HOUSEHOLD OBSERVATIONS OF MEALS AND ENVIRONMENT AMONG

COLLEGE STUDENTS (THE H.O.M.E. STUDY)

by

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LIST OF ABBREVIATIONS

Abbreviation	Description
BCB	Bobcat Bounty
BMI	Body Mass Index
FAO	Food and Agriculture Organization
FSLC	Food Security Learning Community
HBM	Health Belief Model
HEI	Healthy Eating Index
HIS	Hispanic-Serving Institution
IRB	Institutional Review Board
PSE	Policies, Systems, and Environments
SCT	Social Cognitive Theory
SDOH	Social Determinants of Health
SEM	Social Ecological Model
SNAP	Supplemental Nutrition Assistance Program
TXST	Texas State University
US	United States
USDA	United States Department of Agriculture
WHO	World Health Organization

I. INTRODUCTION

Over 13.7 million households in the United States (US) struggle to obtain enough food to maintain a consistent, healthy diet throughout the year.[1] This lack of food security within the US is a major public health issue.[1] While the rate of food insecurity decreased from 2011 to 2019,[1] an increase in households being characterized as food insecure is being seen as a result of recent events such as the COVID-19 pandemic.[2,3] The basic definition of food security is that an individual has consistent access to enough food to maintain a healthy lifestyle.[4] Definitions of what exactly constitutes an individual or household being food secure or insecure differs between organizations and governing bodies, however.

College students as a population are more vulnerable to lacking food security compared to the wider US population. Over half of college students receive financial assistance of some kind, and college students are increasingly coming from low-income households.[5,6] Despite this, the share of college-related costs that students must pay for themselves is increasing.[5] Alongside tuition, students must also deal with expenses related to housing, transportation, food, and other necessities.[5]

There have been several studies on the rates of food insecurity among college students along with fewer studies on the reasons why college students have higher rates of food insecurity than the general population.[7] Studies have also been conducted on ways to address food insecurity among college students, and the efficacy of certain types of interventions. However, there is little information about college students and their home food environment. Many studies have been conducted on the relation of the home

food environment and dietary intake of children and adolescents, and the home food environment in relation to the food security status of families.[2,8,9] There is a need to investigate the home food environment of college students and how this influences their health behaviors and food security. The need to investigate the home food environment, household dynamic, and social ecology in relation to college student food security is especially timely and appropriate as studies have found changes in food security status and the home food environment related to the COVID-19 pandemic.[2,3]

II. BACKGROUND

Food Security

Food insecurity is defined by the United State Department of Agriculture (USDA) as the lack of consistent access to safe, adequate, and healthy food due to a lack of resources.[4] When an individual or household lacks the resources, financial or otherwise, to obtain adequate food on a consistent basis, they are food insecure.[4] The Food and Agricultural Organization (FAO) of the United Nations defines food security as having regular access to food that is safe and nutritious enough to support growth and development.[10] The World Health Organization (WHO) defines food security as having both physical and economic access to food on a consistent basis.[11] The definition of food security, and in turn, food insecurity has changed over the years to better encompass the growing understanding of how food security affects the population.

Food security is characterized by certain behaviors, patterns, and factors that define the level of food security an individual or household has. The USDA categorizes food security into four categories: high food security, marginal food security, low food security, and very low food security.[12] High food security is defined as an individual or household having no reported barriers or issues with acquiring food.[12] Marginal food security is defined as an individual or household experiencing anxiety about procuring food, with little to no change in their usual food intake or diet.[12] Low food security is defined as reduction of the quality or variety of the food that is acquired, but little or no reduction in intake.[12] Very low food security is defined as reduction in intake and quality of food along with disrupted eating patterns, including reduced intake.[12] Several specific

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populations are particularly vulnerable to reduced food security, including households with children, pregnant women, and elderly people. Additionally, the lack of consideration of certain populations in the design of assistance programs (e.g., immigrants, populations with multi-generational poverty, and college students) has resulted in their disenfranchisement and reduced food security.[13]

