estimated to be 22% using 2018 BRFSS data, which is higher when compared with other food insecurity survey data sources. Food insecurity was estimated to be 17%, 11%, and 8% in 2013, 2017, and 2016-2018, respectively, according to different surveys with data on Hawai‘i. Caution should be taken when interpreting these differences as BRFSS is a survey of adults, with adults as the unit of analysis as opposed to households. Most food insecurity measures apply to households, so the numbers in this report are not directly comparable. Additionally, measurement tools to estimate food insecurity, as well as the cut-offs applied, vary by survey. These issues notwithstanding, there are wide variations in the estimates of the number of people who are food insecure in Hawai‘i.



(1) Estimated state prevalence of food insecurity among adults ≥ 18 years, BRFSS 2018

(2) Estimated food insecure households, Food Security Supplement to the Current Population Survey, 2013. Source: <http://www.hawaiihealthmatters.org/indicators/index/view?indicatorId=1247&localeId=14>

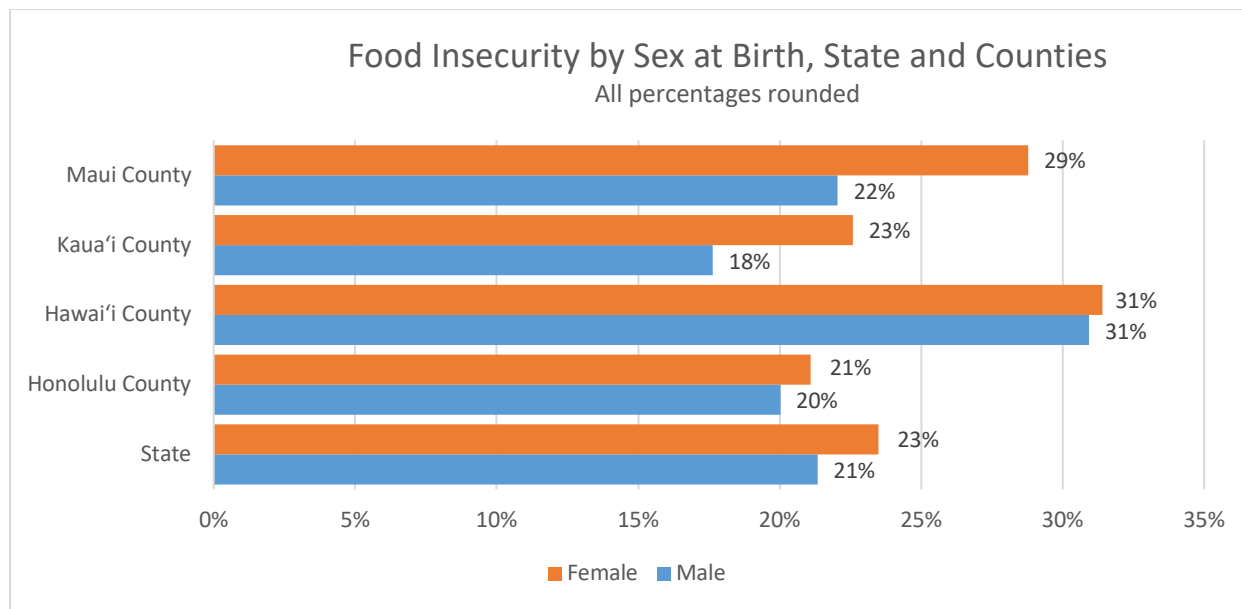
(3) Estimated food insecurity rate, Feeding America, Map the Meal Gap Project, 2017. Source: <https://map.feedingamerica.org/county/2017/overall/hawaii>

(4) Estimated prevalence of household food insecurity (low or very low food insecurity), USDA Economic Research Survey, 2016-2018. Source: <https://www.ers.usda.gov/webdocs/publications/94849/err-270.pdf?v=963.1>

Food Insecurity by Demographic Factors

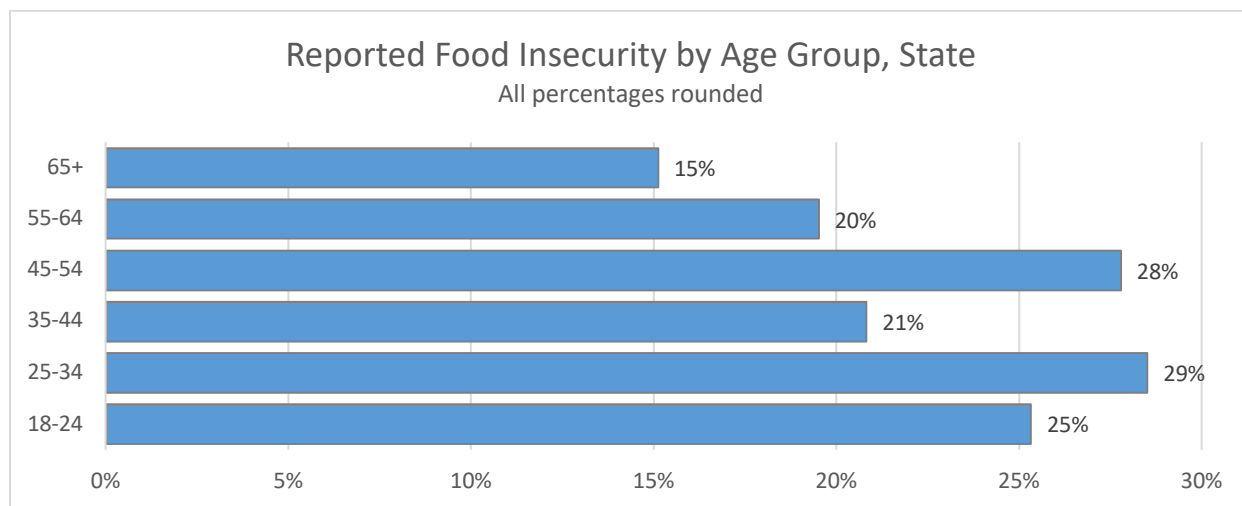
Food insecurity by sex assigned at birth

Sex differences were observed in food insecurity across the state, though they were not statistically significant. Generally, women experienced higher levels of food insecurity than men. Men and women living in Hawai‘i County reported the highest levels of food insecurity, while women in Honolulu County and men in Kaua‘i County reported lowest levels of food insecurity.



