ADDRESSING THE NEEDS OF FOOD INSECURE CHILDREN

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ABSTRACT

Food insecurity affects 50 million Americans, which is about 14% of the population (Gundersen & Zilliak, 2015). Seventeen percent of households with children are food insecure (Hunt et al., 2018). A recent study reported that 15% of children ages 2-5 living in a food-insecure household are obese, compared to 11% of children in food-secure homes (Kaur, Lamb & Ogden, 2015). Children who are food insecure are more likely to present with poor nutritional outcomes (Hunt et al., 2018). There exist few studies on household food insecurity in sub-populations, so this dissertation focused on several understudied sub-populations.

The purpose of this dissertation was to determine the needs of children in food insecure households in specific populations. This dissertation included three studies, and was guided by the Social Ecological Model framework. The first study was a secondary analysis of data from Hawai‘i-based children in the Children's Healthy Living (CHL) Program to determine differing characteristics of food-secure and food-insecure children. I found that food-insecure children were more likely to be living with overweight or obesity, and their caregivers were more likely to not have a college education and not be employed. The second study was a systematic literature review on the effects of school-based food pantries on children's diets. The articles included in this review reported that children who participate in school-based food pantries increased their consumption of fruits and vegetables and decreased their consumption of unhealthy food intake. For the third study, I completed a series of one-on-one interviews with food-insecure parents who are college students. This study found that college students who are parents utilize a variety of strategies to increase their household food-security status, including focusing on price versus nutritional quality of food, reaching out to family and friends, attending food banks or food pantries, and prioritizing their children before themselves.

Taken together, the findings show four things. First, financial resources are a strong predictor of household food insecurity. They are also a determining factor in food purchasing decisions. Households with limited financial resources are more likely to be food insecure. They are also more likely to purchase food based on price, not on nutritional quality. Secondly, children who are food insecure are more likely to be overweight or obese (OWOB). Third, food assistance programs are helpful, but do not prevent food insecurity. Lastly, food security status does not seem to influence the amount of fruits and vegetables in a child's diet. The quantitative study using CHL data showed no significant difference in fruit and vegetable consumption in children who were food secure or food insecure. The studies included in the literature review reported that children ate more fruits and vegetables when offered, with no mention of food security status. The parents who were interviewed for the qualitative study discussed that they are more worried about price of a food than nutritional value, which limited the amount of fresh food they would buy.

This study offers several recommendations. First, food distribution programs such as school pantries and food banks, should increase their focus on supplying fruits and vegetables. Second, increasing minimum wage and providing affordable housing would help families have more disposable income for healthy foods. Third, the income criterion for eligibility for federal food assistance should be increased so that more families qualify.

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CHAPTER 1

INTRODUCTION

Public Health Problem

Household Food Insecurity

Food insecurity occurs when a household does not have adequate resources to access food (Bruce et al., 2019). Food insecurity affects 50 million Americans, which is about 14% of the population (Gundersen & Zilliak, 2015). Seventeen percent of households with children are food insecure (Hunt et al., 2018). This means that almost one in five children in the US is food insecure.

National research suggests that risk factors for food insecurity include being unemployed, high housing costs, low social capital, lack of transportation, and low levels of income or education (Martin et al., 2016). Individuals who are food insecure are also more likely to be an ethnic minority, female, and not have any health insurance (Mendy et al., 2018). Food insecurity most severely affects those who are living in poverty (Bruce et al., 2019).

The United States Department of Agriculture (USDA) recently released a report entitled "Household Food Security in the United States in 2017." This report used data collected over a three-year period to estimate national and state-level rates of food insecurity (USDA, 2018). Compared to the rest of the US, Hawai‘i had the smallest percentage of food insecure households in the nation. Some states reported levels as high as 17%, while Hawai‘i was documented at 7%. Even though this percentage was small, it still represented 35,000 households in Hawai‘i. Hawai‘i News Now published an article about this report, and they quoted the president of the Hawai‘i Foodbank, Mr. Ron Mizutani, as saying that their organization provides food assistance to about 20% of the population of the entire state (HNN Staff, 2018). The Hawai‘i Food Bank

president emphasized that many households in Hawai‘i go through periods of food insecurity, and that national data may not reflect the true extent of the problem locally.

Although Hawai‘i is reported in the USDA report with a relatively low prevalence of food insecurity, local data suggest higher prevalence. For example, Hawai‘i Health Matters (hawaiihealthmatters.org) estimated that 16% of households in Hawai‘i were food insecure in 2013, and Pobutsky, Baker, & Reyes-Salvail (2015) estimated that 1 in 5 adults in Hawai‘i were food insecure in 2012. A different USDA report estimated that 48,000 children in Hawai‘i were food insecure in 2017 (USDA Economic Research Report, 2018). Also, disparities are seen in population subgroups from 2013. For example, 25% of households are headed by a resident without a college degree, 23% of households are headed by never married or divorced/separated parent, and 35% of Native Hawaiian households were classified as food insecure (Stupplebeen, 2019; www.hawaiihealthmatters.org).

Poverty level is a major risk factor of food insecurity. In the state of Hawai‘i, 9.5% of the population is living in poverty, but in Wai‘anae, that number is a much higher 26% of the population that is living in poverty (Census, 2015 http://www.census.gov/quickfacts/table/PST045215/15). Wai‘anae also has a large Native Hawaiian population, estimated at 59% of residents, compared to about 25% of the state’s population (Oneha et al, 2016; Census, 2015). Overweight and obesity prevalence is higher in Native Hawaiian children ages 2-5 years (about 33%) than in White children (about 20%) (Wilken et al., 2013).

Individuals who are food insecure rely on free sources of food, such as food pantries, to provide food or they will resort to skipping meals. Those who are food insecure will also binge eat when food is available because they do not know when their next meal will be. Health

problems associated with persistent food insecurity develop because of disruptive eating patterns coupled with consumption of high-calorie, low-nutrient food, which is often less expensive than nutritious food (Tan et al., 2018). Children who are food insecure are more likely to be obese than children who live in food-secure homes. A recent study reported that 15% of children age 2-5 years living in a food-insecure household are obese, compared to 11% of children in food-secure homes (Kaur, Lamb & Ogden, 2015).

Children who are food insecure are more likely to present with poor nutritional outcomes (Hunt et al., 2018). Researchers used data provided by the National Health and Nutrition Examination Survey (NHANES) to determine if there was a relationship between food security status and overall dietary quality. Some of their results revealed a significant relationship between food security status and intake of salty snacks, sugar sweetened beverages, and intake of vegetables. Those who were food insecure consumed more salty snacks and sugar-sweetened beverages, and less vegetables than those who were food secure (Leung et al. 2014).

Childhood obesity also leads to adulthood obesity and earlier onset of cardiovascular disease, high blood pressure, high cholesterol, and diabetes (Vedovato et al., 2016). Adults who are disabled or chronically sick have difficulty securing steady employment, and will not be able to earn a living. This leads to more reliance on other social services, such as housing and cash assistance. Thus, food insecurity is an important social welfare issue, as well as a public health issue, because prevention of these poor health care outcomes will help improve the overall health of society.

While food insecurity is not the only determinate of childhood obesity, reducing food insecurity can decrease the risk of developing health issues in childhood, including obesity. Regardless of household characteristics, parents influence their children's eating patterns and

food intake through their purchases (Mosley, Delormier & Banna, 2016). Children are secondary decision makers because they mostly make diet decisions based on food made available to them by their parent or caregiver. The Institute of Medicine outlines recommendations for parents, including promoting healthful eating behaviors and regular physical activity for their children and positive family involvement in children's diet and physical activity practices (Slusser, Prelip, Kinsler, Erausquin, Thai & Neumann, 2011).

Interventions

Many diet-related risks that are mentioned above could be greatly reduced if food insecurity were eliminated. The US government provides several food-assistance programs to help those who need it. These programs are administered through the USDA. One government program is the Supplemental Nutrition Assistance Program (SNAP). SNAP provides food assistance in the form of cash to low-income households (Andreyeva, Tripp & Schwartz, 2015). Another program is the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), which provides food vouchers to low-income pregnant and nursing mothers as well as children up to age 5 years (Guthrie et al., 2015). The purpose of WIC is to provide healthy food to low-income families that have young children. Foods that can be purchased with these food vouchers include whole milk, cheese, eggs, fresh produce, legumes, peanut butter, cereal, and formula. Another government program is the National School Lunch Program (NSLP) which funds free or reduced cost meals to children from low-income families who attend public schools.

Feeding America is a nationwide non-profit organization that provides support and resources to food banks across the country (www.feedingamerica.org). They aid 60,000

programs around the country and estimate that they serve 1 in 7 Americans. In 2018, they helped to provide 4.3 billion meals in the US (Feeding America, 2018). This set a record.

In Hawai‘i, the non-profit Hawai‘i Food Bank is a great resource for households with food insecurity. It opened in 1983, and its administrators estimate it distributes 14 million pounds of food across the state every year to various organizations (Hawai‘i Food Bank, 2018). The Hawai‘i Food Bank also partners with other community organizations to distribute food to families in need.

The Children's Healthy Living program (CHL) is a research project focused on children in the US affiliated Pacific Region, including a community in Nānākuli, which is a rural community in Hawai‘i. This program was funded through the USDA's National Institute for Food and Agriculture. CHL's main objective was to impact the prevalence of childhood overweight and obesity through multiple factors including behavior and the social and cultural environment. CHL collected data on children's household and health behaviors. They also collected dietary food logs, and data on household food insecurity (Wilken et al, 2013). These data were tracked longitudinally to assess the impact of a 2-year, community-level intervention designed with Pacific communities to reduce childhood obesity. The interventions' 19 activities addressed policy, environment, messaging, and training, and the intervention was shown to reduce the prevalence of young child overweight and obesity and acanthosis nigricans (Novotny et al., 2018).

CHL researchers published a paper on the association between being overweight or obese and household food insecurity (Li et al., 2016). They found that this likelihood varied by race and location across the Pacific. The results were mixed. Pohnpeians were 69% more likely to be overweight or obese if they were food insecure, while Chuukese, Samoan, and mixed race

children were less likely to be overweight or obese if they were food insecure. Native Hawaiian children were more likely to be underweight if they were food insecure.

Gap

The health factors associated with being food insecure are well understood for the general population. However, there are limited studies on household food insecurity in specific populations, such as children in Hawai‘i. The purpose of this dissertation was to learn more about the local situation of food insecurity by: 1) analyzing CHL data from Hawai‘i to determine health factors associated with children who live in food insecure households in Hawai‘i; 2) reviewing the literature to identify ways that school pantry programs can improve child diet quality; and 3) discovering strategies used by local college students who are parents to increase their household food security status.

The specific research questions (RQ) that were answered are as follows:

1. Among CHL participants in Hawai‘i, what factors are significantly different between food secure and food insecure children?

2. How does participation in a school pantry program affect a child’s diet?

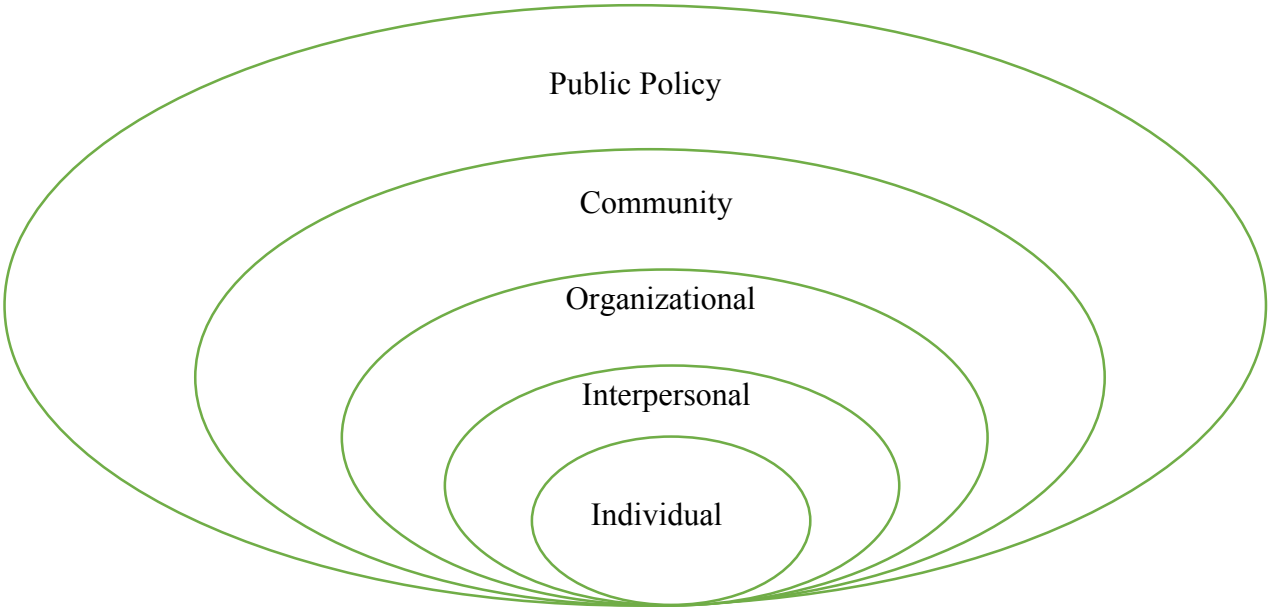
3. What strategies do college students who are parents use to increase their household food-security status?