Major Crises and Food Security

In times of crisis and disaster, populations increase their reliance on food assistance.[14] Stressors and major stressful events are associated with increased risk of experiencing food insecurity.[15] For many relying on emergency food assistance during disasters or crises, food security continues to be diminished even after the disaster is over.[16,17] Disasters and crises can directly increase food insecurity among populations through affecting poverty rates, markets, trades, income, and agricultural production.[17,18] Food insecurity rates are associated with economic trends, such an unemployment and poverty rates.[3] Fluctuating and unstable food prices increases the risk of food insecurity, particularly for households that are already vulnerable.[3,19] In February 2020, the average lowest weekly amount a family of four would need to spend on food that allowed for a nutritious diet was $131.50-$150.90.[20] As of August 2020, this increased to $136.20-$156.30 per week depending on the ages and gender of the family members.[21]

Food insecurity has seen a significant increase since the start of the COVID-19 pandemic.[22] The FAO estimates an added 83 to 132 million people globally will be food insecure due to the COVID-19 pandemic.[10] Public health recommendations encouraged purchasing two weeks' worth of food items at a time to limit contact with others.[22] This

type of recommendation presents issues for individuals already unable to purchase food on a consistent basis. Some households have seen changes in food security status or the home food environment during the COVID-19 pandemic.[2] Other factors that make individuals more susceptible to food insecurity and health disparities remain and/or have been exacerbated by the COVID-19 pandemic. For example, Latino/a and Black populations have been disproportionately affected by the COVID-19 pandemic compared to other ethnic groups within the United States.[23] These populations are already at increased risk of food insecurity and nutrition-related health problems, as will be discussed further in this chapter, resulting in the COVID-19 pandemic compounding pre-existing health disparities.

Health Outcomes

In the US, food insecurity is associated with substandard health outcomes and increased burden on societal structures.[24] Food insecure individuals have subpar nutritional intake compared to their food secure counterparts.[25] Food insecure individuals have an increased risk of developing chronic diseases compared to their food secure counterparts, in part due to this inadequate nutrient intake.[26] Individuals who are food insecure have a 21-50% increase for risk of hypertension, diabetes, and cardiovascular disease compared to those who are not food insecure.[24,26]

Living with food insecurity is associated with adverse mental health effects for both children and adults.[27,28] Being food insecure is shown to promote stress, anxiety, and depression in adults,[29] with increased access to healthful foods, particularly fruits and vegetables, being associated with improved mental health.[30] Children living in

households with food insecurity also report feeling worried or anxious about having enough food to eat.[27] These feelings about being able to access food can translate into certain negative behaviors around food and food purchases that continue into adulthood.[31]

Dimensions of Food Security

There are four dimensions of food security that must occur for a person to be considered food secure. These dimensions are availability, access, utilization, and stability.[11,32] Availability is the abundance of food, whether domestically-made or imported, that a person can access.[32,33] Access is the ease of an individual's ability to acquire food.[32,33] Access refers to both the physical and economic ability to acquire food. Utilization is how well the food a person eats can be utilized by the body to ensure that the individual can function optimally.[32,33] Stability is the consistency in which an individual has access to, availability of, and utilization of food. Stability is also defined as the consistency in which an individual is or is not food secure.[33] All of the dimensions of food security can be affected by individual factors, such as job loss, or wider societal factors, such as a recession or a food shortage.[32,33]

Many interventions have focused on improving access and availability as approaches to address food security. The Supplemental Nutrition Assistance Program (SNAP) is the largest program to address availability and access in the US since its original creation as the Food Stamps Program in 1939.[34] In 2020, 20,536,046 households used SNAP, with $74,156,096,76 being spent using SNAP benefits.[35] The education program which aims to be a companion piece to SNAP is SNAP-Ed. This education program primarily focuses on policy, systems, and environmental (PSE) changes.[36] PSE

approaches look to enact sustainable strategies within the levels of the societal structures where people live.[37]

It is important to focus on the dimensions of food security when looking at concepts related to an individual's food security, such as their home-food environment. The home-food environment are the domains of and influences on an individual's household that encompasses food.[38] These domains and influences include the food readily available in the household, utensils and appliances needed to prepare foods, the cultural and societal practices of those in the household related to the consumption of foods, and the physical environment of the household, such as where those in the household consume food.[38]

Measuring Food Security

In the US, food security is measured by the USDA annually through the Current Population Survey through the US Census Bureau survey.[39] The USDA created a survey tool intended to measure the prevalence of food security related to income among households.[39] The US Household Food Security Module consists of 18 questions intended to look at indicators of food security among respondents in order to determine level of food security.[39] From the 18-item survey, other surveys were created by the USDA to be used in situations where time may be limited or the individuals being surveyed are children.[39] This subset of surveys includes the Six-Item Short Form of the Food Security Survey Module, the Self-Administered Food Security Survey Module for Youth Ages 12 and Older, and other variations of the original 18-item survey.[39] Additionally, throughout the US scholars and public health programs have attempted to

measure food security using assessments. The efficacy of the current USDA surveys and other assessments has been questioned.[5,40] There is a lack of understanding of different populations regarding their food security.