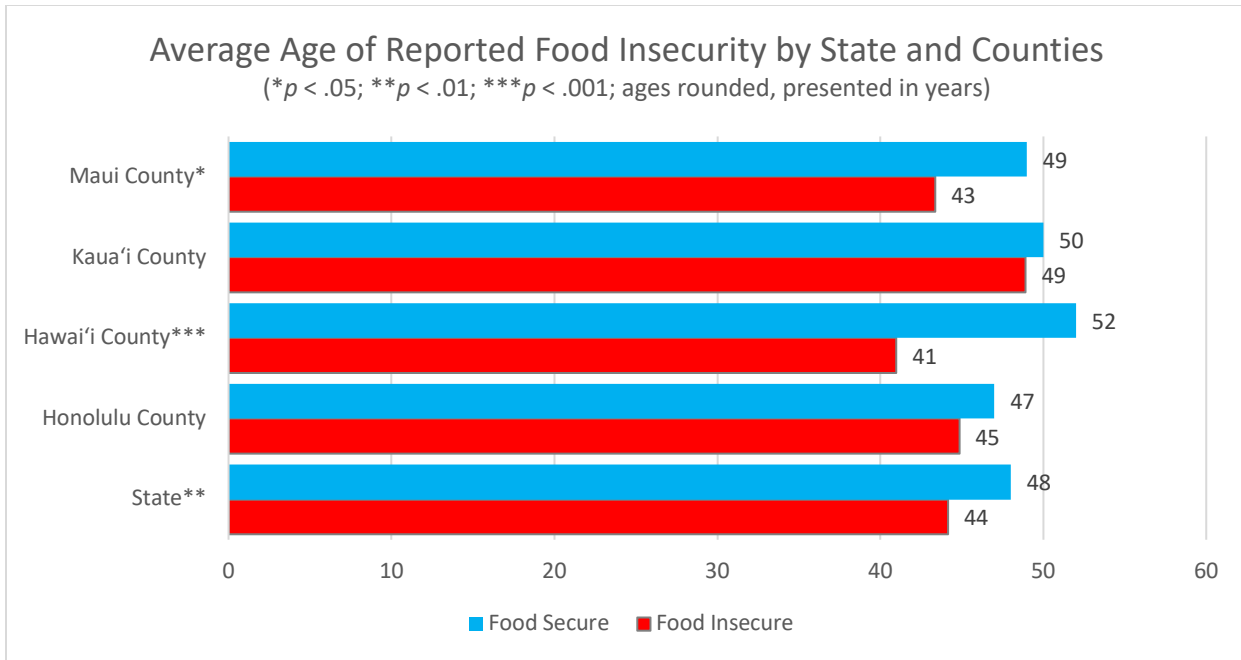
Food insecurity by age group

Across the state, those between 18-24, 25-34, and 45-54 reported the highest levels of food insecurity. Differences by age group were marginally statistically significant ($p=0.06$). Due to small sample size for certain age categories, we were unable to perform this analysis by county.



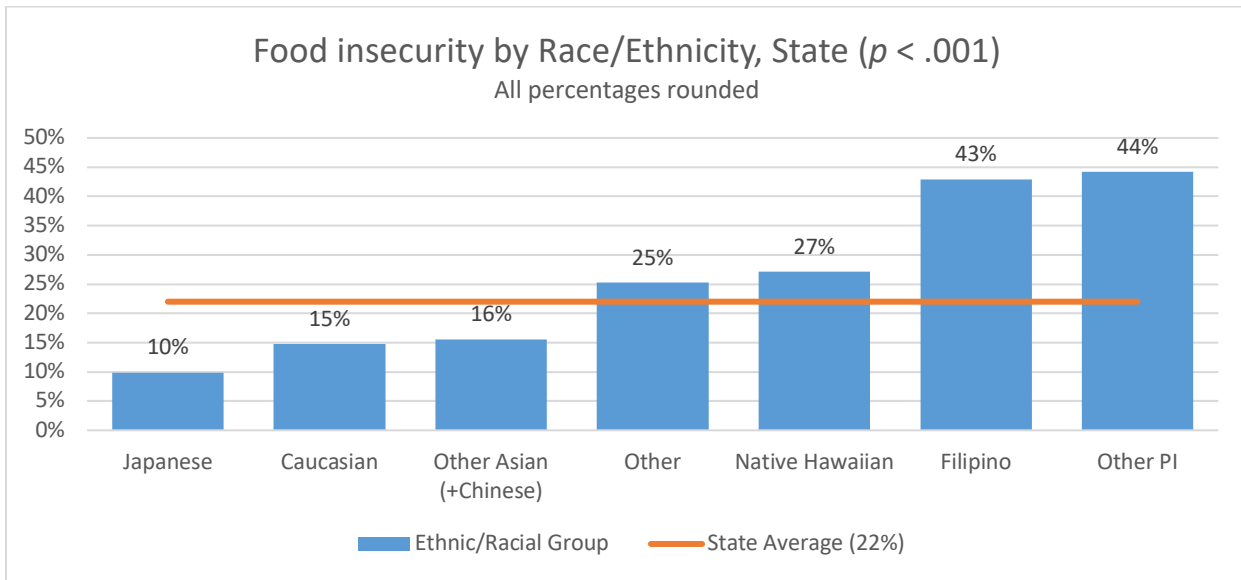
Average age of adults reporting food insecurity

On average, the age of those reporting food insecurity was younger than their food secure counterparts. In Maui and Hawai'i Counties, and for the state overall, these differences in average age were significantly different.



Food insecurity by race and ethnicity

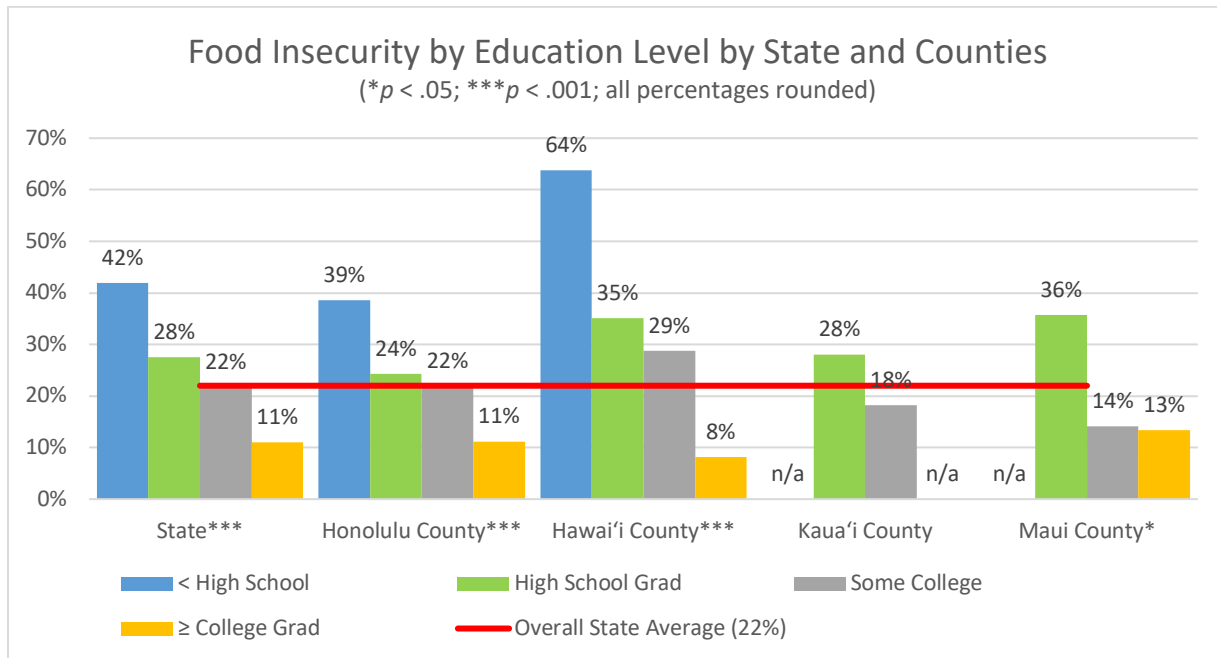
Statistically significant differences existed at the state level by race and ethnicity, with 44% of other Pacific Islanders, 43% of Filipinos, and 27% of Native Hawaiians reporting food insecurity ($p < .001$). Due to small sample sizes for some ethnic groups, we were unable to present the same analysis at the county level.