Conceptual Framework

This dissertation was guided by the Social Ecological Model (SEM) framework. This framework was selected because the purpose of this dissertation was to discover factors that

impact health related to food insecurity, and these factors occur over all five levels of the SEM. The five levels of the SEM are individual, interpersonal, organizational, community and policy.

Figure 1.1 Social Ecological Model



Individual factors are personal factors that influence an individual's life. This can include attitudes, beliefs and behaviors, and can be influenced by their knowledge, skills or attitude toward a problem. Interpersonal factors refer to an individual's relationships with other individuals. Organizational factors refer to established organizations. These organizations can provide support and resources to individuals. Organizations might also present barriers that limit participation in their organization. Community factors refer to the setting an individual lives in and interacts with. Neighborhood structure could influence what is occurring in a community. Public policy factors refer to laws as well as rules and regulations governing society.

Individual factors that affect food security would be income or education level. This also includes their physical and mental health, which can affect their food security status.

Interpersonal factors that affect food security focus on relationships. Individuals may have someone they could call to help them when they are low on food supply. Organizational factors that affect food security include institutions or groups that provide food assistance. This refers to food banks and food pantries. Community factors related to food security refer to accessibility to food resources in the community. For example, a community factor that would increase food security would be having the space to grow a garden, whether in someone's home or at a location in the community. Policy factors refer to laws that govern food assistance programs. This refers to programs such as SNAP or WIC.

Community Partners

This dissertation could not have been completed without assistance from community partners. Data collected by CHL was used for the first research study, and researchers with CHL graciously granted permission to use their data. Special thanks to Dr. Rachel Novotny who is the principle investigator of CHL. Staff at SPAM (Student Parents at Mānoa) at UH Mānoa were also helpful in advertising the third study.

The following chapters present the methods and results for each study. Chapter 2 presents the methods and findings for RQ 1, Chapter 3 presents the methods and findings for RQ 2, and Chapter 4 presents the methods and findings for RQ 3. Chapter 5 summarizes the overall findings from all three studies, and includes recommendations for future work to help children who are food insecure.

CHAPTER 2

ASSOCIATION BETWEEN FOOD SECURITY STATUS AND OVERWEIGHT AND OBESITY STATUS IN CHILDREN IN HAWAI‘I: A CROSS-SECTIONAL ANALYSIS OF DATA COLLECTED FROM THE CHILDREN’S HEALTHY LIVING PROGRAM

Abstract

Previous studies have shown adverse effects of food insecurity on children. Hanson & Connor (2014) found that children who were food insecure were less likely to have adequate amounts of fruit in their diet, while Kirk et al. (2014) found that children who were food insecure were less likely to consume enough fruits and vegetables to meet dietary recommendations compared to children who were food secure. Children who were food insecure were more likely to be overweight or obese (OWOB) than children who were food secure, and this difference was stastically significant. This study analyzed previously collected data by the Children’s Healthy Living Program to compare characteristics between food secure and food insecure children in Hawai‘i. Data was collected in communities with an indigenous population above 25% and totaled 942 children. Bivariate associations were estimated between food insecurity status and all the independent variables. Bivariate associations were also estimated between OWOB status and all independent variables. Correlation was performed to ascertain the association between specific variables, especially variables that appear related, such as income and employment status. Multivariate analysis was also performed to analyze the associations between dependent and independent variables. Results suggested that 36% of children in these communities live in food insecure households, which is higher than the national average of 20%. It seemed that food security status appeared to have little impact on fruit and vegetable consumption, which was very

low in both groups. Unfortunately, only 53.5% of children in the total sample consumed the recommended amount of fruits, while only 2.3% of the children consume the recommended amount of vegetables. Findings also showed that children who are food insecure are more likely to be OWOB, and were more likely to have a caregiver who was unemployed or who did not attend college. Educational opportunities and well-paying employment opportunities for caregivers would positively affect the food security status of many households. Young children in these communities, regardless of food-security status, should also benefit from interventions to increase fruit and (especially) vegetable consumption.

Introduction

Food insecurity is defined as unreliable access to sufficient, nutritious food (Hunt et al., 2018). In 2017, 11.8% of American households reported some level of household food insecurity (Brown et al., 2019). Household with incomes near or below the federal poverty line, households with children, or households whose head of household is Black or Hispanic are at higher risk of being food insecure than households with higher incomes, without children, and/or headed by members who are non-Hispanic White (Coleman-Jensen, 2017). People living in food insecure households are more likely to have calorie dense/nutrient poor diets that tend to be high in sodium, sugar, and simple carbohydrates (Leung et al., 2014). Poor quality diets tend to be low in fruits and vegetables. Households with low levels of income, as well as households that rely on government assistance programs, are less likely to purchase fruits and vegetables (Kirk et al., 2014). A diet high in fruits and vegetables has been shown to have many positive benefits. This includes a reduced risk of developing a chronic disease (Leung et al., 2014).

Although food insecurity affects one in every five children in the US (Casey et al., 2006), research suggests that the association between food insecurity and poor diet quality is stronger in

adults than in children (Hanson & Connor, 2014). Researchers hypothesize that the association was higher in adults because the adult caregivers in their study likely made sure their children were fed first in times of limited food supply before eating themselves.

A recent literature review that studied the effects of childhood food insecurity and dietary quality found that many studies reported adverse effect, although some reported no association. Among studies that reported an association, Hanson & Connor (2014) found that children who were food insecure were less likely to have adequate amounts of fruit in their diet, while Kirk et al. (2014) found that children who were food insecure were less likely to consume enough fruits and vegetables to meet dietary recommendations. Children who were food insecure were more likely to be overweight or obese (OWOB) than children who were food secure, and this difference was stastically significant. Kaur, Lamb & Ogden (2015) also reported in their study that children who were food insecure were more likely to be OWOB. Childhood is an important developmental time period, where a lack of sufficient nutrients could lead to difficulties such as being at higher risk to develop a chronic disease (Vedovato et al., 2016). When a child has a diet high in fruits and vegetables, it helps them maintain a healthy weight (Tan et al., 2018).

Pacific Islanders, including Native Hawaiians, have unique struggles related to their diets. Traditional Pacific Islander diets are composed largely of complex carbohydrates, fish, vegetables, and fresh fruit. However, as Pacific jurisdictions moved from a subsistence to a cash economy, the affordability and convenience of processed foods has decreased dietary intake of traditional foods (Kessaram et al., 2015). In recent years, the incidence of non-communicable diseases in these Pacific islands has increased, and 60% to 80% of deaths in this region are due to non-communicable diseases (Charlton et al., 2016). In addition, a recent study of adults reported that 33.6% of Native Hawaiians or Other Pacific Islanders (NHOPI) in Hawai‘i were

either sometimes or always food insecure (Stupplebeen, 2019), which is higher than the state average of 25%.

Even though there is a National Health and Nutrition Examination Survey (NHANES) to gather data in the US, it does not include the US Affiliated Pacific region. As non-communicable disease rates have risen in these areas, there was a desire to pursue research and wellness activities, especially with children. Thus, the USDA supported a 5-year grant called the Children's Healthy Living Program for Remote Underserved Minority Populations in the Pacific Region (CHL). Six jurisdictions were included in this program: The Federated States of Micronesia (FSM), Alaska, the Commonwealth of the Northern Mariana Islands (CNMI), Guam, American Samoa and Hawai‘i. CHL researchers especially focused on communities with high proportions of indigenous peoples. A systematic literature review of children's weight status in the in US Affiliated Pacific, conducted by CHL researchers, reported that 20% of two year olds are OWOB and about 34% of children age eight are OWOB (Novotny et al., 2016).

Overall, the CHL program had six program objectives: 1) conduct program/data inventories and situational analysis; 2) train 22 professionals and paraprofessionals in obesity prevention; 3) develop a Pacific food, nutrition, and physical activity data management evaluation system; 4) develop and conduct a community-based environmental intervention to prevent maintain, or reduce young child OWOB; 5) evaluate the environmental intervention; and 6) incur at least one obesity prevention policy change per jurisdiction (Wilken et al., 2013).

The community-based environmental intervention was tested in 27 communities across five CHL jurisdictions: Hawai‘i, Alaska, CNMI, American Samoa and Guam. The communities in Hawai‘i that were selected to participate in this program were Hilo, Kaua‘i, Moloka‘i,

Nānākuli, Wailuku and Waimānalo. The Indigenous population (referred to as Native Hawaiian in Hawai‘i) of each of these communities was above 25%.

For children who participated in the community-based environmental intervention, researchers created the following goals: 1) lower BMI; 2) increase sleep; 3) reduce consumption of sugar-sweetened beverages; 4) improve fruit and vegetable intake; 5) improve water intake; 6) reduce TV/video viewing; 7) increase physical activity; and 8) lower presence of acanthosis nigricans (AN) (Wilken et al., 2013). The intervention activities supported existing community programs in each locale and were grouped into four different strategies: organizational policy change, environmental change, social marketing, and training (Novotny et al., 2018).

To test the intervention, multiple communities were identified in each jurisdiction to participate in a cluster matched pair controlled trial. These communities were randomized into either the intervention group or the delayed intervention control group. Baseline data was collected in the years 2012-2013. Follow-up data was collected after the two-year intervention. Compared to baseline data, there was a significant improvement in BMI after the intervention for children in the intervention versus the control communities. Specifically, there was a 3.95% reduction in OWOB prevalence in children who participated in the intervention, and these children also had a reduced waist circumference of .71 cm and a 2.28% decrease in prevalence of AN (Novotny et al., 2018).

CHL researchers presented an abstract at Experimental Biology examining the baseline data for the association between food-insecurity status and BMI for all child participants among the 11 USAP jurisdictions included in CHL (Li et al., 2016). The authors reported 52% of the 4,838 participants were food insecure at baseline. The relationship between food insecurity and OWOB status was significantly modified by the race/ethnicity of the child, controlling for age

and sex of the child. For example, Pohnpeian children who were food insecure were 69% more likely to be OWOB than those who were food secure. Interestingly, Native Hawaiian children who were food insecure were more likely to be underweight than those who were food secure. This is the only study on food security using a CHL dataset, and it focused on child ethnicity rather than location. The relationship between OWOB status and food insecurity status in children in Hawai‘i could be associated with income or diet quality; however, this is currently unknown.

The purpose of this research analysis is to explore the relationship between food security status, OWOB status, and other indicators in children in Hawai‘i who participated in CHL. These indicators included children's demographics, children's variables, caregiver demographics, and household characteristics for the caregiver.

Methods

Study Population

For the CHL intervention testing, children ages 2-8 years were recruited to participate from 27 communities spread out over the five jurisdictions. Data were collected at baseline (time 1) and 2 years later. The data included in this analysis are only from time 1. Across the jurisdictions, 4,333 children participated in the testing of the intervention. Outcomes measured from the intervention included BMI, sleep quality, physical activity, and dietary intake. As part of the intervention, caregivers filled out two-day Food and Activity Logs at each time point. Demographic information was also recorded (Novotny et al., 2018). Data at baseline were collected from 942 children from Hawai‘i.

Measures

Dependent variables were food security status and OWOB status, and the independent variables included were individual and interpersonal factors from the SEM. For individual, there were children's demographics and other dietary variables. For interpersonal factors, there were caregiver demographics, and caregiver household variables. The definitions and coding of these variables are shown in Table 2.1 and summarized below.

Food Security Status

Food security status was the primary dependent variable. Households were considered food insecure if they answered yes to the following question: "In past 12 months, does money for food run out at least sometimes (or most times, always) in your household?"

OWOB Status

Trained CHL staff used standardized measurement instruments to determine height and weight of participants and used these values to calculate BMI. Height was measured with a stadiometer and recorded in centimeters, and weight with a scale and recorded in kilograms. BMI was calculated as weight (kg)/ height (m^2). The CDC guidelines are that if a child's BMI is in the 85^{th} to 94^{th} percentile for age, the child will be recorded as overweight. If their BMI is higher than the 94^{th} percentile, the child will be recorded as obese. Only 3% (n=24) children in this sample were considered underweight, defined as having a BMI at or below the 10^{th} percentile, and were excluded from the sample, because of the small sample size. Thus, when analyzing OWOB status, children with a healthy weight (11^{th} percentile to 84^{th} percentile for age and sex) were compared to children who were overweight and obese (85^{th} percentile and above).

Child Demographics

Age, Native Hawaiian ethnicity, and sex were the variables that were used to describe demographics of children. Mean age was reported. Native Hawaiian ethnicity was divided into two categories, either yes or no. Sex was self-reported as male or female.

Other Child Variables

Data on screen time, presence of AN, dietary intake, and history of being breastfed were collected for children. Whether or not children met the recommended time of less than two hours a day of screen time (yes/no) was also a variable. For AN, researchers were trained to use a scale developed by Burke et al. (1999) to determine severity of AN from 0-4. Zero meant no AN, four meant most severe. This data was collapsed into two cateogories: 0=no AN, and 1-4=AN. For breastfeeding status, the caregiver self-reported if the child was ever breastfed (yes/no).