Characteristics of Food Security

Certain household characteristics are more prominent within households experiencing low and very low food security. Households with children are at higher risk for being food insecure.[1,41] 13.6% of households with children experience food insecurity.[1] Single parent households have higher rates of food insecurity, with single mothers with children being most at risk of experiencing food insecurity.[1,4] Individuals, particularly women, who live alone also have higher rates of food insecurity than those living in multi-person households.[1]

There are certain characteristics that are found to be indicative of food insecurity. Decreased food intake is the predominant characteristic of food insecurity.[12] This decreased food intake tends to be episodic or recurring but not constant.[1] Households experiencing very low food security tend to have disrupted food intake for a few months a year.[1,4] Disrupted dietary patterns are also indicative of having decreased food security. Disrupted dietary patterns can include skipping meals and reducing the portion sizes of meals.[1] People who are food insecure report spacing out the timing of their meals and when they eat, more so than individuals who were characterized as having high or marginal food security.[42] Food insecure individuals also tend to eat more outside the household than food secure individuals.[41,42]

Households with low income spend more than 30% of their income on food

compared to the 14% middle income families spend on food items.[41] Food items

purchased by individuals and households with food insecurity also tend to be lower in

quality, variety, and healthfulness.[43,44] Food insecure households were found to score 10

points lower on the Health Eating Index (HEI), a tool that examines the quality score of a

diet, than food secure households when comparing purchased food items and food items

stored at home.[43] Purchasing and intake of fruits, vegetables, and proteins decreases as

food insecurity becomes more severe.[25,43] Foods purchased tend to instead be high in

energy and low in nutritional value.[25] These dietary patterns are found to be consistent for

households with marginal, low, and very low food security.[43,45] Households experiencing

marginal food security also tend to have more characteristics in common with low and

very low food secure households than those with high food security.[45]

Trends of Food Security

35.2 million people in the US live with food insecurity in some form.[1] As of 2019,

13.7 million households in the United States are categorized as having low or very low

food security, putting the national average rate of food insecurity at 10.5%.[1,4] While rates

of food insecurity were shown to be decreasing from 2018 to 2019,[1,4] the COVID-19

pandemic has potentially led to an increase in food insecurity, both globally and within

the US.[3,10]

Trends of food security have likewise fluctuated through other major events.

Trends in food security also differ between different lifestyles and demographics.

Households with children and households led by single-parents have higher rates of food

insecurity in comparison to the national average rate of food insecurity.[1] Inequities within

society can influence an individual's or household's susceptibility to food security, with certain demographics and regions having higher rates of food insecurity when compared to the national average.

Ethnicity

Racial and ethnic minorities within the US are at an increased risk of experiencing food insecurity.[46,47] Black and Hispanic populations have higher rates of food insecurity compared to non-Hispanic White populations in the United States.[1,47] The national rate for food insecurity in the US in 2019 was 10.5%, while for Black and Hispanic households the average rates of food insecurity were 19.1% and 15.6%, respectively. Black and Hispanic populations are at increased risk of certain chronic diseases related to nutritional intake including obesity and Type 2 Diabetes Mellitus.[48] Food security has also been closely associated with certain health outcomes for Latino/a populations, even more so than non-Hispanic White populations.[26,49]

There is limited data on food insecurity rates among Native American and Alaskan Native populations both outside and within tribal and reservation communities.[50,51] However, these populations have high rates of factors associated with food insecurity, such as lower socioeconomic status and geographical location, which will be further discussed in this section.[50] There are also differing rates of food security within the subpopulations of these racial groups, such as differences between ethnicities and those of differing immigration status.[52,53] Immigrant populations in the United States are at an increased risk of experiencing food insecurity, whether due to financial restraints or a lack of access to assistance programs.[54,55] Undocumented status is also

associated with a higher risk of experiencing food insecurity.[53,56]