Food insecurity by education level by county

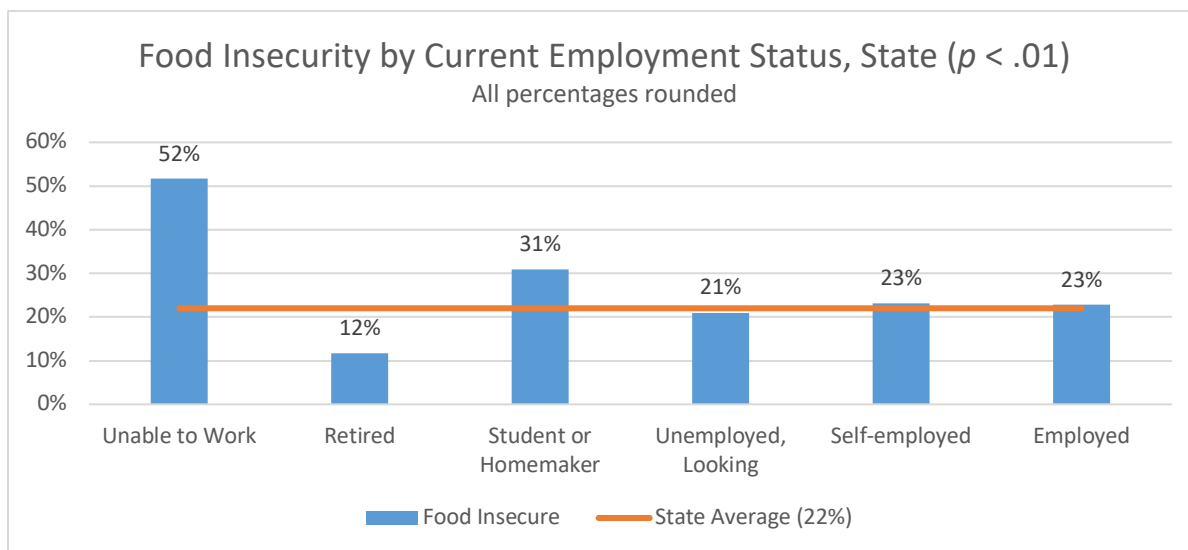
Highly significant differences in the prevalence of reported food insecurity by educational attainment existed in all counties except Kaua'i. Those with lower levels of educational attainment were more likely to report food insecurity compared to those with higher levels of education; although, between 8%

and 13% of those with a 4-year college degree or higher also reported food insecurity. Note that not all data is shown for Kaua‘i and Maui Counties due to small samples for certain categories.



Food insecurity by current employment status

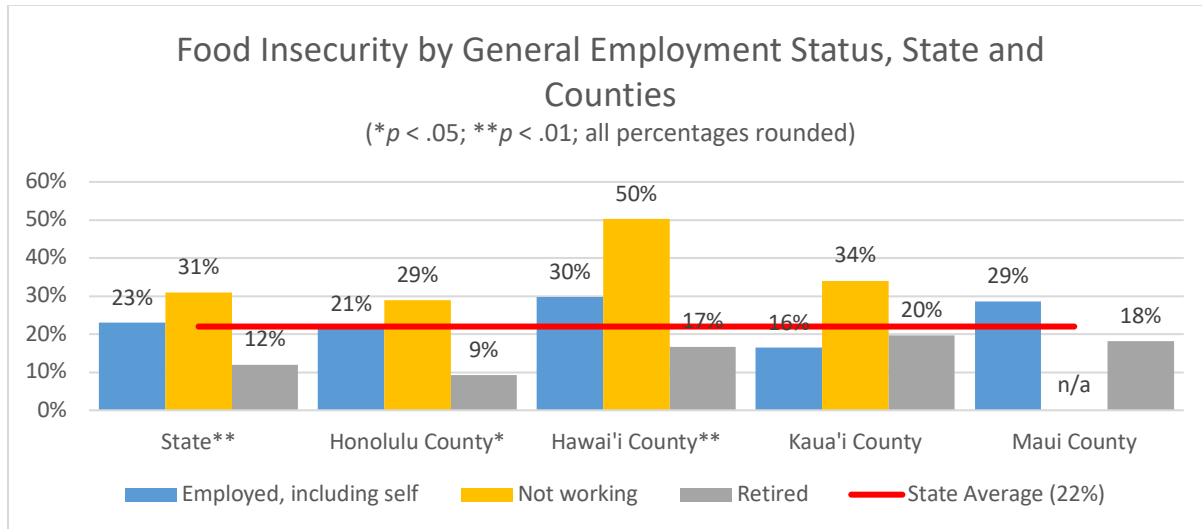
Significant differences were observed among those reporting food insecurity by employment status. Far more people unable to work due to disability or other reason, students or homemakers, and self-employed people reported food insecurity compared to their employed, unemployed but looking, and retired counterparts.



Food insecurity by aggregated employment status

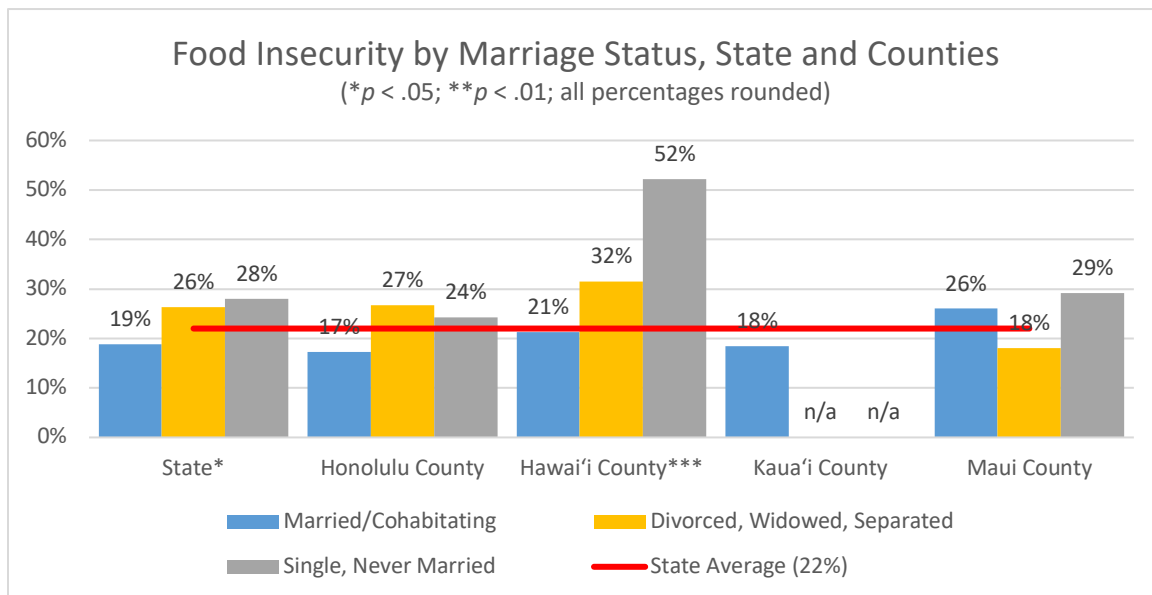
We aggregated employment status to employed (employed and self-employed), not working (student, homemaker, unemployed, and disabled) and retired, since we could not run the previous analysis at a

county-level due to small numbers of people in certain categories. Those reporting being out of work were significantly more likely to report food insecurity in Honolulu and Hawai‘i Counties, and in the state overall. The results from Hawai‘i County are worth noting. Half of those reporting that they were not working were food insecure. We were unable to report on those out of work in Maui County due to small sample size.