From the Food and Activity Logs, several dietary variables were measured for children, including fruit intake, vegetable intake, sugar sweetened beverage (SSB) intake, and total energy intake. Researchers then determined if children met the Dietary Guidelines for Americans (DGA) of fruits(yes/no) or vegetables (yes/no). For children ages 2-3, the DGA is one cup of fruits and one cup of vegetables (CDC, 2014). The DGA for children ages 4-8 is 1-1 ½ cups of fruits or vegetables. Thus, CHL participants who consumed at least one cup of fruit or one cup of vegetable were coded as 1, meaning they met the DGA (Grimm et al., 2014). The recommended total energy intake for children varies widely by age, so this variable was included in bivariate analysis as a mean, and in multivariate analysis to adjust for age. Generally, it is not recommended that children in this age group consume any SSB, so means were also calculated in millileters.

Caregiver Demographics

Education level, employment status, household income, and acculturation were the variables self-reported by the caregivers. For purposes of this analysis, education level was divided into two groups, caregivers whose highest level of education was high school (coded as 0), and caregivers who attended at least some college (coded as 1). Another question asked if caregivers were currently unemployed (yes=1, no=0). Based on their answers to several questions, caregivers acculturation status was determined to be one of four categories. 1) Integration, where the caregiver is a participant of US culture but also maintains their cultural identity; 2) Assimilation, where the caregiver has adopted the US culture, but has given up some of their cultural identity; 3) Traditional, where the caregiver rejects the US culture while maintaining their culture; or 4) Marginalization, where the caregiver does not identify with their own culture or the US culture.

Household Variables

The income variable was divided into two groups, $35,000 a year and below (coded as 0), or above $35,000 a year (coded as 1). Several questions asked caregivers if they participated in any food assistance programs. The caregivers responded yes or no. Several food assistance questions were asked, and the following were included: EBT or SNAP, food bank, or free school meals. Caregivers were also asked if money for utilities ever runs out before the end of the month.

Analysis

Data were analyzed using SPSS. Bivariate associations were estimated between food insecurity status and all the independent variables. Bivariate associations were also estimated

between OWOB status and all independent variables. For both, crosstabs were used to determine the relationship between the dependent variable and the categorical variables. The difference in mean age between food secure and food insecure children was tested by t-test. The difference in mean energy intake was also tested by t-test. Statistical significance was determined based on a two-sided P value <0.05.

Correlation was done to see the association between specific variables, especially variables that seem to be related, such as income and employment status. This procedure helped determine which of the variables to include in the logistic regression to minimize multicollinearity. The phi correlation coefficient measures the strength of correlation between dichotomous variables (De Leon et al., 2015), and this test was used here.

To further explore the association between food security status, OWOB status, and other variables, multivariate logistic regression was conducted. First, food security was used as the dependent variable. The independent variables used were Native Hawaiian ethnicity, total energy intake, BMI, education level of caregiver, and employment status of caregiver. These variables were also selected because they were correlated with food security status. Income was not used because many respondents skipped this question, so there was a lot of missing data. Also, income and employment status were highly correlated ($phi=-.225$, $p<.01$), so employment status was used because it had very little missing data. The second logisitic regression conducted used OWOB as the dependent variable. Many of the dependent variables used in this logistic regression were the same, but breastfeeding and presence of AN were added because they were significantly correlated with OWOB.

Results

Of the 942 children from whom baseline data for collected, data on household food security was available for 792 children. Of these, 507 (64%) were food secure, and 285 (36%) were food insecure. The average age for food secure children was 4.83 years and for food insecure children it was 4.85 years. Bivariate analysis (Table 2.2) shows no difference between food secure and food insecure children for the following variables: age group, sex, AN, previously breastfed, SSB intake, or acculturation of caregiver. There was no significant difference in fruit or vegetable intake between chidren who were food secure or insecure. Each group reported a little more than half of children (food secure=53.5%, food insecure=53.7%) met the daily intake recommendation for fruit. Each group also reported a very small number of children who meet the daily recommendation intake for vegetables (food secure=2.0%, food insecure=2.8%).

However, children who live in food insecure households were more likely to be OWOB, to be of Native Hawaiian ancestry, to participate in a free or reduced school meal lunch program, or to not meet the recommendation for daily screen time (Table 2.2). The caregivers of food insecure children were more likely to not have any college education, to utilize the services of a food bank or pantry, to have an annual income below $35,000/year, to run out of money to pay household utilities, and to utilize a government food assistance program such as SNAP.

Table 2.1. Definitions and coding of the variables

Variable Name	How measured by CHL	Coding
Food insecurity	"In past 12 months, does money for food run out at least sometimes (or most times, always) in your household?"	1=food insecure 0=food secure
BMI	Based on height and weight, child categorized as: obese, overweight, healthy weight	1=OWOB 0=healthy weight

Age group	Continuous variable, coded into two groups	0=2-5 years old 1=6-8 years old
Native Hawaiian ethnicity	Do you consider your child Native Hawaiian?	1=Native Hawaiian 0=not Native Hawaiian
Sex	Male or female	1=male 2=female
Meets recommendations for fruit	Child meets recommendation for daily fruit consumption for age	1=yes 0=no
Meets recommendations for veg	Child meets recommendation for daily vegetable consumption for age	1=yes 0=no
Acanthosis nigricans	Is the child assessed to have acanthosis nigricans present?	1=yes 0=no
Breastfed	Was child ever breastfed?	1=yes 0=no
Screen time recommendations	Does child meet recommendation for screen time of less than or equal to 2 hours a day?	1=yes 0=no
Intake of SSB	Does child intake SSB during the day?	1=yes 2=no
Caregiver education	Respondents' education level	1=some college or higher 0=High school or less
Caregiver employment status	Respondent is unemployed	1=yes 0=no
Household income	Average annual household income	1=>35,000 0=<35,000

Household receives food assistance	Does your household receive food assistance?	1=yes 0=no
Child receives reduced cost or free school meals	Does your household receive free or reduced cost breakfast or lunch at school?	1=yes 0=no
Acculturation	Overall	1=integrated 2=Traditional 3=Assimilated 4=Marginalized

Table 2.2. Characteristics of children who are food secure and food insecure

Variable	**Food Secure** n=507 (64%)	**Food Insecure** n= 285 (36%)	p value
Child Mean Age (years)	4.83	4.85	.937
Child Age Group n (%)			.850
2-5 years old	340 (67.1%)	193 (67.7%)	
6-8 years old	167 (32.9%)	92 (32.3%)	
Child Ethnicity			.004*
Native Hawaiian	406 (80.1%)	251 (88.1%)	
Other	101 (19.9%)	34 (11.9%)	
Child Sex n (%)			.505
Male	258 (51%)	138 (48%)	
Female	249 (49%)	147 (52%)	
Child BMI			.027*
Underweight	17 (3.4%)	7 (2.5%)	
Healthy Weight	342 (67.5%)	164 (57.5%)	
Overweight	64 (12.6%)	56 (19.6%)	
Obese	78 (15.4%)	57 (19.3%)	

Missing	6 (1.2%)	3 (1.1%)	
Child meets rec of fruit			.950
No	236 (46.5%)	132 (46.3%)	
Yes	271 (53.5%)	153 (53.7%)	
Child meets rec of vegetable			.449
No	497 (98%)	277 (97.2%)	
Yes	10 (2%)	8 (2.8%)	
Child mean energy intake per day			
2-5 years old	1620.99	1652.07	.549
6-8 years old	1817.81	1878.92	.394
Child has acanthosis nigricans			.095
No	493 (98.8%)	272 (97.1%)	
Yes	6 (1.2%)	8 (2.9%)	
Child ever breastfed?			.661
No	84 (17%)	51 (18.2%)	
Yes	411 (83%)	229 (81.8%)	
Child meets recommendation for screen time?			.005*
No	366 (72.2%)	231 (81.1%)	
Yes	141 (27.8%)	54 (18.9%)	
Child daily intake of sugar-sweetened beverages			.267
=0	388 (76.5%)	208 (73%)	
>0	119 (23.5%)	77 (27%)	
Caregiver education level			.001*
High School or lower	204 (40.3%)	149 (52.5%)	

Some college or more	302 (59.7%)	135 (47.5%)	
Caregiver employment status			.000*
Employed	472 (93.1%)	241 (84.6%)	
Unemployed	35 (6.9%)	44 (15.4%)	
Household Income			.000*
Below 35,000/yr	217 (46.8%)	185 (70.1%)	
Above 35,000/yr	247 (53.2%)	79 (29.9%)	
Missing			
Household receives food assistance			.000*
No	195 (39%)	51 (18%)	
Yes	305 (61%)	232 (82%)	
Household receives EBT or SNAP			.000*
No	253 (49.9%)	84 (29.3%)	
Yes	254 (50.1%)	201 (70.5%)	
Household uses food bank or food pantry			.000*
No	479 (94.5%)	235 (82.5%)	
Yes	28 (5.5%)	50 (17.5%)	
Household runs out of money for utilities at least sometimes?			.000*
No	435 (86.8%)	89 (32.7%)	
Yes	66 (13.2%)	183 (67.3%)	
Child receives reduced-cost breakfast or lunch at school?			.005*
No	399 (78.7%)	199 (69.8%)	
Yes	108 (21.3%)	86 (30.2%)	
Caregiver acculturation			.223
Integrated	370 (75%)	190 (69%)	

Traditional	100 (20%)	72 (26.5%)
Assimilated	7 (1.4%)	2 (.7%)
Marginalized	16 (3.2%)	8 (2.9%)

*=significant

Bivariate analysis (Table 2.3) showed a significant difference between OWOB status and several child and caregiver variables. Interestingly, 23 of the 24 children who were underweight (and not included in this analysis) were food insecure. The mean age of children who were OWOB was older than children who were a healthy weight (5.9 vs 4.7) and this was statistically significant. Also, children ages 6-8 who had a higher energy intake were more likely to be OWOB. This was also true for children who were not breastfed, had AN, or had more screen time than recommended were more likely to be OWOB. Children whose caregivers who had low levels of income or education were more likely to be OWOB. Household food security status was also significantly related to OWOB status. Households that reported food insecurity, usage of EBT or food assistance programs, or did not always have money to pay utilities were more likely to have a child who was OWOB. There was also no significant difference in fruit or vegetable intake in children who were OWOB or children who were not OWOB. No other variables had a significant relationship with child OWOB status.

Table 2.3. Characteristics of children who are Healthy Weight or OWOB

Variable	**Healthy Weight** n=506 (66.7%)	**OWOB** n= 253 (33.3%)	p value
Child Age Group	4.7	5.19	.001*
Child Ethnicity			.126
Native Hawaiian	351 (69.4%)	189 (74.7%)	
Other	155 (30.6%)	64 (25.3%)	
Child Sex n (%)			.837
Male	250 (49.4%)	123 (48.6%)	
Female	256 (50.6%)	130 (51.4%)	
Food Security Status			.002*
Food Secure	342 (67.6%)	142 (56.1%)	
Food Insecure	164 (32.4%)	111 (43.9%)	
Child meets rec of fruit			.681
No	240 (47.4%)	116 (45.8%)	
Yes	280 (52.6%)	137 (54.2%)	
Child meets rec of vegetable			1
No	494 (97.6%)	247 (97.6%)	
Yes	12 (2.4%)	6 (2.4%)	
Child mean energy intake per day			
2-5 years old	1602.99	1700.48	.079
6-8 years old	1773.21	1936.59	.021*
Child has acanthosis nigricans			.000*
No	500 (99.8%)	236 (95.2%)	
Yes	1 (0.2%)	12 (4.8%)	

Missing	10		
Child ever breastfed?			.015*
No	75 (15.2%)	56 (22.4%)	
Yes	418 (84.8%)	194 (77.6%)	
Missing	16		
Child meets recommendation for screen time?			.043*
No	370 (73.1%)	202 (79.8%)	
Yes	136 (26.9%)	51 (20.2%)	
Child daily intake of sugar-sweetened beverages			.997
=0	169 (33.4%)	85 (33.6%)	
>0	337 (66.6%)	168 (66.4%)	
Caregiver education level			.001*
High School or lower	207 (41.0%)	136 (54.0%)	
Some college or more	298 (59.0%)	116 (46.0%)	
Missing	2		
Caregiver employment status			.932
Employed	455 (89.9%)	228 (90.1%)	
Unemployed	51 (10.1%)	25 (9.9%)	
Household Income			.029*
Below 35,000/yr	241 (52.2%)	143 (60.9%)	
Above 35,000/yr	221 (47.8%)	92 (39.1%)	
Missing	62		
Household receives food assistance			.035*
No	166 (33.3%)	65 (25.8%)	
Yes	332 (66.7%)	187 (74.2%)	

Missing	9		
Household receives EBT or SNAP			.014*
No	227 (44.9%)	90 (35.6%)	
Yes	279 (55.1%)	163 (64.4%)	
Household uses food bank or food pantry			.864
No	456 (90.1%)	227 (89.7%)	
Yes	50 (9.9%)	26 (10.3%)	
Household runs out of money for utilities at least sometimes?			.048*
No	343 (69.7%)	155 (62.5%)	
Yes	149 (30.3%)	93 (37.5%)	
Missing	19		
Child receives reduced-cost breakfast or lunch at school?			.099
No	368 (72.7%)	198 (78.3%)	
Yes	138 (27.3%)	55 (21.7%)	
Caregiver acculturation			.084
Integrated	363 (74.7%)	171 (69.2%)	
Traditional	101 (20.8%)	68 (27.5%)	
Assimilated	6 (1.2%)	1 (.4%)	
Marginalized	16 (3.3%)	7 (2.8%)	
Missing	26		

*=significant

The correlation analysis (Table 2.4) showed that many of the variables were correlated. For example, income was positively correlated with education level (phi=.432, $p<.01$). Income

was negatively correlated with employment status of caregiver (phi=-.225, p<.01), food assistance utilization (phi=-.522, p<.01), participation in a free school meal program (phi=-.218, p<.01), and household money runs out to pay utilities (phi=-.285, p<.01). Free school meals were also positively associated with food security status (phi=.099, p<.01) and Native Hawaiian ethnicity (phi=.171, p<.01). If a child met fruit or vegetable intake recommendations, this was positively correlated with energy intake (phi=.206, p<.01). Income had many missing values (n=64), so because income highly correlates with employment status as well as education level of caregiver, the income variable was not used in logistic regression.