Socioeconomic Status

Socioeconomic status is a driver of food insecurity susceptibility. Among individuals and households below 185% of the poverty level, 27.6% are reported to be food insecure.[1] This rate is over double the national average rate of food insecurity in the US.[1] A higher level of education is associated with increased food security, which is considered to be in part due to the association of higher education with higher income.[25] Financial constraints increase risk of food insecurity with food insecure individuals reporting that they do not have enough money to buy food on a consistent basis.[57] Even when socioeconomic factors are taken into account, minority populations still show a higher risk food insecurity than non-Hispanic White populations.[13] This is in part due to geographical location and the surrounding environment of the household.[50]

Geographic Location

Rural and metropolitan areas have higher rates of food insecurity than suburban areas.[41,58] There are similarities and differences in the way food insecurity affects populations in different geographic locations.[59] As urbanization increases, urban poverty and resulting food insecurity related to poverty increases.[60,61] Residents in urban and suburban areas are found to be at higher risk for the double burden of malnutrition.[60] Differences between urban and rural areas are also seen depending on regional location. Southern and Southeastern states tend to have higher rates of food insecurity than the national average rate in the US.[1] 13.1% of households in Texas were found to have low or very low food security, placing Texas above the average rate of food insecurity in the

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US.[1] Unlike other states, Texas also did not see a decline in the rates of low food security or very low food security from 2016 to 2019.[1]

In southern states, rural areas tend to have a higher incidence of food insecurity than urban areas.[62] In rural areas, access to food tends to be a major barrier to food security.[59,62] There tend to be less resources for traveling to reach food for people living in rural areas than those living in urban and metropolitan areas.[63] Food insecure individuals also report shopping at corner stores and discount stores more frequently than their food secure counterparts.[62] These barriers are associated with and further exacerbated when living in a food desert, defined as an area where an individual lives 10 or more miles from a grocery store in a rural area, or more than 1 mile from a grocery store in an urban area.[63]

College Students

To review the complexity of all issues related to college student food security, the micro, meso, and macro levels of the Social-Ecological Model (SEM) will be explored. These domains are the individual level (micro), the social-emotional and social-physical levels (meso), and the policy/institutional level (macro). College students and their food security must be understood at each level to gain a full understanding of why college students are an especially vulnerable population to being food insecure and their means of achieving food security. This section will first discuss the individual level of the college student by detailing what defines the college student population in the US. The relation of food security to the social and physical environments of the college student will be detailed followed by interventions to reduce or address college student food

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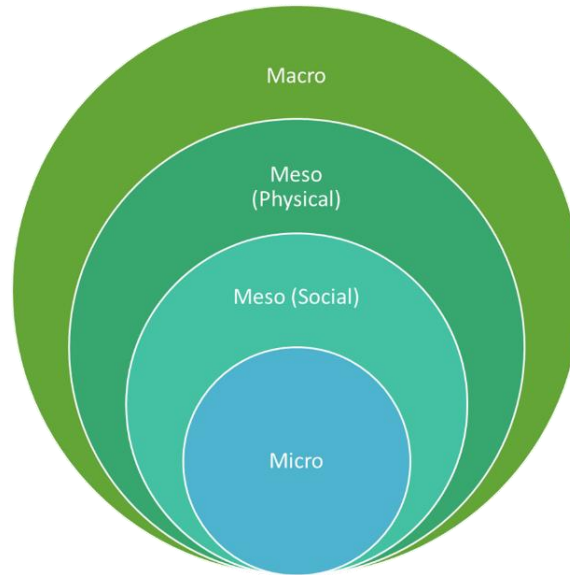insecurity through a policies, systems, and environmental lens.

Figure 1: SEM Model

To understand the complexities of college student food security, we must understand the multifaceted population that encompasses college students within the US. College students are defined as those attending a 2- or 4-year institution in pursuit of an undergraduate or graduate degree.[64] The National Center for Education Statistics estimates that 19.7 million students will be enrolled in colleges and universities in the US as of fall 2020.[65] This total includes both full-time and part-time students as well as students enrolled in distanced learning and in-person courses.[65] While this total is a decrease from projected enrollment rates, data from spring 2020 does not show significant changes in enrollment trends and rates from previous years.[64,65]

Federal data provides information on the demographics of college students within the US. Around 62% of college students are under the age of 25, with the majority in this age-range being full-time students at 2- or 4-year institutions as of 2018.[64] Students aged