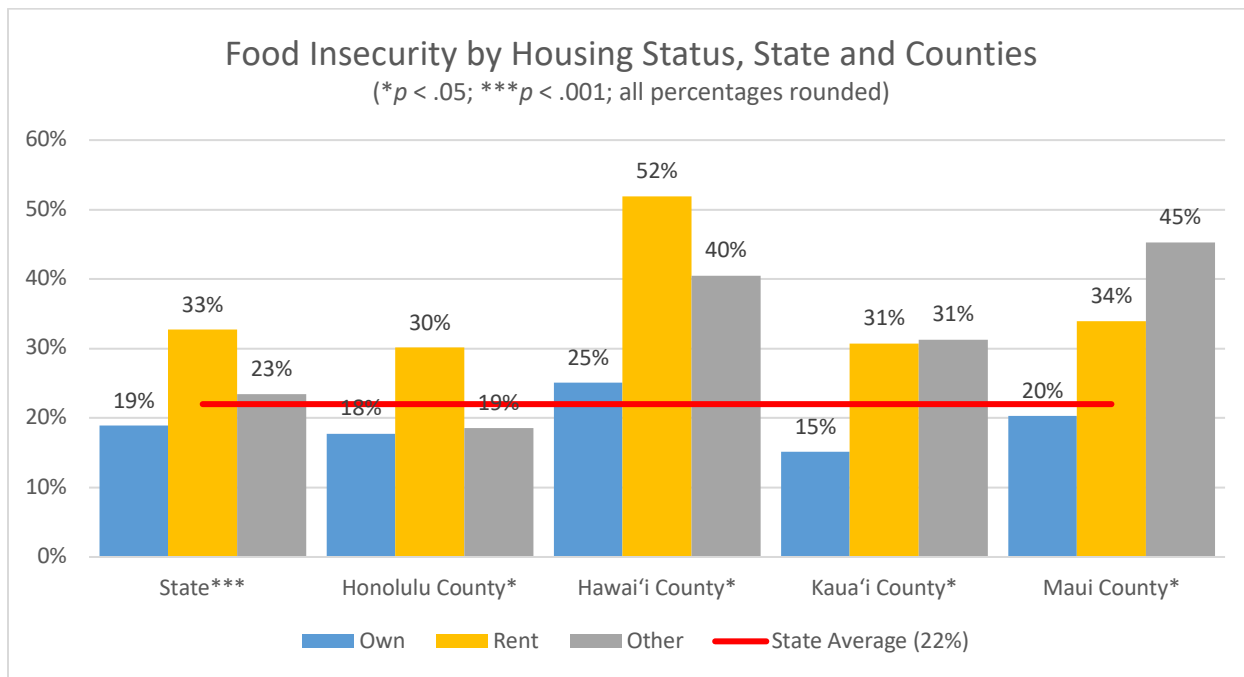
Food insecurity by marriage status

Significant differences food insecurity by marriage status were found statewide and in Hawai‘i County. Across all counties (except Kaua‘i County), those who were single/never married reported the highest levels food insecurity. Again, results from Hawai‘i county merit note. The estimated prevalence of food insecurity among those single/never married exceeds 50%.



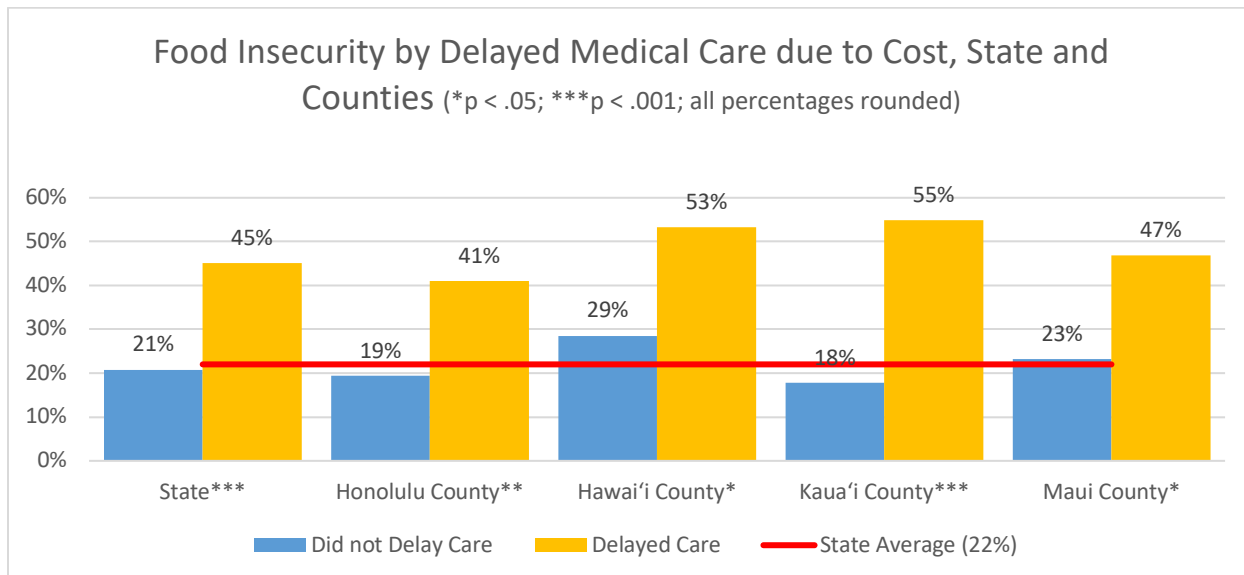
Food Insecurity by Housing Status

Significant differences in those reporting food insecurity were found when comparing housing status. Those who rent were more likely to report food insecurity than those who own their homes, while in Kaua'i and Maui Counties, those who live in other situations (neither renting nor owning, e.g., crashing, student housing) were just as likely or more likely to report food insecurity than renters. In all counties, homeowners were less likely to report issues with food insecurity than the state average of 22%, with the exception of Hawai'i County.



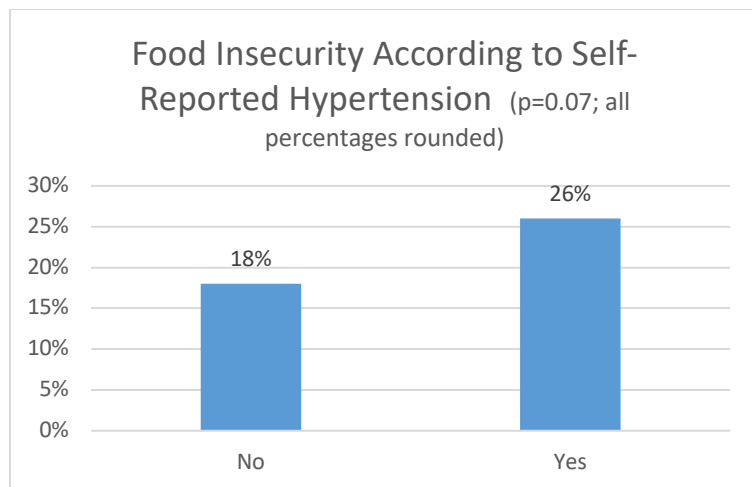
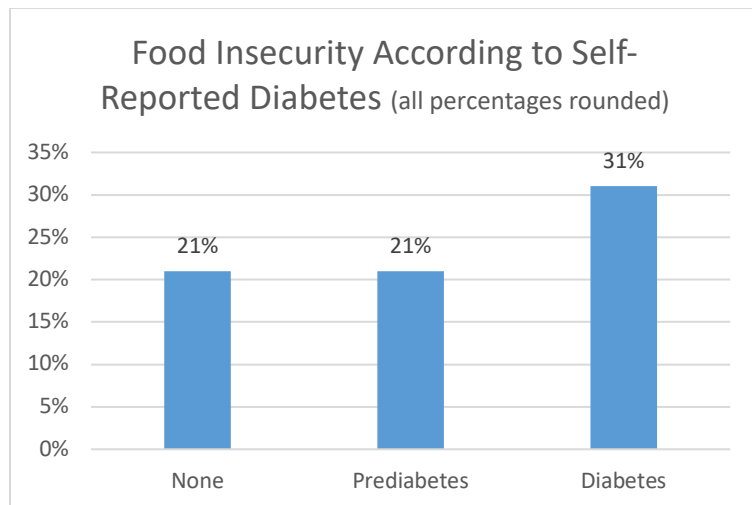
Food insecurity among those who also delayed medical care due to cost in the past year

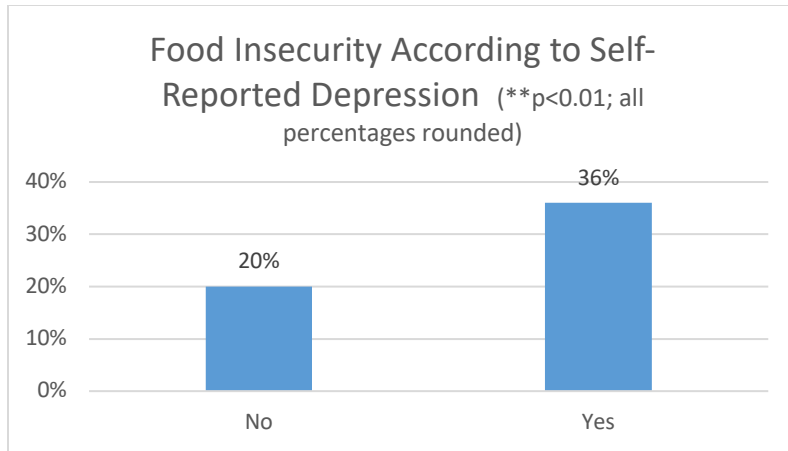
Across all counties, those who delayed medical care in the past year also reported significantly higher levels of food insecurity.