Table 2.4. Correlation matrix of food insecurity and independent variables

	1	2	3	4	5	6	7	8	9	10	11	12
1. Food insecure (n=792)	1.00	.112**	.033	.009	-.117**	.137**	-.225**	-.016	.217**	.553**	.099**	.049
2. OWOB (n=783)	.112**	1.00	.117**	.011	-.123**	-.003	-.083*	-.089*	.077*	.073*	-.060	.056
3. Energy intake (n=792)	.033	.117**	1.00	.206**	-.054	-.013	-.036	-.015	.015	.000	.072*	.096*
4. meets FV (n=792)	.009	.011	.206**	1.00	.027	.019	-.058	-.014	-.004	.002	-.024	.002
5. some college (n=790)	-.117**	-.123**	-.054	.027	1.00	-.133**	.432**	.203**	-.278**	-.099**	-.102**	-.025
6. unemployed (n=792)	.137**	-.003	-.013	.019	-.133**	1.00	-.225**	.016	.179**	.135**	.036	-.014
7. >35k/yr income (n=728)	-.225**	-.083*	-.036	-.058	.432**	-.225**	1.00	.232**	-.522**	-.285**	-.218**	-.077*
8. child breastfed (n=775)	-.016	-.089*	-.015	-.014	.203**	.016	.232**	1.00	-.113**	-.059	-.031	-.029
9. food assistance (n=783)	.217**	.077*	.015	-.004	-.278**	.179**	-.522**	-.113**	1.00	.233**	.388**	.069
10. $ run out for utilities (n=773)	.553**	.073*	.000	.002	-.099**	.135**	-.285**	-.059	.233**	1.00	.125**	.049
11. free school meals (n=792)	.099**	-.060	.072*	-.024	-.102**	.036	-.218**	-.031	.388**	.125**	1.00	.171**
12. Native Hawaiian (n=792)	.049	.056	.096*	.002	-.025	-.014	-.077*	-.029	.069	.049	.171**	1.00

*=.05 significance **=.01 significance

Based on the bivariate and correlational analyses, the following independent variables were selected for logistic regression with food insecurity as the dependent variable (Table 2.5): Native Hawaiian ethnicity, energy intake, OWOB, caregiver completed at least some college, and caregiver is unemployed. After adjusting for confounders, household food insecurity was independently associated with OWOB status (OR=1.526, p=.010). This means that households that report food insecurity were more likely to have children who were OWOB. Household food insecurity was also independently associated with caregivers who had at least some college (OR=.689, p=.018) and caregivers who were unemployed (OR=2.214, p=.002). This means that households that report food insecurity were more likely to have caregivers that did not complete college or were unemployed. Other associations, such as being Native Hawaiian or energy intake were not significant.

Table 2.5. Multivariate mixed effects logistic regression examining the association between food insecurity and selected variables

Dependent Variable	**Food Insecure**	
Independent Variable	**Odds Ratio (95% CI)**	**P value**
Age	1.005 (0.925, 1.093)	.900
Sex	1.094 (0.808, 1.482)	.561
Native Hawaiian	1.199 (0.853, 1.684)	.296
Energy Intake	1.000 (1.000, 1.000)	.722
Overweight or obese	1.526 (1.107, 2.103)	.010*
Caregiver completed at least some college	0.689 (0.506, 0.938)	.018*
Caregiver is unemployed	2.214 (1.306, 3.456)	.002*

*significant

Logistic regression was also performed with OWOB as the dependent variable (Table 2.6). The independent variables included were age group, sex, child ever breastfed, presence of AN, child met recommendations for screen time, Native Hawaiian ethnicity, total energy intake, food security status, education level of caregiver, and employment status of caregiver. OWOB status in the children was independently associated with being an older child (OR=1.100, p=.032), presence of AN (OR=19.353, p=.005), household food insecurity (OR=1.423, p=.037), and lower caregiver educational attainment (OR=.625, p=.006). This means that children who were OWOB were more likely to be older and much more likely to have AN present. Children who were OWOB were also more likely to live in a household that is food insecure, and their caregiver was more likely to not have any college education.

Table 2.6. Multivariate mixed effects logistic regression examining the association between OWOB and selected variables

Dependent Variable	**OWOB**	
Independent Variable	**Odds Ratio (95% CI)**	**P value**
Age	1.100 (1.008, 1.201)	.032*
Sex	1.003 (0.728, 1.381)	.987
Ever Breastfed	.687 (.456, 1.036)	.074
Presence of AN	19.353 (2.454, 152.630)	.005*
Native Hawaiian	1.114 (0.777, 1.598)	.558
Energy Intake	1.000 (1.000, 1.000)	.060
Food Insecure	1.423 (1.021, 1.983)	.037*

Caregiver completed at least some college	0.625 (0.449, 0.871)	.006*
Caregiver is unemployed	0.809 (0.468, 1.399)	.448

*significant

Discussion

This study examined the relationship between food security status, OWOB, and several demographic and nutrition variables among children who live in high prevalence indigenous communities in Hawai‘i. The data suggested that 36% of children in these communities live in food insecure households, which is higher than the national average of 20%. This is similar to a previous finding from Stupplebeen (2019) that 35% of Native Hawaiian households in Hawai‘i are food insecure. The data also suggested that 32% of the children in these communities were OWOB. This is concerning because the national average of all youth ages 2-19 years old is 32% (Ogden et al., 2014). This finding also agrees with a previous study that looked at data from 2003 with children ages 2-10 in Hawai‘i, which reported that 32% of the participants were OWOB (Stark et al., 2011).

Previous studies have reported that children who are food insecure are more likely to be OWOB (Hanson & Connor, 2014; Kaur, Lamb & Ogden, 2015), and this held true in this study. Food insecure children in this study were more likely to be OWOB, and children who were OWOB were more likely to be food insecure, even when other variables were controlled. This is an interesting finding compared to a previous study (Li et al., 2016) that analyzed the complete CHL dataset of 4,333 children. Li et al.’s study reported the relationship between food security status and weight status by ethnicity. A significant finding of the Li study was that Native Hawaiian children in food insecure households were not more likely to be OWOB than their

food secure counterparts, which we also found to be true. However, when all children were considered, regardless of ethnicity, food insecurity and OWOB were clearly and strongly associated with each other in the CHL population in Hawai‘i. Ethnicity does not seem to be a moderator in the relationship between food insecurity and OWOB.

Previous studies have reported that individuals who are food insecure, and children who are OWOB, are less likely to consume diets high in fruits and/or vegetables, but this study did not report any significant association. In fact, children regardless of food insecurity or weight status, consumed roughly the same amount of fruits and vegetables. Unfortunately, only 53.5% of children in the total sample consumed the recommended amount of fruits, while only 2.3% of the children consume the recommended amount of vegetables. This result is similar to a recent report that around half of children in the United States meet recommended intakes of fruits and vegetables from the Dietary Guidelines for Americans (Savoie-Roskos, Wengreen & Durward, 2016).

Clearly, interventions are needed to increase fruit and (especially) vegetable consumption among young children. Gardening-based interventions in schools have found moderate success in increasing fruit and vegetable intake in children and youth according to a 2016 systematic literature review (Savoie-Roskos, Wengreen & Durward). Food distribution programs could focus on incorporating more fruits and vegetables in their distributions, whether it be fresh, frozen, or canned (Liu et al., 2019). Also, children should be encouraged to eat whole fruit. A previous study reported that when children consume whole fruit, they are more likely to meet their daily fruit consumption requirement (Penny et al., 2017).

The only significant finding in this study related to fruit and vegetable intake was that children who had high total energy intake were more likely to meet daily recommendations for

fruit and vegetable intake. A cup of fruits or vegetables in a day is easier to consume when many calories are being consumed overall. A future study could compare the relative amount of fruits and vegetables consumed in a day to total calorie intake. They may find that a higher overall energy intake contributes to meeting the recommended daily intake for fruits and vegetables.

Two strong indicators of food security status in this study were education and employment status of caregivers. Higher education increases an individuals' ability to earn money (Pfeffer, 2018). At low levels of income, it is harder to afford enough food to feed a family. Affordability and accessibilty of nutritious food becomes a greater concern when an individual is unemployed. Policy interventions that address these issues, such as vocational training programs or a higher minumum wage, could be offered in communities with high rates of food insecure households (Bowen, Bowen, & Barman-Adhikari, 2015). For those who have low-paying jobs, food distribution can be done at their worksites to address food insecurity Programs that help with other household expenses, such as the Low Income Home Energy Assistance Program, also can assist with improving the food security status of the household (Frank et al., 2006).

Participation in a free or reduced-cost school meal program was slightly correlated with household food insecurity. This could be because several communities included in this study qualified to participate in a program where the schools offered free lunches to every child at the school. Commonly, communities that qualify for this program have a high percentage of low-income families. Children can also qualify individually for free or reduced school meals based on household income. A household may be food insecure but not want to apply for free school meals because of the stigma associated with it. A recent study reported that when there are lower

levels of stigma, children are more likely to participate in the program (Mirtcheva & Powell, 2009).

Children who are food insecure must rely on their caregivers to provide for their nutritional needs. This study shows that caregivers of food insecure children are more likely to utilize government food benefits, but that is not always enough to combat food insecurity. More research should be done on the food security status of households who are receiving government food benefits, because many of them are still food insecure. School-based food pantries are one way to increase food security status of households with children. These pantries commonly do not have any income requirements to qualify to receive food, but are more likely to be offered to all students at schools where a high percentage of students receive free or reduced meals (Alcazar et al., 2017; Bica & Jamelske, 2012).

Limitations

Because cross-sectional data was used for this analysis, no inference of causality can be made. This study only captures data at a specific point in time. CHL did community sampling, so community data that was collected 2 years after baseline could be compared, but these data mostly does not include the same children.

Most of the variables captured in this study were self-reported, so there may be some error in data collection. Caregivers may not be able to observe the child every time they ate something (for example if a child had a meal at school), so consumption of food may have been underreported. Also, caregivers could possibly under report fruit and vegetable consumption. Research has shown that the more caregivers are trained, the more likely they will give an accurate report of a child‘s food intake, but this is also dependent on discussing details of food

intake with the child (Sobo et al., 2000). Child consumption patterns may differ depending on their caregiver, such as when they do household food shopping or how they prepare meals. Fresh produce has a short shelf life, and the caregiver may only do grocery shopping on pay day or when they receive Electronic Benefit Transfer (EBT) benefits. EBT is a cash benefit given to low-income families to buy food. A recent qualitative study of households with low food security reported that caregivers use various strategies to adjust their household food supply (Burke et al., 2017). These strategies include increasing or decreasing they type of food they keep in their house. One of the foods that they were least likely to increase was fruit.

Commonly, more than a single question is recommended to determine food security status, and using more questions might have better identified the food security status of respondents. The USDA has an 18-item survey to thoroughly assess food security status (Gundersen & Ziliak, 2015). They also provide a short form 6-item survey for those times when an 18-item survey is impractical. Food security status was not the primary purpose of CHL research investigators, which explains the limited number of questions on this topic. Despite these limitations, valid measurement tools were used as much as possible to get accurate information from participants.

A significant number of respondents declined to answer the income question (n=64). Even though income was left blank, other variables highly correlated with income, and these variables served as good indicators of the income level of the household. The variables that highly correlated with income were unemployment and education. These variables had less than 10 missing cases.

Conclusion

Overall, children who live in communities with a high proportion of indigenous populations in Hawai‘i are more likey to be food insecure than those in other communities. Children in food insecure households in these communities are also more likely to be OWOB. Caregiver unemployment was associated with food insecurity, and both caregiver employment status and lack of college education were associated with OWOB children. Food secure and insecure chidren eat about the same amount of fruits and vegetables, so there must be other dietary, or environmental factors that explain the low consumption of fruits and vegetables in these communities. Also, other factors should be esxplored to determine what affects this consumption in children. Interventions are needed to address the high rate of food insecurity in this population. Educational opportunities and well-paying employment opportunities may positively affect the food security status of many households.