25 and older tended to be enrolled in graduate programs.[64] Students under the age of 30 made up to 80% of all college students, whether enrolled in undergraduate or graduate programs.[64] Women make up over 50% of students enrolled in a college or university, for both undergraduate and graduate students.[64,65] The estimate for college students for fall 2020 is that 10.3 million students are white, 3.7 million are Hispanic/Latino of any race, 2.6 million are Black, 1.3 million are Asian or Pacific Islander, .1 million are Native American, and .7 million are two or more races.[65] About 36% of college students had "adult roles".[64] This is defined by the US Census Bureau as being married, being caretakers of children, and/or working full-time.[64] Women had higher rates of having an "adult role" (40%) compared to male students (31%). Female students were more likely to be parents than male students.[64] More data on the sub-populations that make up college students exists through research conducted on college students and their experiences.

This population as a whole has unique needs in many ways and have profound food security needs. 72% of college students in the US receive some form of financial aid.[6] This aid includes scholarships, grants, federal veteran benefits, student loans, and other forms of financial help.[6] Students who are utilizing financial aid are at increased risk of being food insecure than students who do not use financial aid.[66] Accruing debt related to financial aid is also associated with higher rates of food insecurity among students.[66]

College Student Food Security

Since 2015, around 43% of college students experience food insecurity at some point in their college career.[67] Rates of food insecurity varied depending on whether the

student was enrolled in a 2-year or 4-year institution, with students at 2-year institutions experiencing a slightly higher rate of food insecurity than those at 4-year institutions.[67] College students are a vulnerable population with increased susceptibility to food insecurity.[68-70] College students have a higher rate of food insecurity when compared to the general population.[7] Across universities and college campuses in the United States, the average rate of food insecurity is 32.9%, with some colleges having even higher rates of food insecurity among their students.[69]

Many food assistance programs, such as SNAP and some regional food banks, routinely exclude college students from being allowed to participate in or utilize their services.[5,7] College students are restricted from participating in SNAP if they are enrolled in more than half the hours to be considered a part-time college student.[5] Food insecurity negatively affects college students by lowering nutritional intake, decreasing academic performance and negatively affecting health outcomes, both long-term and short-term.[68,71]

First-year college students can be particularly vulnerable to experiencing food insecurity due to being in a state of transition.[69] When looking at freshmen at an Appalachian college, students were found to be up to three times more likely to experience food insecurity while at the college campus than they were when living with family.[70] A 10-item Adult Food Security Survey Module and an 18-item Household Food Security Survey Module were given to 494 college freshmen at the university to measure their rate of food security throughout the their first year of college and while they were living with family.[70] The students' coping measures for dealing with food insecurity were also measured.[70] The freshmen considered to have low food security or very low food

security were found to be adversely affected by their lack of food. These students who were food insecure were scored lower than students who were food secure on an academic progress test.[70] Moreover, food insecure students were noted to have asked for additional resources and aid in obtaining food, nutrition education and financial budgeting.[70]

When looking at college freshmen in a southwestern college, 209 students took a 128-item survey on food access, demographics, food habits and other items to assess level of food security.[72] Freshmen were still found to be at an increased risk for food insecurity, with 32% of freshmen being considered as having low or very low food security and 37% of students overall stating they had experienced food security at some point in the previous three months.[72] These findings show food insecurity among college students is prominent regardless of the region in the United States where the college is located.

Most studies on food insecurity among college students focus on undergraduate students and their experiences.[73] It is important to note that graduate and undergraduate students may not face the same barriers to food access and levels of food insecurity as each other. A study was conducted on 4,819 students at a University of North Carolina at Chapel Hill to determine the differing characteristics of food security between graduate and undergraduate students.[73] Students were asked to complete a 10-item AFSSM and provide demographic information about themselves.[73] It was found that undergraduate students experienced slightly higher rates of food insecurity (25.2%) compared to graduate students (17.8%).[73] The factors influencing the food security status of graduate students differed than the factors associated with undergraduate students in many

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studies.[73] For graduate students, food security status was associated with marital status, enrollment status, body mass index (BMI), and whether they had children.[73]