Food insecurity by chronic conditions

Food insecurity was higher among those self-reporting diabetes compared to those reporting prediabetes or neither condition. The difference was not statistically significant. Similarly, more people with hypertension also were also food insecure. The difference was marginally significant. Finally significantly more people reporting depression were food insecure. This difference was statistically significant. Due to small numbers in certain categories, results cannot be reported by county.

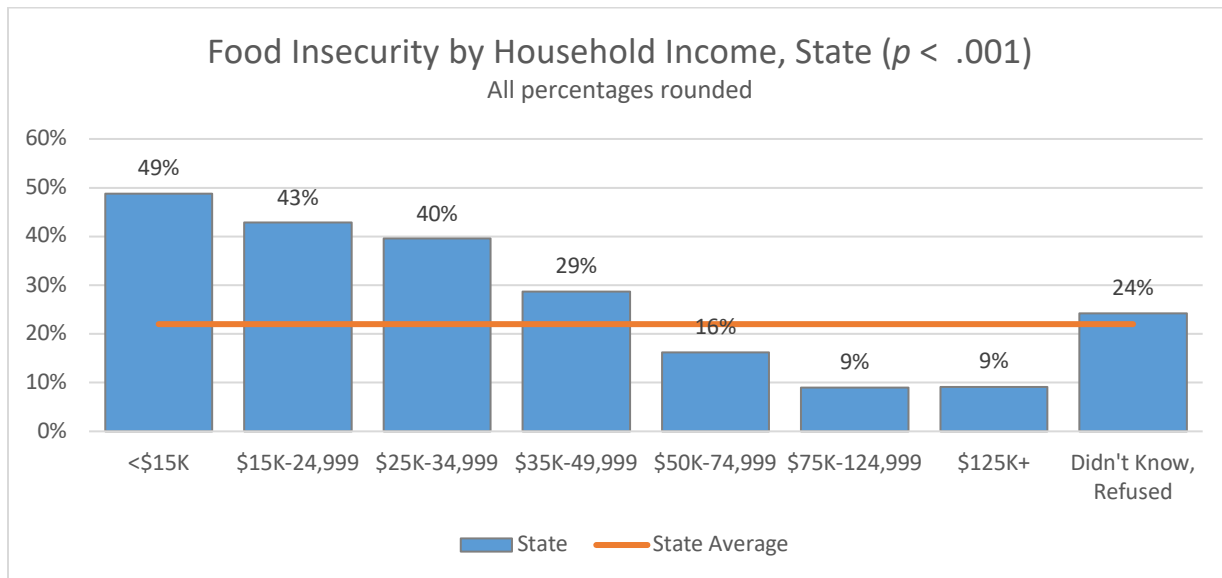




Household-level Indicators

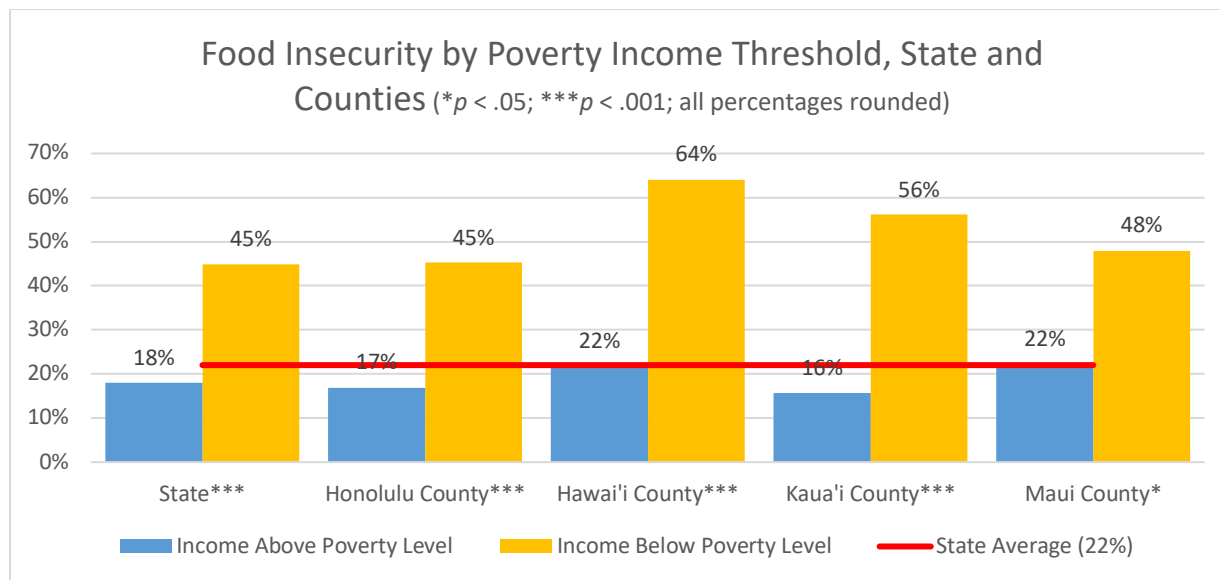
Food insecurity by household income

Those whose households made less money were more likely to report food insecurity versus those making \$50,000 or more per year; although, 9% of those at the highest end of the income scale reported food insecurity. A large percentage of BRFSS participants either refused to answer the income question or did not know their household income; this group reported slightly higher than the state’s average food insecurity (24% vs 22%).



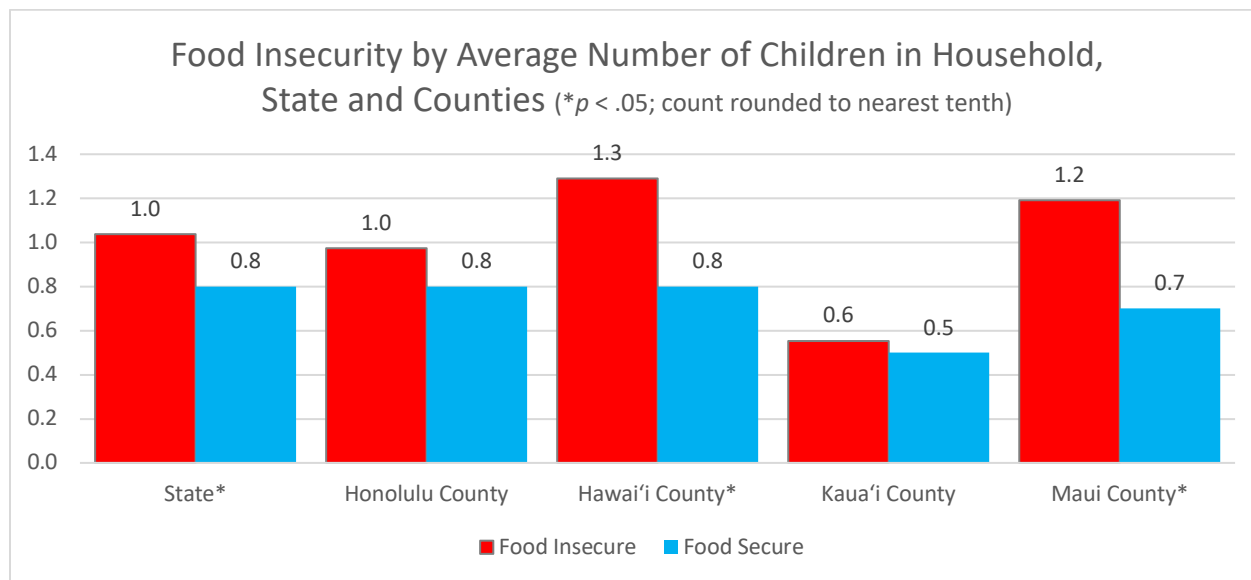
Food insecurity by household poverty

We constructed a variable to estimate household poverty by using household size and income cutoffs used by the USDA to determine SNAP eligibility. High proportions ($\geq 45\%$) of households determined to be in poverty experienced food insecurity across the state and in all counties, most acutely in Hawai‘i County.