CHAPTER 3

A SYSTEMATIC LITERATURE REVIEW OF THE EFFECT OF SCHOOL PANTRY PROGRAMS ON CHILDREN'S DIET

Abstract

Persistent food insecurity in children can lead to health problems associated with disruptive eating and/or consumption of high-calorie, low-nutrient foods. For example, children who are food insecure eat diets that are higher in fat, sugar, and energy (Tan et al., 2018). Participation in food pantry programs have shown to improve diet, but there is no systematic literature review that focuses on the association between participation in a school-based food pantry and a child's diet. PubMed, CINAHL, and ERIC were searched for articles that tested school-based food pantries on children. Five articles reporting on four different studies were included in this literature review based on inclusion criteria. All five of these articles showed a positive improvement in dietary quality after participation in a school based food pantry. These studies show that integrating fruits and vegetables into free food distribution increases the presence of these items in a child's diet.

Introduction

Food Security and Children

When someone is food insecure, they have limited food choices and usually have a lower quality diet (An et al, 2019). In 2016, 12% of US households reported experiencing food insecurity (Hunt et al., 2018). This percentage accounted for over 15 million households. Households with children reported a higher rate of food insecurity at 17% (Hunt et al., 2018), suggesting that almost one in five children in the US is food insecure. Households with no

children are less likely to be food insecure compared with households with children, demonstrating a child's vulnerability to experiencing food insecurity.

Exploring food insecurity in childhood is important to investigate as this is a critical period when many important developmental milestones occur. Lack of proper nutrition can adversely affect these developmental milestones (Aurino, Wolf, & Tsinigo, 2020). Persistent food insecurity can also lead to health problems associated with disruptive eating and/or consumption of high-calorie, low-nutrient foods. For example, children who are food insecure eat diets that are higher in fat, sugar, and energy (Tan et al., 2018). They often have limited access to foods that have important nutrients, such as fruits and vegetables. Thus, food insecurity and dietary quality are associated with each other.

Food insecurity in childhood is positively associated with adverse health outcomes. Those who are food insecure are at a higher risk of developing a chronic disease and present with poor nutritional outcomes (Hunt et al., 2018). Food insecurity is not the only determinant of childhood obesity but reducing food insecurity may decrease obesity rates and associated health problems (Kirk et al., 2014). Children who are food insecure are more likely to be obese than children who live in food-secure homes. A recent study reported that children between the ages of 2-11 who live in a food-insecure household have a prevalence of 20% obesity compared to 14% of children in food-secure homes, and this difference was statistically significant (Kaur, Lamb & Ogden, 2015). Children who are obese are at higher risk for several health problems such as cardiovascular disease, high blood pressure, high cholesterol, and diabetes (Vedovato et al., 2016).

Food Assistance at Schools

The community level of the SEM explores the setting in which a public health intervention can take place. Schools are one example of a community resource. This is especially true in communities with high levels of poverty. When children are food insecure, their parents often rely on help from nonprofit agencies, such as food banks, to supplement their diet (Van der Velde et al., 2019). Children also heavily rely on schools to provide at least one of their meals during the school day. The US government administers multiple programs to reduce food insecurity, and several of these programs are geared specifically toward children (Kong et al., 2014).

One Federal program is the National School Lunch Program (NSLP). This program operates in over 100,000 schools around the country, and provides lunch for free or at a very reduced price for children whose families are low income. If household income is above the federal poverty level by 130-185%, children qualify for a reduced-price meal of 40 cents. If household income is 130% of the federal poverty level or below, then there is no charge for meals. This program is administered by the USDA.

Free or reduced school meals are beneficial for children when school is in session, but there are many times during the year when school is not in session. During these times, children do not have the safety net of a guaranteed place (school) that will provide meals for them. Food security rates of children can decrease during these times. A recent analysis of food insecurity reported that children who participate in NSLP have a higher rate of food insecurity during summer months compared to months when school is in session (Huang, Barnidge & Kim, 2015). The USDA offers a free summer meal program only in communities with low socioeconmic factors, so many communities are left out (Hopkins & Gunther, 2015). This systematic literature review will not include studies that focus on free school meals because this program is only

available to children who meet specific qualifications. This focus of this review is to include studies that aim to alleviate food insecurity in children regardless of a qualification process.

School Pantry Programs

Even with these school-based programs, many children in the US are still food insecure. Another approach to reduce food insecurity is through food banks or food pantries, most often supported by the nonprofit sector. Food banks or pantries can be free-standing or established in community centers, with many in low-income housing communities. A recent literature review evaluated food pantry interventions that were either free-standing food pantries, in community centers, or in low-income housing. The authors concluded these interventions improved the diet quality of participants (An et al. 2019).

Of the 14 interventions included in the review by An et al. (2019), none of them were conducted in a school setting, and only one of the included articles included child participants. Nonetheless, schools have started partnering with nonprofit organizations to distribute food to children after school. These programs are generally known as school-based food pantries (Wright et al., 2018). To my knowledge, there are no published literature reviews on school-based food pantry programs and their effects on children's diet.

Aim

The overall goal of this systematic literature review is to understand the effect of school pantry programs on the diet quality of school-aged children. Research has shown that children who are food insecure consume diets higher in sugar, fat and carbohydrates. This review included any dietary factors that were measured.

Methods

Search Methods

The following literature databases were searched: PubMed, CINAHL, and ERIC. The search terms were divided into categories based on the PICOS (Participant, Intervention, Comparator, Outcome, Study Design) framework (Ho et al., 2016). For Participants, search terms included students, child, preschool or adolescent. For Intervention, search terms included food assistance and schools. There was no specific Comparator used in the search. For Outcome, some type of dietary outcome needed to be included in the study. Study Design was another category where any type was accepted.

Study Selection

Interventions were excluded if they: 1) did not have a food assistance component (e.g., they only provided education materials), 2) were conducted at a college or university, 3) were a free-meal program, or 4) were a policy. Free meal programs were excluded because these programs usually require a qualification process. Studies were also excluded if they did not report any dietary impact. Articles were excluded if they were not written in English. Both quantitative and qualitative studies were included in this review.

After the initial search, duplicate articles were removed. Titles and abstracts of the remaining articles were reviewed for relevance, and then full texts of relevant articles were reviewed against the exclusion criteria. Information abstracted from each selected article included: 1) components from the intervention (if applicable), 2) study design, 3) demographics, 4) setting, and 5) dietary outcomes.

Quality Appraisal

Zaza et al. (2000) developed an abstraction form to identify key characteristics of interventions that are included in systematic reviews. This form has been standardized to improve consistency and reliability of systematic reviews. I used an adapted version of this form, which has 10 questions to assess study quality. These questions are 1) Is the intervention well described? 2) Is the sample well described: did the authors specify the sampling frame? 3) Did the authors specify the screening criteria for study eligibility? 4) Was there a comparison group? 5) Were participants randomized to the intervention and comparison groups? (were the intervention and comparison groups comparable?) 6) Were the exposure and outcome measures valid and reliable? 7) Was exposure (dose, attendance) tracked? 8) Were assessors blinded? 9) Did at least 80% of enrolled participants complete the study? 10) Did the authors correct for controllable confounders? One point was given for each question where the answer is yes, for a total possible score of 10. If the answer is not clear, I gave half a point. The overall quality score was interpreted as follows: score 8–10 = good; 5–7 = fair; <5 = limited.

Results

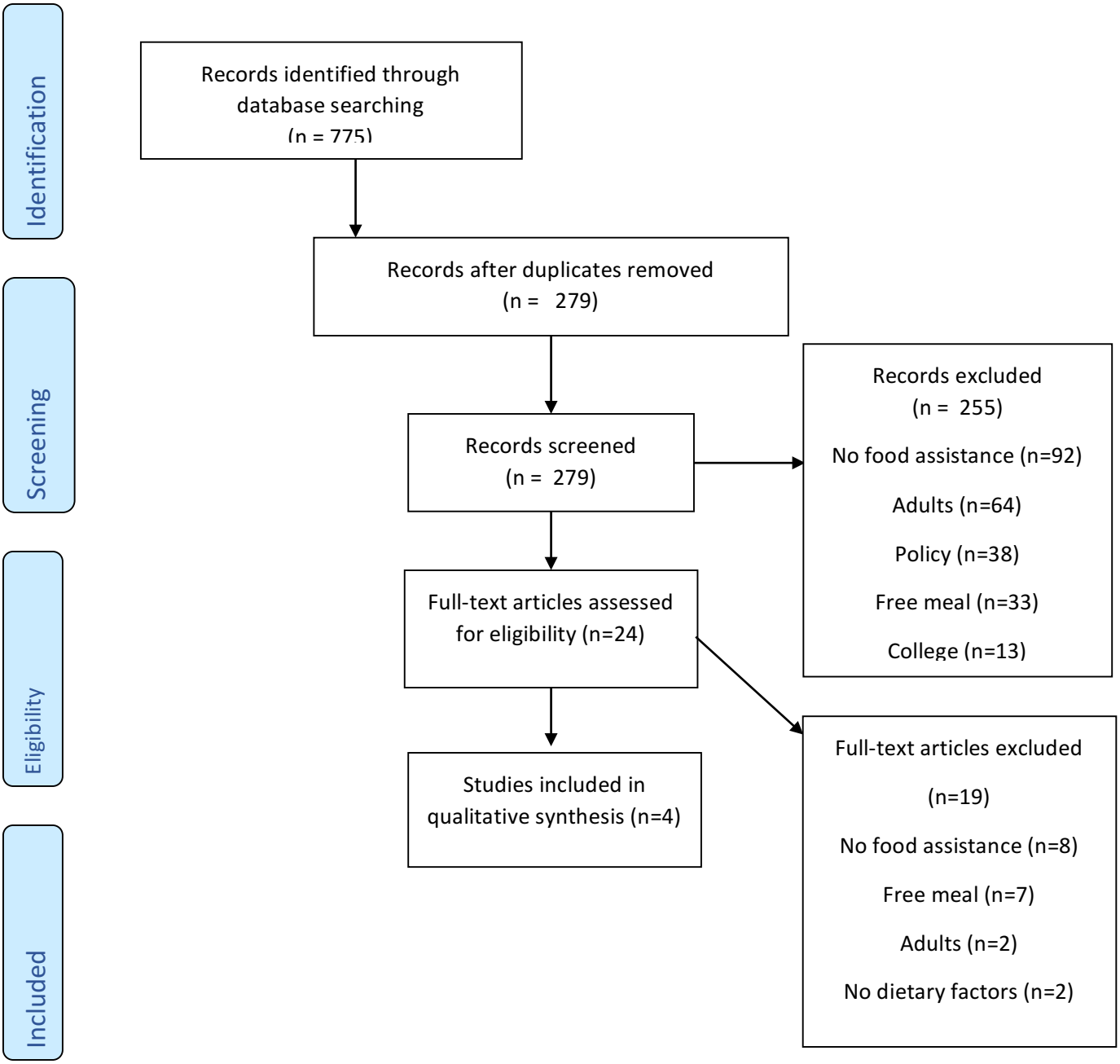
The literature search yielded 775 articles (Refer to Figure 3.1 PRISMA Flow Diagram on page 45). After removal of duplicates (n=496), 279 articles remained. Through reading the title and abstract, an additional 255 articles were excluded for the following reasons: the article did not report on an intervention with a food assistance component (n=92), the study did not focus on children in school (n=64), the study's focus was on free meals (n=33), the study only addressed policy (n=38), the study was conducted at a college or university (n=13), or there was no diet-related measure (n=12). Three additional citations were excluded for the following reasons: two of the citations refereed posters and one article was written in Spanish.

Twenty-four articles were left, and their full-texts were read. An additional 19 articles were excluded because the intervention did not include food assistance (n=8), the study targeted adults (n=2), the study was about free school meals (n=7), or the study had no diet-related measure (n=2). The remaining five articles are included in this review. Two of the included studies (Bica & Jamelske, 2012; Jamelske & Bica, 2012) reported on the same intervention, so the five articles reported on four separate interventions. Of these four interventions, two were tested using a controlled design, and the remaining two were tested using qualitative approaches. Thus, the tables present findings from the controlled-design studies first, followed by findings from the other studies.

Study Characteristics

Characteristics of the four interventions are summarized in Table 3.1, showing: 1) study author and citation, 2) name of intervention, 3) location, 4) type of school, 5) intervention activities, 6) frequency of activities and 7) duration of intervention. The two studies (Bica & Jamelske, 2012; Jamelske & Bica, 2012) that tested the same intervention were combined.

Figure 3.1. PRISMA 2009 FLOW DIAGRAM



Two interventions (Bere et al., 2015 & Holmberg et al., 2018) were conducted outside of the US. All interventions were conducted in elementary schools except the Holmberg et al. (2018) study, which was implemented at a middle school. The shortest duration of an intervention was 16 weeks (Alcazar et al., 2017), two interventions (Bere et al., 2015; Bica & Jamelske, 2012; Jamelske & Bica, 2012) lasted 9 months, and one lasted 1 ½ years (Holmberg et al., 2018).

All interventions distributed fruits and vegetables to students. Bica & Jamelske (2012) distributed a fruit or vegetable during snack time, and children were expected to eat the food item during snack time. The Bere et al. (2015) intervention was similar where children were given a fruit or vegetable during lunchtime, when students were expected to eat them. The most common food items were carrots, apples, pears, bananas, oranges, clementines, and nectarines. In the Holmberg et al. intervention (2018), students enrolled in cooking classes, and these classes focused on incorporating vegetables into meals. Students then ate the food they prepared. This intervention also included educational workshops that focused on healthy eating and physical activity. Adolescents who participated in this intervention interacted with health coaches who encouraged self-reflection of intervention activities. For the Alcazar et al. (2017) intervention, students were given 30-35 pounds of produce to take home. These distributions occurred on a weekly basis for 16 weeks.

Table 3.1. Characteristics of the interventions*

Citation	Name of Intervention	Location	School	Activities	Frequency	Intervention Duration
Bere et al. (2015)	Fruits and Vegetables Make the Marks	Norway	Elementary	FV distribution	Weekly	9 months

Bica (2012) & Jamelske (2012)	USDA Fresh Fruit and Vegetable Program	Wisconsin	Elementary	FV distribution	Weekly	9 months
Alcazar et al. (2017)	Brighter Bites	Houston, Texas	Elementary	FV distribution	Weekly	16 weeks
Holmberg et al. (2018)	How to Act	Sweden	Middle school	FV distribution, educational classes, cooking classes	Weekly	1 ½ years (3 semesters)

*In the table above, FV=fruits and vegetables

Table 3.2 describes the study designs used to test the interventions. Two of the interventions were tested using randomized controlled trial (RCT) designs (Bere et al., 2015; Bica & Jamelske, 2012). Bere et al. (2015) used a cluster RCT design, in which 38 randomly selected elementary schools in Norway were randomly assigned to two groups. Nine schools participated in the intervention, and 29 schools were control schools. At baseline and follow-up, participants filled out a 24-hour dietary recall and were also given a food frequency questionnaire. Researchers determined how many fruits and vegetables were eaten per day and how many were eaten per week. Researchers also documented how many unhealthy snacks were eaten per week. At baseline, there were 1,950 students included in the study, with 585 participating in the intervention, and 1,365 in control schools. The follow-up results that are reported in this study were collected seven years after participation in the intervention, and only 320 students were included in the follow-up sample. From the intervention group, 112 completed the 7-year follow-up, and from the control group, 208 completed 7-year follow-up.

The other intervention tested by RCT was conducted in Wisconsin (Bica & Jamelske, 2012; Jamelske & Bica, 2012). In this study, 2 elementary schools were intervention schools,

and 2 elementary schools with similar characteristics were control schools. The participants were fourth and fifth graders. A total of 124 students participated in the intervention group and 134 students in the control group. Two open-ended questions were asked of the students at baseline, two months after the intervention started, and six months after the intervention started. These questions were 1) what do you eat before school? and 2) what do you eat during snack time? Based on the answers, the researchers estimated the amount of servings of fruits and vegetables eaten each week per child. These researchers also used an eight-item survey to measure behaviors related to fruit and vegetable consumption. Four of the questions were about fruit and there were four parallel questions about vegetables. An example of a fruit question was "How likely will you try new fruit offered at home?". An example of a vegetable question was "How likely will you choose a vegetable as a snack instead of chips, cookies, or candy?". The response options for all questions were 1= never, 2=sometimes, 3=often, and 4=always. The total score was the average of all eight answers. Higher scores indicated more favorable behavior.

Table 3.2. Characteristics of the Study Designs

Citation	Study Design	Sample	Data Collection Method	Dietary Variables Collected	When Data Collected
Bere et al. (2015)	CRCT by school	38 schools Baseline n=1950 Intervention n=585 Control n=1365 7 yr follow-up n=320 Intervention n=112 Control n=208	24-hour dietary recall Food Frequency Questions	FV intake (portions per day) FV intake (times/week) Unhealthy snack intake (times/week)	Baseline (2001) Follow up (2009)
Bica (2012) & Jamelske (2012)	Matched control design	4th and 5th grade students 2 intervention schools (n=124) 2 control schools (n=134)	Open-ended question about before school food and snack time Eight item questionnaire about food behaviors	FV intake before school FV intake during school snack time	Pretest Posttest 1 (2 months after initiation) Posttest 2 (6 months after initiation)
Alcazar et al. (2017)	Photovoice	213 families 8 parents recruited, 5 completed study All were Hispanic women	Two research questions. Participants were asked to take a minimum of 7 pictures for 2 weeks	Common themes across the photos.	During intervention End of intervention
Holmberg et al. (2018)	Individual Interviews and Focus Groups	7th graders at 1 school 29 girls 20 boys	Cue words were used to facilitate reflection on the positive and negative aspects of participating	FV intake	Individual interviews at Baseline 9 focus groups (n=4-7) at end of intervention

The other two interventions used qualitative methods to collect their data. Alcazar et al. (2017) recruited parents of elementary children who were participating in the Brighter Bites intervention. Five (out of 213 families) parents participated. They were asked to use Photovoice to document their experience in the intervention. The parents were given two weeks to take at least seven pictures. These pictures were used to answer two questions: 1) What benefits and impacts have we experienced with Brighter Bites? And 2) And how can we improve the program? The parents then participated in a focus group to discuss their photos. One Photovoice session occurred during the intervention, and another Photovoice session occurred two weeks after the intervention concluded. Researchers identified four themes that emerged from these discussions. These themes were that the program made a positive impact on their household food budget, increased the variety of fruits and vegetables in the home, increased accessibility to fruits and vegetables, and they implemented fruit and vegetable related knowledge in the home.

Holmberg et al. (2018) utilized individual interviews and focus groups to collect data about the impact of their intervention, titled How to Act. A total of 49 students (29 girls and 20 boys) participated in the intervention and data collection. Nine focus groups were conducted at the end of the intervention, each with four to seven students. The students were asked about the positive and negative aspects of participating in the intervention.

Summary of Findings for Each Study

Findings from each study are summarized in Table 3.3. For fruit and vegetable intake, Bere et al. (2015) reported a statistically significant increase in consumption (an increase of .44 portions per day and 1.31 times a week) for the intervention group between baseline and the 7-

year follow-up. The authors also reported a significant reduction in unhealthy snake intake for students who had parents with lower levels of education.

Table 3.3. Dietary Benefits

Author	Data collection method	Saving Money	Use of FV in meals or snacks	Access to FV	FV intake	Unhealthy food intake
Bere et al. (2015)	24hr FV recall				↑	↓
Bica (2012) & Jamelske (2012)	Baseline and follow up		↑		↑	↓
Alcazar et al. (2017)	Photovoice	↑		↑	↑	
Holmberg et al. (2018)	Focus groups		↑		↑	↓

Bica & Jamelske (2012) also reported an overall increase in fruit and vegetable intake for students who participated in their intervention. Six months after the intervention, researchers reported that students who participated in their intervention were more likely to eat fruits and vegetables for snacks rather than an unhealthy choice.

Two common themes were identified by the authors of the studies that used qualitative methods to collect data (Alcazar et al., 2017; Holmberg et al., 2018). The themes were 1) saving money and 2) improvement in dietary habits. These themes are described in more detail below.

Saving Money (individual level): The families who participated in these studies reported that they liked the program because it helped their household save money. All participants in the Alcazar et al. (2017) evaluation of Brighter Bites expressed that this program helped their

household budget. Students who participated in the Holmberg et al. (2018) study expressed that they were surprised at the affordability of incorporating produce into meal preparation.

Improving Dietary Habits (individual level): There are several dietary habits that improved because of participation in these studies. First, both studies reported that those who participated in their program were more likely to integrate fruits and vegetables in their meals and snacks. The middle school students who participated in the cooking program *How to Act* in Sweden (Holmberg et al., 2018) said they enjoyed the hands-on nature of cooking with vegetables and felt that they were incorporating more vegetables into their diets. These cooking classes increased their confidence to try these recipes at home. Parents of students in the Alcazar (2018) study also reported integrating more fruits and vegetables into their daily meals and snacks.

Another dietary habit that improved was the overall fruit and/or vegetable intake of participants. Parents of children in the Brighter Bites program (Alcazar et al., 2017) noted that their children eat more fruits and vegetables at home because of participating in this program. They also expressed that because most produce is ready to eat, it is easy for the children to serve themselves these foods. These parents felt their children enjoyed eating fruits and vegetables that were colorful and looked fresh.

The last dietary habit that improved was a reduction in unhealthy snack intake which was reported by the program in Sweden (Holmberg et al., 2018) as well as the one in Wisconsin (Bere & Jamelske, 2012). The students in Sweden felt the nutrition education component increased their desire to eat more fruits and vegetables instead of less-healthy food. The students in Wisconsin reported a decrease in unhealthy snack intake after participating in the program.

Quality Scores

The two interventions that were tested through a controlled trial (Bere et al., 2015; Bica & Jamelske, 2012; Jamelske & Bica, 2012) had higher quality scores than the three interventions tested with qualitative methods. They both received a 9.5 out of 10. These interventions used control groups to compare their results and random selection to determine which schools would participate in their intervention.

The interventions that used a qualitative approach to intervention testing had lower scores. Alcazar et al. (2017) and Holmberg et al. (2018) both received a 6.5 out of 10. None of these interventions randomly selected participants or had a comparison group, which is normal for qualitative studies. It also was impossible for assessors to be blinded in these qualitative studies, but in Holmberg et al. (2018), they noted that the main researchers who developed the intervention did not conduct the focus groups.

Table 3.4. Quality Scores

Study	Description	Sampling	Eligibility	Comparison	Randomized	Outcome Measures	Exposure	Blinded assessors	80% completion?	Controllable confounders?	Total Items Met
1 Bere et al., 2015	1	1	1	1	1	1	1	.5	1	1	9.5
2 Bica, 2012 & Jamelske, 2012	1	1	1	1	1	1	1	.5	1	1	9.5
3 Alcazar et al., 2017	1	1	1	0	0	1	1	0	1	.5	6.5
4 Holmberg et al., 2018	1	1	1	0	0	1	1	0	.5	1	6.5

Discussion

Food insecurity is a public health issue that affects many children in the US. Because school attendance for children is required by law, the school setting is a natural location to provide extra food assistance to children. Many children already participate in the Free or Reduced School Lunch program, but some schools are adding food pantry programs.

This review examined and summarized four interventions, two tested with high-quality quantitative designs and two with lower-quality qualitative designs. The two quantitative studies were tested by cluster randomized control design, and they found that offering children fruits and vegetables increased their fruit and vegetable intake. These results still held true during their follow-up period. The interventions tested with qualitative approaches provided additional data about how free food programs make food more affordable and improve diet quality.

The above studies show that integrating fruits and vegetables into free food distribution increases the presence of these items in a child's diet. Bica & Jamelske (2012) noted that children appear more willing to try produce when it looks fresh and not overripe. Parents of children who participated in these programs were also appreciative that there was no cost to participate. Consumption of fruits and vegetables increased in all studies for children who participated. These results are similar to the systematic review by An et al (2019) that assessed dietary quality of adults who participated in food bank interventions. All studies included in that review reported improvement in indicators such as diet, cooking skills, food security, nutrition knowledge or health outcomes. Another study conducted among adults also reported similar results (Wright et al., 2018). This study found that adults who participated in a food pantry program increased the amount of fruit in their diet.

Only Bere et al. (2015) conducted a long-term follow-up of their intervention. The overall effect of increased fruit and vegetable intake in participants weakened over time. At the seven-year follow-up, the only significant effect of the intervention was on unhealthy snack intake. This could be due to increased maturity in participants as they got older and were more aware of how eating can affect their health. However, members of the control group, who are the same age as participants in the intervention group, did not show the same improvements. These same findings are similar to a study by Stea et al (2018), who followed-up with a cohort of students 14 years after the completion of a free-fruit intervention in elementary schools. According to this study, there were limited positive effects of the intervention in participants after 14 years. The only significant effect reported was an increase in fruit intake for females who did not attend college.

Holmberg et al. (2018) reported the benefit of adding an educational component to the food distribution. Students who were given educational materials felt these materials helped them understand the importance of eating healthy. A recent review found that nutrition education for parents that is not coupled with food distribution does not impact the eating habits of their children (Hodder et al., 2017). This review illustrates that actual food distribution does have a positive impact on children and families.

Interestingly, none of these studies measured food security status. These studies were all conducted in school districts with high levels of poverty, which is an indicator for food insecurity. Food distribution increases accessibility and availability of nutritious foods to those who need it the most. Future studies on school-based food distributions could benefit from analyzing the food security status of individuals who utilize their programs.

Limitations

There are several limitations to the studies included in this review. First, only a few studies were found after a systematic search. There are many studies about free food at school, but most of them focus on free school meals. Free school meal programs in the US have been in place for over 40 years. Participation in a free school meal program positively affects children's diets (Sabinsky et al., 2019), but that was not the focus of this review. The qualification process to obtain free school meals is based on household income, so there may be students who are food insecure but do not qualify for free school meals. Ninety-two studies focused on food distribution, but many of these lacked a follow-up on the impact the program had on the diet of the children who participated.