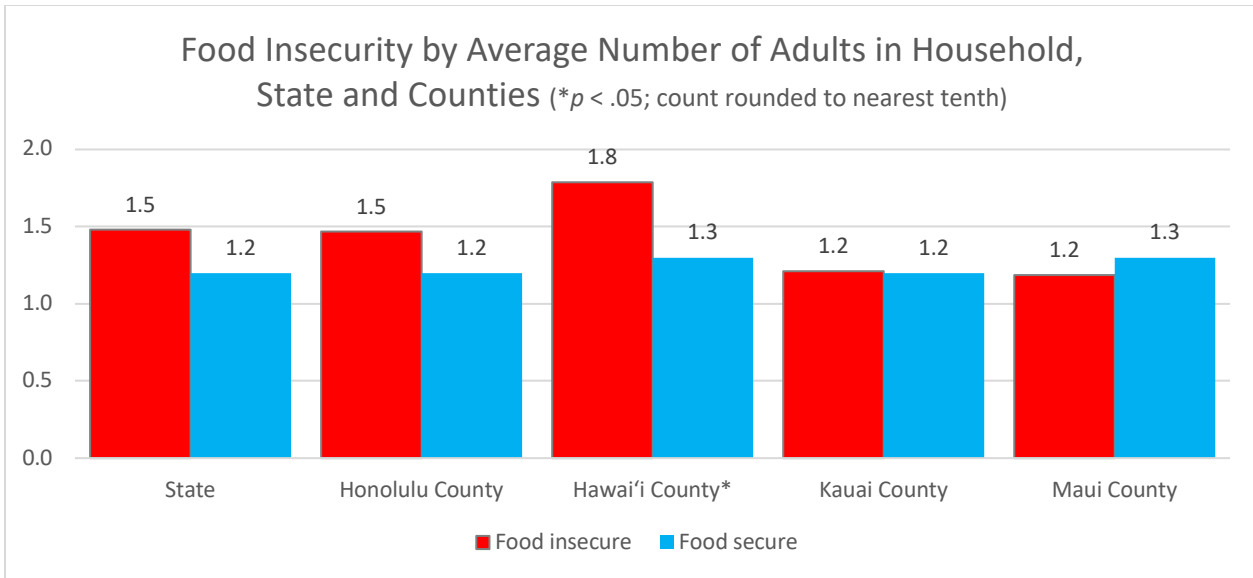
Food insecurity by number of children in household

The average number of children per food insecure households ranged from 0.6 in Kaua'i County to a high of 1.3 in Hawai'i County. Across all counties and the state, households that were food secure typically had less than one child on average.



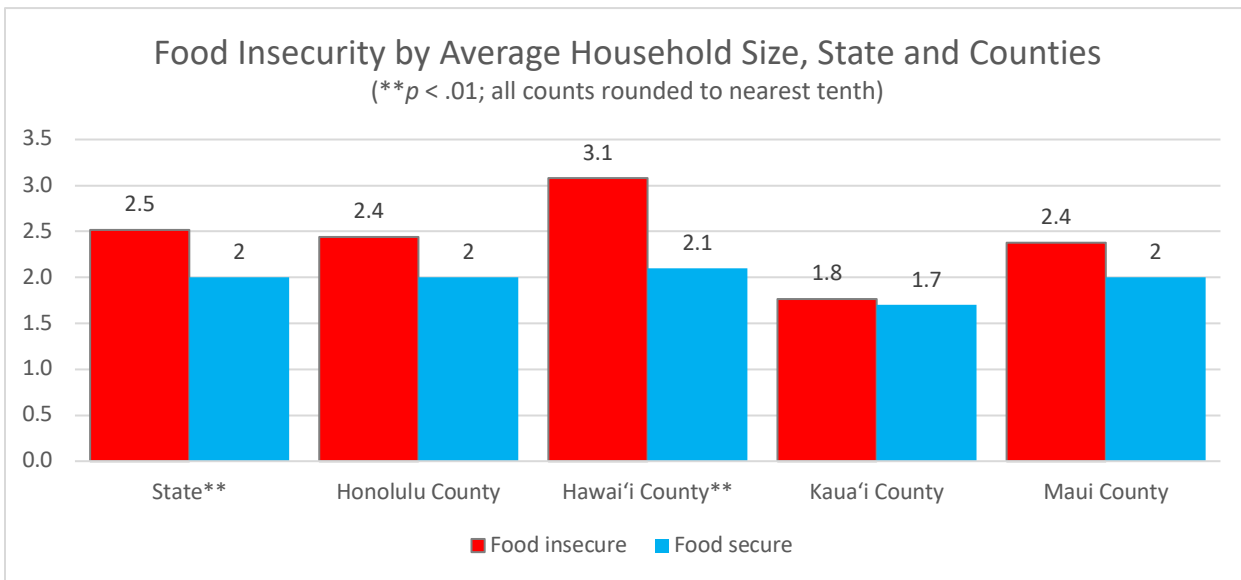
Food insecurity by average number of adults per household

On the whole, food insecure households had more adults than food secure households; although, this difference was only statistically significant in Hawai'i County.



Food insecurity by overall household size

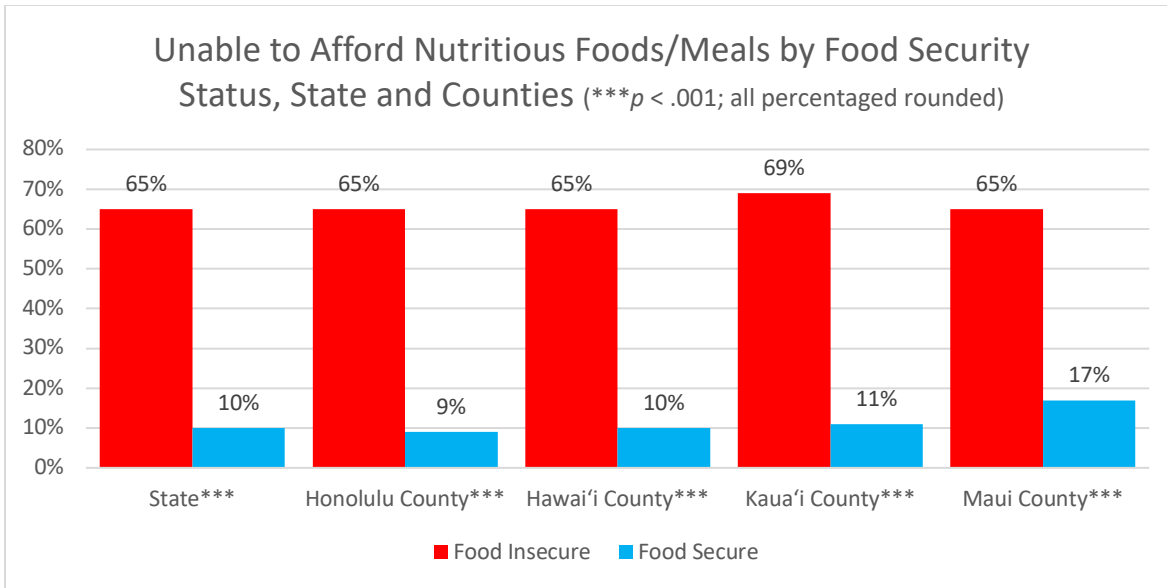
Generally, larger households reported food insecurity; at the state level and in Hawai'i County, these differences were statistically significant.