School-based food pantries or other programs that distribute food in schools (outside of the free or low-cost meals provided already) are a relatively new approach to reducing food security among children in the US. This systematic review located only two studies on school-based food distribution programs conducted in the US. These programs are gaining popularity around the world, but rigorous testing of these programs and publishing findings from these analyses takes time.

Second, the quality of research was limited. Two of the four studies received a high score of 9.5 out of 10. Both studies were RCTs, so they incorporated many important elements commonly used to strengthen research. But the other two studies were qualitative, so their score was lower at 6.5. Qualitative studies are good at supporting anecdotal evidence, but lack some of the more rigorous elements found in quantitative studies.

Conclusion

This review shows that a community-level intervention can improve individual-level habits. These studies show that school-based food distribution positively affects children's diets. This includes cost savings for their family and an immediate increase of fruits and vegetables in their diets. One study reported that incorporating health education with food distribution increased fruit and vegetable intake. Recommendations include adding educational components to food distribution programs and conducting more high-quality tests of these interventions.

CHAPTER 4

STRATEGIES COLLEGE STUDENTS WHO ARE PARENTS USE TO INCREASE THEIR HOUSEHOLD FOOD SECURITY STATUS: A QUALITATIVE STUDY

Abstract

Almost 1 in 5 college students are parents in the US. Almost half of them are food insecure. College students who are parents are less likely to graduate than college students who are not parents. Food insecurity is one factor that affects their ability to graduate. The goal of this qualitative study was to identify strategies food insecure college students who are parents use to increase their household food security status. One-on-one interviews were conducted over Google Meet, and interview questions were adapted from a previous study conducted with SNAP recipients. Interviews were coded and analyzed with NVIVO software. A total of six interviews were conducted. Five themes were identified, and they were categorized by the socio-ecological model framework. These themes were 1) money is a huge factor, 2) food insecurity negatively affects academics, 3) friends and family are a food resource, 4) children are prioritized over parents, and 5) food banks and government assistance programs are helpful, but not enough. Future efforts to assist college students who are parents could focus on providing affordable family housing as well as an on-campus food bank, with more being given to households that are larger. An on-campus garden where students grow and harvest their own produce could also increase their access to nutritious food.

Introduction

The prevalence of food insecurity in the US is 11%, and research has consistently shown that college students have higher prevalence of food insecurity than the general population. One study reported that around 50% of undergraduate students were not able to eat balanced meals,

and about 25% of students skip meals because of financial issues (Leung et al., 2019). A systematic review reported the food insecurity prevalence of college students between 35-42% (Bruening et al., 2017) College students who are food insecure are more likely to do poorly academically compared to food secure students (Martinez et al., 2018), and are less likely to finish their degree programs (Weismann, 2020). Food insecurity in college students has also been shown to negatively affect their psychosocial health (Raskind, Haardofer, & Burge, 2019).

Nationally, almost 1 in 5 of college students are also parents (NPSAS, 2018). Out of the roughly 3 million student parents who were enrolled in a US college between 2001-2017, over 2 million were single parents (Cruse et al., 2019). The Hope Center for College, Community, and Justice reports that 53% of student parents are food insecure (Weissman, 2020). The Institute for Women's Policy Research reports that only 37% of student parents are able to complete their degree in six years, compared to 59% of students who are not parents, primarily because of their need to work and care for children while in school (Weissman, 2020). Food insecurity affects student parents more severely, yet only 29% of student parents pursuing an undergraduate degree receive SNAP, and only 18% of food-insecure student parents have access to a campus food pantry (Goldrick-Rab, Welton, & Coca, 2019).

A study completed in 2006 found that 21% of UH Mānoa students were food insecure (Chaparro et al., 2009). A more recent survey conducted in 2018 reported that 50% of undergraduates at UH Mānoa have experienced food insecurity, and 37% of these students experience moderate to severe hunger (Hendrix, 2018). An on-line survey on food security conducted in fall 2019 reported an even higher prevalence of food insecurity at UH Mānoa at 63% (Olfert, 2020).

Kinsey et al. (2019) conducted a qualitative study among mothers who received SNAP benefits. The researchers wanted to learn strategies these mothers used to manage their SNAP benefits over the course of a month. They concluded that price was the determining factor over health when purchasing food. These participants also relied on social support (emotional, financial or informational) for help. Another qualitative study conducted in Latin America reported that grandmothers were an important source of provisions for families that are food insecure (Alderete, Sonderegger & Perez-Stable, 2018). Another study found that only 38% of food-insecure college students utilized an on-campus pantry (El Zein et al., 2018). This study asked students about barriers to utilization, and they reported social stigma and insufficient information. A recent systematic literature review reported strategies that parents of children in the general population use to increase their household food security based on ethnic background (Kamdar et al., 2018). Strategies were similar for all ethnic groups, and these strategies included using public and/or private food assistance, reaching out to social networks, reducing or skipping meals, and financial strategies, such as using coupons or buying food that is on sale, regardless of nutritional value.

There are many studies on food security with college students or parents of children, and these primarily use surveys to collect data. However, there are no qualitative studies focusing specifically on food insecurity among student parents, their strategies to address it, and their unmet needs for food assistance. A qualitative study by Kinsey et al. (2019) interviewed parents that received food stamps on their strategies to address food insecurity, and their interview questions guided my qualitative study of student parents. The purpose of this study was to determine strategies college students who are parents use to increase their household food security status.

Methods

Study Design and Ethics

This was a qualitative study consisting of one-on-one interviews. The qualitative approach used for this study was phenomenology. Phenomenology focuses on the lived experience of a group of people, and this was explored through one-on-one interviews (Korstjens & Moser, 2017). IRB approval for this research study was obtained from the University of Hawai‘i at Mānoa IRB in August 2020.

Sample and Participant Recruitment

Participants needed to meet some certain criteria to participate in this study, so criterion sampling was used (Moser & Korstjens, 2018). Snowball sampling was also used, where participants referred others to participate in the study. Adults enrolled in at least one college course, having at least one minor under the age of 18 in their home, and meeting criteria for food insecurity were recruited. A recruitment flyer was developed and initially distributed through a student-parent email listserv at the University of Hawai‘i. The flyer was also shared on Instagram and Facebook and were texted to potential participants. Those who were interested in participating were directed to a Google Form where they inputted their email address. The Google Form also asked the USDA six-item short form household food security survey (Blumberg et. al, 1999). Each potential participant received a score based on their answers, and if their score was 2 or above, they were emailed the informed consent form. If participants gave consent, then they were contacted to set up an interview. Recruitment continued until thematic saturation was reached.

Due to COVID-19 restrictions, interviews were not allowed to be conducted in person. All one-on-one interviews were conducted by the researcher over Google Meet. The researcher audio recorded all interviews, as well as took notes. All participants were given a copy of the informed consent for their records and gave verbal consent at the beginning of the interview. Participants were provided with $40 worth of nonperishable food for their time.

Measures

Each interview lasted about 30 minutes. At the beginning of the interview, participants were asked 10 sociodemographic questions to allow the researcher to describe the sample. Demographic items were: 1) gender (male or female); 2) student status (full or part-time); 3) single parent household (yes/no); 4) undergraduate or graduate student; 5) employment status (full-time, part-time or no employment); 6) living on or off campus; 7) number of adults in household; 8) number of children in household; 9) what type of school children attended if any; 10) and government food assistance programs they participated in.

Participants were then asked 10 open-ended questions about their household food situation and strategies they used in relation to food. These questions were adapted from a previous study about strategies to increase food security status (Kinsey et al., 2019) and included:

1) Can you tell me a bit about your family and your mealtime routines?
2) Let's talk about your food shopping trips. How do you decide what to buy and what not to buy?
3) Tell me about a typical food shopping month. When do you go to the store? Do you make a budget for the month?

4) Tell me about how you choose where you shop for food? How do you feel relying on SNAP/WIC restrains or influences your choices? Are there other things that influence or restrain where you shop?
5) A lot of people say there is a lot of time left in the month after their benefits or paychecks run out. How about for you? Over the last year, how have you coped during times when money was tight? Tell me all about the last time that happened.
6) We're especially interested in food. Tell me about the last time you ran short of what you needed to pay for food. How did you cope? What do you typically do when the food budget gets tight?
7) If you visited a food pantry in the last year, can you tell me about your experience there? What did you like? What didn't you like? How did you decide which pantry to visit? How did going there make you feel?
8) What sorts of foods did they give you at the food pantry? Were they foods that you were familiar with or similar to the foods you buy at the store? Did you eat them right away or save them?
9) Some times of the year are easier financially than others. For example, some families tell us it's a lot easier to afford to feed their families in months when their kids are getting free breakfast and lunch at school. Others say it's easier during the summer, when kids are off visiting relatives. How about for you?
10) When you don't have enough money to cover all your expenses, how do you prioritize things, and how do you decide what to pay first, second and so on? Think about the following expenses and tell me how you prioritize them: food, rent/mortgage, electricity, heat, phone/internet, transportation, healthcare.

11) What impact does your food situation have on your academic performance?

Data Analysis Strategy

Demographic data was aggregated to describe the interview population. Interviews were audio recorded and transcribed. Transcripts were then uploaded to NVIVO for thematic analysis. Codes were developed by one researcher.

Positionality

I am currently a PhD student, and several interview subjects attend the same university as me. I have previously experienced food insecurity as a student parent, so I was careful not to project my personal experiences while conducting interviews. Several of the interview subjects are people I know; I believe because they knew me, they were honest with their answers. In all interviews, I collected answers and received them as neutrally as possible.

Overall Rigor

There are four categories of rigor that were used through the research process (Maher, 2015). Credibility of the study was enhanced by using an interview guide developed by other public health researchers and used successfully to interview food-insecure parents (Kinsey et al., 2019). The second category was transferability, and I believe findings from this research can be transferred to other groups of parents who are food insecure. To enhance dependability, the steps taken to complete this research are outlined in this study, so that others could follow this process if they would like to conduct a similar study. The last category is confirmability. NVIVO software was used to code interviews. I have also sent the study to several of the participants and asked them for feedback to confirm that the paper adequately reflected their experiences.

Results

Participants

After three weeks of recruitment, 47 individuals completed the Google Form. Of the 47 individuals, 28 qualified to participate in the study. All 28 were invited to participate in the study through email, and of those, six completed the one-on-one interview. Most who did not participate never responded to the intial email, and several declined to participate when they learned the incentive a food basket, rather than cash or a gift card. After four interviews, this researcher noticed that new themes were not emerging. Two more interviews were conducted to ensure that no new themes appeared. Once six interviews were completed, this researcher determined that thematic saturation was reached.

Of the six who participated, two were men and four were women. Five lived with partners, and one did not. Three were graduate students, and three were undergraduate students. Five participants stated that they were full-time students. All lived off campus. All participants were employed, but only one was employed full-time. Three participants had one child in the home, and the remaining three participants had two, three, and five children in the home. Three participants received SNAP, and three had children who received free meals from the National School Lunch Program (NSLP).

Thematic analysis

The research question for this study was "what strategies do college students who are parents use to increase their household food security?" This research question guided the thematic analysis, and five major themes were identified and categorized using the socio-ecological model (Bronfenbrenner, 1977). Two themes were identified to be individual level

factors, two themes were identified to be interpersonal level factors, and one theme was an organizational factor. They are described below.

Theme 1: Money is a huge factor (individual level): At the individual level, all six participants shared that they take price into consideration when purchasing food. As much as possible, they buy food items that are on sale, or they buy the generic version because it is less expensive. One participant shared that "we just go wherever is cheapest" when deciding which store to visit to buy food. Another participant said "we want things that are non-perishable, that will last, that we can stock, and things that are cheap." Another participant stated "if its on sale, we'll definitely get it."

Overall, the price of food was more important than the nutritional value. Several participants mentioned stores that they frequented because of the prices. Walmart was brought up several times as place to shop for food because of its low prices. Several participants discussed the difficulty of trying to minimize spending on food while still making healthy choices. Even though they wanted to purchase healthy items, the price was a determining factor for whether or not they purchased that item. Several participants also mentioned that buying food in bulk was more affordable. One participant shared that they focus on price first, and then try to make meals based on what they were able to buy.

When discussing spending priorities, all participants mentioned the need to first pay their rent or mortgage. Having a roof over their heads was of utmost importance, with food supply a close second. The participants made statements such as "I always pay the rent first," "first and foremost for us is always rent," and "we made sure rent was paid." Four participants mentioned that they juggled paying household bills so that they had money to spend on food. They talked about how certain bills may not get paid on time, such as utilities or credit card bills. One

participant shared that they called the credit card company to discuss delayed payment options. Two participants shared that they delayed paying for car-related expenses such as gas or repairs. One participant stated that after rent and food "everything else is kind of like back burn," meaning that other bills can be missed or delayed until after rent and food are paid for.