Other Food Security Related Indicators

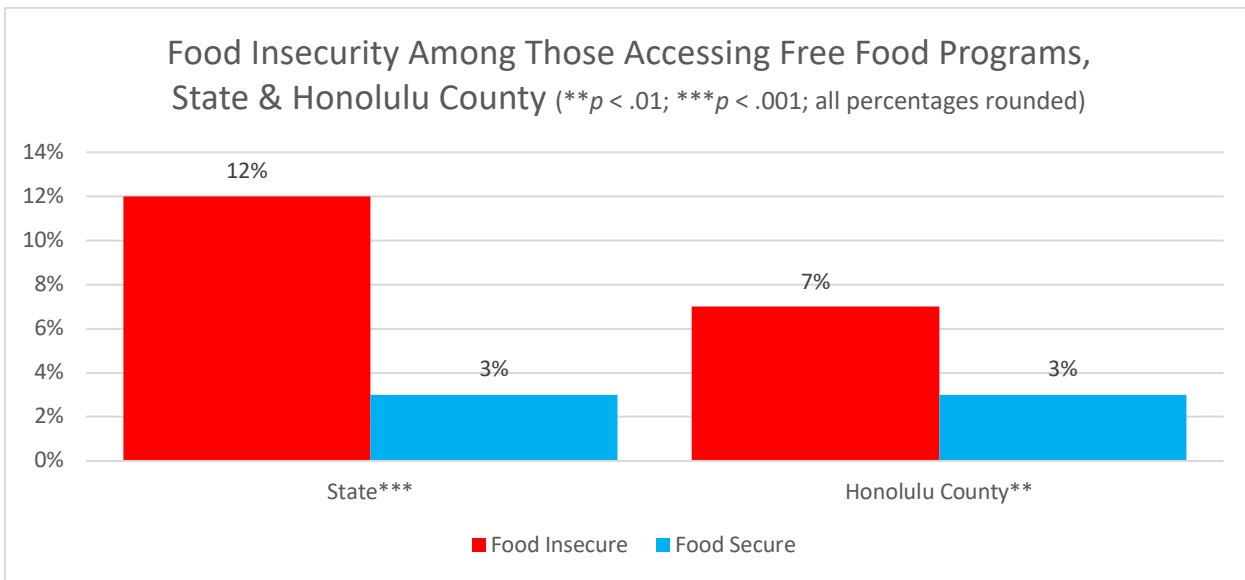
Food insecurity by ability to afford nutritious meals

Among those who were food insecure, nearly two-thirds were unable to get nutritious foods for a balanced diet versus around 10% for the state and other counties, except for Maui County, where 17% of those who were food secure could not always afford nutritious foods or balanced meals.



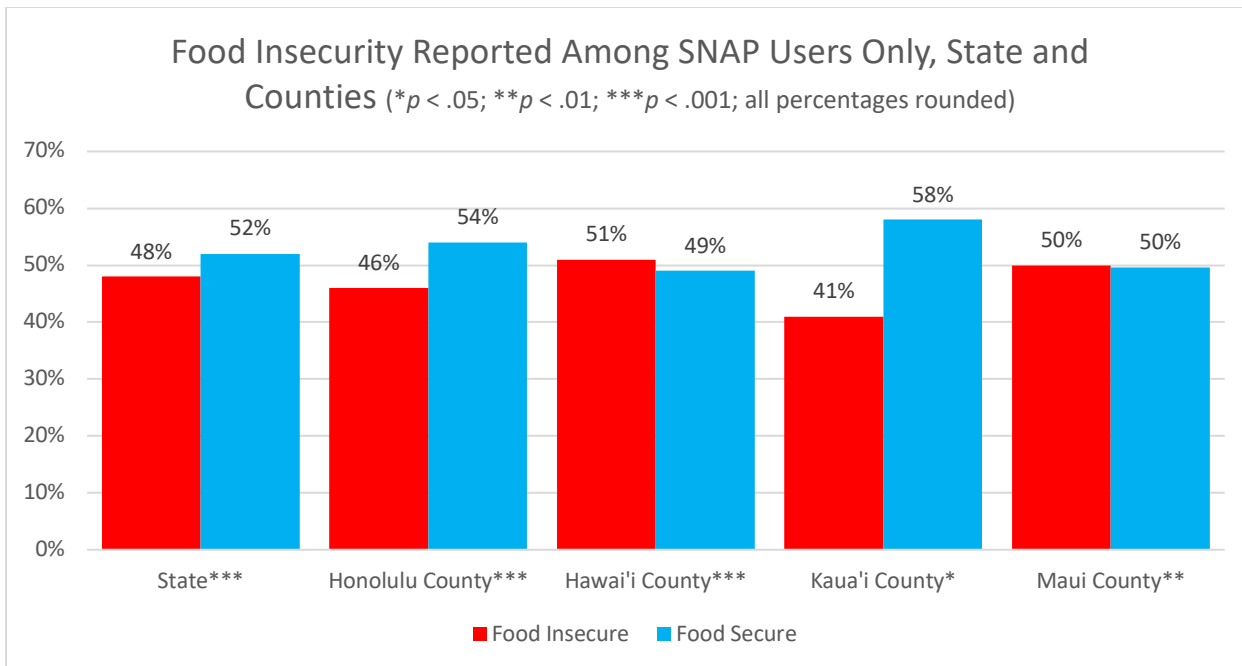
Food insecurity and access to free food programs

Due to small sample sizes, we are unable to report on use of free food programs, such as food distribution at food banks or churches, in any other county beside Honolulu. In the case of the state and Honolulu County, significantly more respondents reporting food insecurity accessed such programs compared to those who are food secure.



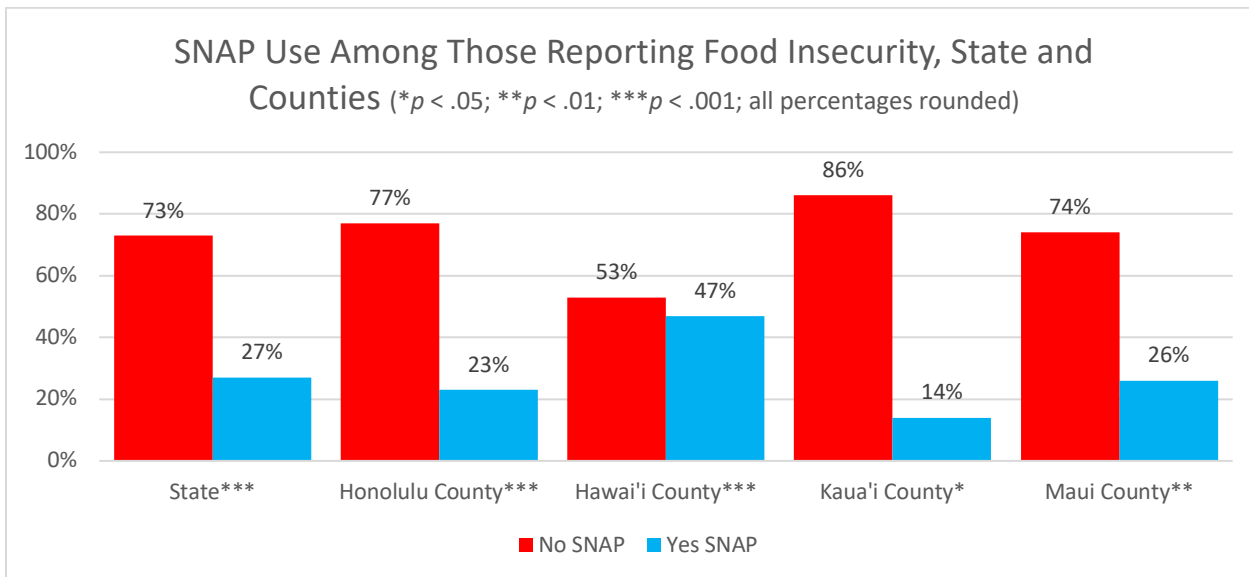
Food insecurity among SNAP users

SNAP users reported varying levels of food insecurity ranging from a low of 41% in Kaua‘i Country to a high of 51% in Hawai‘i County. Differences were significant at both the state and county levels.



SNAP use among those reporting food insecurity

Among those reporting being food insecure, only small percentages actually access SNAP, except in Hawai'i County. In all other counties and at the state-level, more than 70% of food insecure respondents did not access the SNAP program.



References

- Baker, K.K., Derrickson, J.P., Derrickson, S.A.K., Reyes-Salvati, F., Onaka, A.T., Horiuchi, B., Yu, M.Q., & Dannemiller, J. (2001). *Hunger and food insecurity in Hawai'i: baseline estimates 1999-2000, Hawai'i Health Survey*. Hawai'i Department of Health.
<https://health.hawaii.gov/hhs/files/2013/04/specfood.pdf>
- Berkowitz, S.A., Baggett, T.P., Wexler, D.J., Huskey, K.W., & Wee, C.C. (2013). Food insecurity and metabolic control among U.S. adults with diabetes. *Diabetes Care*, 36(10), 3093-3099.
<https://doi.org/10.2337%2Fdc13-0570>
- Berkowitz, S.A., Basu, S., Meigs, J.B., & Seligman, H.K. (2018). Food insecurity and health care expenditures in the United States, 2011–2013. *Health Services Research*, 53(3), 1600-1620.
<https://doi.org/10.1111/1475-6773.12730>
- Berkowitz, S.A., Seligman, H.K., & Basu, S. (2017). Impact of food insecurity and SNAP participation on healthcare utilization and expenditures. *University of Kentucky Center for Poverty Research Discussion Paper Series*, DP2017-02. Retrieved June 1, 2020, from
https://uknowledge.uky.edu/ukcpr_papers/103/
- Berkowitz, S.A., Seligman, H.K., & Choudhry, N.K. (2014). Treat or eat: food insecurity, cost-related medication underuse, and unmet needs. *The American Journal of Medicine*, 127(4), 303-310.
<https://doi.org/10.1016/j.amjmed.2014.01.002>
- Bickel, G., Nord, M., Price, C., Hamilton, W., & Cook, J. (2000). *Guide to Measuring Household Food Security, Revised 2000*. US Department of Agriculture. <https://fns-prod.azureedge.net/sites/default/files/FSGuide.pdf>
- Coleman-Jensen, A., Rabbitt, M.P., Gregory C.A., & Singh, A. (2019). *Household Food Security in the United States in 2018*. US Department of Agriculture.
<https://www.ers.usda.gov/webdocs/publications/94849/err-270.pdf?v=2497>
- Crews, D.C., & Novick, T.K. (2019). Social determinants of CKD hotspots. *Seminars in Nephrology*, 39(3), 256-262. <https://doi.org/10.1016/j.semnephrol.2019.02.003>
- Frongillo, E.A., Nguyen, H.T., Smith, M.D., & Coleman-Jensen, A. (2017). Food insecurity is associated with subjective well-being among individuals from 138 countries in the 2014 Gallup World Poll. *The Journal of Nutrition*, 147(4), 680-687. <https://doi.org/10.3945/jn.116.243642>
- Garcia, S.P., Haddix, A., & Barnett, K. (2018). Incremental health care costs associated with food insecurity and chronic conditions among older adults. *Preventing Chronic Disease*, 15(E108), 1-11.
<https://doi.org/10.5888/pcd15.180058>
- Gregory, C.A., & Coleman-Jensen, A. (2017). *Food insecurity, chronic disease, and health among working-age adults*. US Department of Agriculture.
<https://www.ers.usda.gov/webdocs/publications/84467/err-235.pdf?v=8137.9>
- Gundersen, C., Dewey, A., Kato, M., Crumbaugh, A.S., Strayer, M., Odeen, B., Kriss, M., Ratulangi, P., Bertels, A., & Huen, C. (2019). *Map the meal gap 2019 - a report on county and congressional district*

food insecurity and county food cost in the United States in 2017. Feeding America.

https://www.feedingamerica.org/sites/default/files/2019-05/2017-map-the-meal-gap-all-modules_0.pdf

Gundersen, C., & Ziliak, J.P. (2015). Food insecurity and health outcomes. *Health Affairs*, 34(11), 1830-1839. <https://doi.org/10.1377/hlthaff.2015.0645>

Knight, C.K., Probst, J.C., Liese, A.D., Sercye, E., & Jones, S.J. (2016). Household food insecurity and medication “scrimping” among US adults with diabetes. *Preventive Medicine*, 83, 41-45.

<https://doi.org/10.1016/j.ypmed.2015.11.031>

Leung, C.W., Epel, E.S., Willett, W.C., Rimm, E.B., & Laraia, B.A. (2015). Household food insecurity is positively associated with depression among low-income supplemental nutrition assistance program participants and income-eligible nonparticipants. *The Journal of Nutrition*, 145(3), 622-627.

<https://doi.org/10.3945/jn.114.199414>

Long, C.R., Rowland, B., McElfish, P.A., Ayers, B.L., & Narcisse, M.R. (2020). Food security status of Native Hawaiians and Pacific Islanders in the US: analysis of a national survey. *Journal of Nutrition Education and Behavior*, 1-8.

<https://doi.org/10.1016/j.jneb.2020.01.009>

Mangini, L.D., Hayward, M.D., Dong, Y.Q., & Forman, M.R. (2015). Household food insecurity is associated with childhood asthma. *The Journal of Nutrition*, 145(12), 2756-2764.

<https://doi.org/10.3945/jn.115.215939>

McLaughlin, K.A., Green, J.G., Alegria, M., Costello, E.J., Gruber, M.J., Sampson, N.A., & Kessler, R.C. (2012). Food insecurity and mental disorders in a national sample of U.S. adolescents. *Journal of the American Academy of Child and Adolescent Psychiatry*, 51(12), 1293-1303.

<https://doi.org/10.1016/j.jaac.2012.09.009>

Njai, R., Siegel, P., Yin, S., & Liao, Y. (2017). Prevalence of perceived food and housing security – 15 states, 2013. *MMWR Morbidity and Mortality Weekly Report*, 66(1), 12-15.

<https://doi.org/10.15585/mmwr.mm6601a2>

Seligman, H.K., Laraia, B.A., & Kushel, M.B. (2010). Food insecurity is associated with chronic disease among low-income NHANES participants. *The Journal of Nutrition*, 140(2), 304-310.

<https://doi.org/10.3945/jn.109.112573>

State of Hawai‘i, Department of Health. (2020). Hawaii behavioral risk factor surveillance system.

Accessed March 19, 2020 from <https://health.hawaii.gov/brfss/>

Stuppelbeen, D.A. (2019). Housing and food insecurity and chronic disease among three racial groups in Hawai‘i. *Preventing Chronic Disease*, 16(E13), 1-11. <https://doi.org/10.5888/pcd16.180311>

Urke, H.B., Cao, Z.R., & Egeland, G.M. (2014). Validity of a single item food security questionnaire in Arctic Canada. *Pediatrics*, 133(6), e1616-e1623. <https://doi.org/10.1542/peds.2013-3663>

Vaccaro, J.A., & Huffman, F.G. (2017). Sex and race/ethnic disparities in food security and chronic diseases in U.S. older adults. *Gerontology & Geriatric Medicine*, 3, 1-9.

<https://doi.org/10.1177/2333721417718344>

Walker, R.J., Grusnick, J., Garacci, E., Mendez, C., & Egede, L.E. (2019). Trends in food security in the USA for individuals with prediabetes, undiagnosed diabetes, and diagnosed diabetes. *Journal of General Internal Medicine*, 34(1), 33-35. <https://doi.org/10.1007/s11606-018-4651-z>

Wu, Q., Harwood, R.L., & Feng, X. (2018). Family socioeconomic status and maternal depressive symptoms: mediation through household food insecurity across five years. *Social Science & Medicine*, 215, 1-6. <https://doi.org/10.1016/j.socscimed.2018.08.043>