Theme 2: Being food insecure negatively affects academics (individual level): Another individual level factor was the relationship between being food insecure and academic performance. Five participants agreed that being food insecure impacted their academics, as being hungry made it harder to concentrate on school. This added to the stress of trying to do well in school. One participant stated, "I think just being in that position where it's tight, and you don't have it [money], and you don't feel secure, it's a stress. You're always feeling it at the back of your mind." They were saying it was hard to focus on academics because of the additional stress of not having enough food.

Theme 3: Family and friends are a food resource (interpersonal level):. At the interpersonal level, five of the six participants mentioned family members when asked what they did when they did not have enough food to eat. Four participants mentioned their own parents. They shared that they are comfortable asking their parents for help with meals when needed. They also shared their gratitude for parents who were generous with food or money. One participant shared "I'll tell my mom and then like, go eat dinner at her house." Another participant mentioned that "we will bank on family meals with them to scrape by." Participants remarked that they could depend on family when they were short on food.

Theme 4: Children are prioritized over parents (interpersonal level): Another interpersonal level factor was that parents made food decisions based on their children. When asked about strategies they use when there is not enough food in the home, four of the six participants shared

that they first ensured that their children had enough to eat. These participants talked about eating less so their children could have more. They mentioned skipping meals as well as taking smaller portions for themselves. One participant said "I just made sure my kids eat first." Another participant mentioned that they and their partner would wait until the kids were done eating, and if there was no more food left, they said "at least the kids are fed."

Participants discussed the struggle to keep up with their children's food preferences and appetites. One participant lamented that her toddler was no longer interested in baby food and had developed a big appetite for perishable foods, which were hard to keep stocked. Another participant mentioned that even though her children received free meals at school, the children still wanted to pack snacks and other food to supplement their meals. They also mention that having limited funds for food make it more difficult to celebrate special occasions such as birthdays and holidays.

Theme 5: Food banks and government assistance programs are helpful, but not enough (organizational level): The organizational factor identified in this study focused on food banks and government assistance programs. Five of the six participants indicated that they visited a food bank to supplement their food supply within the last year. They all expressed appreciation that the food from the food bank was given to them at no cost. When asked if they were given food they typically eat, their responses were mixed. They did note that if a food item was unfamiliar to them, they tried to incorporate it in their meals, or stored it to increase their supply of stored food. Only one participant mentioned that their family doesn't always eat everything given to them by a food bank. Two participants expressed that they "definitely ended up eating it" and "we pretty much ate it all."

Food banks were an important resource for families with limited income. Interestingly, all the participants who reported receiving food from a food bank were participating in at least one government food assistance program. Three of these participants received SNAP, and three had children who received free meals from the NSLP. Those who did not receive SNAP mentioned that they don‘t qualify for the program. The participant with five children specifically mentioned that their SNAP benefits did not last the whole month. The other two SNAP recipients commented that it was harder to make benefits last through longer months than shorter months.

Discussion

This study used open ended questions to solicit strategies college students with children use to increase their household food-security status. Participants noted that cost is a major factor when purchasing food. They relied on their own parents and other family members to feed them or help with food when they run short. They made sure their children ate before they did. Food banks, SNAP, and school lunch programs were good resources, but not enough. These results help to identify strategies that have been successful in increasing household food-security status.

A 2013 paper on child hunger reported that the most common strategies parents who are food insecure used include cutting meal sizes, delaying payment of other household bills, and utilizing public assistance programs (Chilton et al, 2013). These similar strategies were also identfied in this research. Other studies have also reported that those who are food insecure rely on financial stratgies, as well as social networks and food banks to help them get through the month (Alderete, Sonderegger & Perez-Stable, 2018; Kinsey et al., 2019). Affordability is a huge factor when deciding which foods and how much food to buy. Programs that provide financial assistance or low-cost job training could help those who are food insecure.

The high cost of fresh food, especially produce, was mentioned as a concern. One food-based intervention that has been implemented in many schools around the US is a school-based garden intervention (Robinson-Obrien, Story, & Heim, 2009). The purpose of these gardens is to teach children how to grow produce, and these children can then harvest the produce and take them home free of charge. Research has shown that children who participate in this type of intervention are more likely to try a new vegetable and eat more vegetables in the course of a day (van den Berg et al., 2020). Universities could also dedicate a space on campus for a community garden where students could grow and harvest their own produce. A recent literature review found that participants in school based gardens increased their nutritional knowledge and were more willing to try new fruits and vegetables (Charlton et al., 2020).

All participants listed rent as their main priority when allocating their money. Because college students are taking classes, they commonly are unable to work full-time jobs. This limits their income opportunities. Yet, students, including those with families, are expected to pay the market rate for rent. According to the National Center for Student Parent Programs, almost 300 universities in the US currently offer housing for students with families (Green & Galison, 2016). This represents a small fraction of all colleges and universities in the US, which is over 5,000 (Selingo, 2015). Providing affordable family housing at a university is a possible way to increase food security in college student parents. This could, in turn, improve the academic achievement of these students. Five of the participants in this study shared that food insecurity negatively affected their academics. This agrees with previous studies that report that college students who are food insecure have lower academic achievement than those who are food secure (Patton-Lopez, 2014; Gallegos, 2014).

This study also highlighted the limited nature of government food assistance programs. All but one participant used at least one food assistance program, yet these households still met USDA criteria for food insecurity. SNAP benefits are usually given in the beginning of the month, but not every month has the same amount of days. Those who receive SNAP get the same amount of money every month, no matter how many days are in the month. Previous research also found that SNAP participation decreases household food insecurity, but does not eliminate it (Ettinger, 2019). In fact, the Institute of Medicine released a report in 2013 that the current method used to calculate SNAP benefit is inadequate (Caswell & Yaktine). This is especially evident in high cost of living areas, such as Hawai‘i.

Receiving free meals at school through the NSLP was also common among participant's children. Those who did not participate mentioned that they have applied but their income is too high to qualify for the program. That being said, participating in NSLP does not guarantee that the child consumes a high-quality diet. A recent study that used the Healthy Eating Index (HEI) to compare the diet quality of children participating in the NSLP and not participating in the NSLP reported that children who did not partiicpate in the NSLP had a better quality diet (Gu & Tucker, 2017). Even though meals administered through NSLP meet nutritional requirements, these children have limited access to healthy food when they are not in school, reducing overall diet quality.

A positive finding from this study is the beneficial nature of food banks. Even when participants shared that they received food from food banks that they wouldn't necessarily buy, they stated that very little of it was wasted. Colleges could start on-campus food banks, with the goal of giving more food to households that are larger. Food banks usually have a very simple screening process, if any, for those who request food. The barriers to using a food bank are low,

and this is helpful to those who have exhausted all other resources. Food banks depend on food donations, and food banks do not have control over the nutritional components of the food they distribute. Studies have reported low levels of important nutrients, such as calcium and Vitamins A and C, in foods distributed by food banks (Irwin et al., 2007; Jessri et al., 2014). A recent study of food banks in New York City reported that a third of food banks did not carry food items from any of the five MyPlate.gov food groups, which are fruits, vegetables, grains, dairy and protein (Bryan et al., 2019). Even if a food pantry had food from one of these food groups, they were commonly highly processed.

Limitations

There were several limitations to this study. First of all, the sample size was small and consisted of mostly students from one university (4 out of 6). So answers may have been similar because the participants have similar experience. Most of the participants live in Hawai‘i (5 out of 6), so the results may not be generalizable to other areas of the United States. Lastly, the codes were developed by one researcher, so there was some researcher bias in the analysis. Future research should explore ways to include students from a variety of universities. Also, to decrease researcher bias, the interviews should be analyzed by another researcher to improve the reliability of the results.

Conclusion

Parents who are college students have additional struggles because they are trying to provide for a family while on a very limited income. Fortunately, at least for those who participated in this study, they are willing to apply for assistance and ask for help when needed to provide for their children. Those who participated in this study mentioned family as great

sources of help for food. As more parents decide to go back to school, universities could create more programming to address their specific food needs. This could be in the form of rental or housing assistance or a community garden, as noted above. Universities also could sponsor a food bank specifically for students. This will pay off for universities because students will be less worried about feeding their children, and will be able to dedicate more attention to passing their classes and graduating.

CHAPTER 5

CONCLUSION

In this dissertation, three studies were conducted to determine impacts of household food insecurity on different groups of children. First, health and other characteristics were examined health and other characteristics that differentiate food secure and food insecure children in Hawai‘i. Based on the analysis of previously collected data from the CHL Program, children who were food insecure were more likely to be overweight or obese than children who were food secure. The food insecure children were also more likely to have a caregiver who was unemployed or had never completed any college. Regardless of food-security status, only 2-3% of children in the sample were meeting minimum recommended guidelines for vegetable consumption, and 50-60% of children were meeting minimum recommended guidelines for fruit consumption.

Next, a comprehensive literature review was conducted on the relationship between school pantry programs and dietary outcomes in children. This literature review produced only five studies that focused on four different programs. Although two of the four programs were tested with non-rigorous study designs, the results suggest that school pantry programs positively affect diet. Children who participate in programs that deliberately distributed fruits and vegetables increased their consumption of fruits and vegetables and decreased their unhealthy food intake.

The last study was a qualitative study that focused on food-insecure college students who are parents. One-on-one interviews were conducted with these parents, and they shared strategies they used to stretch the limited funds they have to spend on food. Money for food was most often limited because parents paid their rent first. Then, they reported eating less so their

children could eat more, utilizing food banks, and reaching out to friends and family to increase access to food. They noted that constant worry over food and being hungry negatively impacted their academic performance.

Overall, the findings from this dissertation tell us four things. The first main finding is that food security is related to having a low income, especially in communities where cost of living is high, such as Hawai'i. A recent news article gave Hawai'i the distinction of being the most expensive state to live in the US based on housing costs, taxation rate and cost of common household goods (Ross, 2017). Caregivers who are unemployed or did not attend college are more likely to be low-income earners. Attending college is expensive, so pursuing a college degree with limited income is difficult for those who want to raise their standard of living.

The second finding is that food security status is related to overweight or obesity in children. Children who were food insecure were more likely to be overweight or obese. The literature shows that children who are food insecure have unsteady, interrupted access to food, and have diets higher in added sugar, which could influence their BMI (Eicher-Miller & Zhao, 2018). This contributes to the higher prevalence of overweight or obesity in food insecure children.

The third finding is that overall, food assistance programs such as SNAP and food pantries are helpful, but they do not eliminate food insecurity in households. Five of the six participants in the third study participated in at least one government food assistance program, but based on USDA guidelines were still food insecure.

The last finding is that food security status does not necessarily affect the amount of fruits and vegetables children eat. The CHL data from the first study showed that food secure

and food insecure children eat the same amounts of fruits and vegetables. The second study showed that regardless of food security status, children ate more fruits and vegetables when they were offered to them.

Nutritional security is a newer concept that encompasses food security but is a broader term that describes the ability to have safe, physical, nutritional and economic access to food that helps individuals achieve an active and healthy life (Ramaswamy, 2017). Programs and policies that address food security may find that their approach also helps individuals achieve nutritional security.

This study offers recommendations for program and policy improvements. First, food distribution programs such as school pantries and food banks, should increase their focus on supplying fruits and vegetables. Food insecure children in study one were more likely to be overweight or obese, and studies have shown that a diet high in fruits and vegetables are protective factors against a high BMI. The literature review in study 2 also showed that when children are given fruits and vegetables, they are more likely to include them in their diet. They are also less likely to eat unhealthy snacks they eat during the day. They could also offer educational information on the importance of eating fruits and vegetables every day. A recent food distribution program that included health education reported significant improvements in participants' food security, dietary intake, physical activity, health status and depression (Cheyne et al., 2020). Another study reported a positive correlation between a caregiver's level of education and a child's intake of healthy food. They report that this was found in their study as well as previous studies (Dubois et al., 2011).

A policy recommendation is to provide affordable housing assistance to families who qualify for SNAP benefits and other low-income families. This could be in the form of public

housing, or financial assistance. Participants in study 3 all mentioned that paying for housing is a higher priority than buying food. Research has shown that food-insecure households use greater portions of their income on household expenses, which limits the money they have left to spend on food (St Germain & Tarasuk, 2018). Another policy recommendation is for state officials in areas with high housing costs to reconsider the current monthly allotments being distrbuted through SNAP. Even though this is a federally funded program, states determine eligibility. This eligibility is determined using numbers based on the federal poverty limit. A recent report acknowledged that most SNAP participants spend their monthly allotment within the first week of receiving their benefits (Bleich et al., 2020).

A recommendation for future research would be to focus on comparing income level and food security status. Income greatly influences a household's ability to afford food, and this does not always translate into qualifying for a food assistance program. In other words, a household can be food insecure but make too much money to be able to utilize a government food assistance program. This type of research would better inform those who determine the qualification metrics for food assistance. Families whose SNAP benefits were reduced or eliminated because of an increase in income were reported to have an increase in household food insecurity in a previous study (de Cuba et al., 2019). These researchers recommend a buffer program for those who are food insecure but they are eligible for little or no SNAP benefits.

In conclusion, this research has illuminated some of the struggles that households with children face when they are food insecure. This research has also identified strategies that could be implemented to increase household food security status. Based on this research, recommendations are offered to assist those households that are food insecure. Hopefully, this

research will bring about positive change to programs that focus on providing food to children who need it.

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