COVID-19 and College Student Food Security

During the pandemic, unemployment rates have been highest among adults aged 18 to 24 years old.[74,75] There were 12 federal-level, unique bills that addressed college food insecurity in some way during the 2019 to 2020 legislative session.[74] There have yet to be any bills aimed at addressing college food insecurity that may have arose during the pandemic.[74] Many college students were also unable to receive aid through stimulus packages due to still being claimed as dependents of their parents.[75] Two bills have been introduced to address college food insecurity: The Emergency Ensuring Access to SNAP (EATS) Act (H.R.6565), and the End Pandemic Hunger For College Students Act (H.R. 6756). These bills would allow for college students to be eligible for further federal food assistance programs that they may have otherwise been unable to access due to eligibility requirements.[74]

Inequities that increase an individual's susceptibility to food insecurity also remained during the COVID-19 pandemic, with many of those determinants being exacerbated by confounding health disparities.[74,75] When looking at students in Houston, Dallas, and Denton, Texas, upwards of 52.7% of students experienced low or very low food security during the COVID-19 pandemic.[75] Many of these students were classified in minority population categories (Black, Latino/a or Hispanic, and Asian/Pacific Islander) and/or single parents.[75] Students who have experienced exogenous shock or strife are also at a higher risk of becoming food insecure.[66]

Built Environment

The built environment refers to the physical surroundings of where a person lives and experiences life.[76] The built environment influences health on both an individual and community level.[76,77] Physical activity and other health behaviors are influenced by an individual's surroundings.[76,77] The built environment can be an indicator of food security in terms of an individual being able to access healthy food on a consistent basis.[78] Environments that have supermarkets lead to healthier dietary practices among individuals living in those areas.[79] Food insecure households routinely spend more money purchasing food items at convenience stores than at grocery stores.[43]

When looking at college students, the built environment is a major factor in the dietary choices of students.[80] There are differences in the dietary habits when students are living and dining on campus versus when they are living off-campus.[81] College campuses usually contain dining halls or centers along with small convenience stores.[82-84] While dining halls and centers on campuses tend to have a wider availability of healthy food options for students to choose from,[81] environmental assessments have found that on-campus and surrounding stores either have less healthy food options available or have healthy food options at a higher price than other food items.[83,84]

Home-Food Environment

Currently, most research on the home-food environment and food security is focused on adolescents.[81,85,86] These studies have found that the home-food environment could have a higher influence on nutrition intake of those in the household than the surrounding community and built environments.[9] There is, however, little information on

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both the home-food environment of college students and how the unique home-food environment of college students affects their food security. Studies that do focus on college students and their home-food environment primarily examine on-campus living residencies such as dorms.[85] Further research is needed to describe the home-food environment of college students and its relation to their food security.

Interventions

PSE Changes to Address Food Insecurity

As previously mentioned, PSEs look to enact sustainable strategies within the levels of the societal structures where people live.[37] Interventions to address food insecurity among college students have been conducted on multiple levels, with varying success and longevity. Government-level policies have been passed in some states to address food insecurity among college students. California passed SB 85, a bill intended to help colleges and universities fund food insecurity interventions for their students.[87] Likewise, in 2019, New Jersey enacted bill A4702 which created a grant that could be used to fund initiatives to fight food insecurity on college campuses.[88] Bills and policies have also been amended or created to address college food insecurity during the COVID-19 pandemic, such as changing SNAP eligibility to better allow college students to utilize those services. These will be further expanded upon when discussing college food security during the COVID-19 pandemic. Institutional-level policies at some colleges have been created to address difficulties students may face. For example, the University of Houston offers a general Meal Plan Scholarship and the Urban Experience Program Sysco Meal Plan Scholarship to lessen the burden of acquiring food on students and to

aid students that are already facing food insecurity.[89,90]

System-level interventions have been initiated to create sustainable ways of addressing food insecurity among college students. An example of this type of intervention is the Swipe Out Hunger Initiative started at the University of California in Los Angeles.[91] Swipe Out Hunger has partnered with universities and colleges across the US to participate in "swipe drives" where students can donate leftover meal swipes.[92] An environmental level change is the establishment and/or changing of the food resources available to students on the campus they attend. This could include the establishment of free food markets, such as the one that has been implemented at Portland State University by the Committee for Improving Student Food Security.[93]

Food Pantries on College Campuses

An emerging environmental intervention has been the creation of food pantries located on college campuses. Students routinely listed a lack of resources as a barrier to food security.[69,70,72] Campus food pantries have become a means of addressing this barrier and food insecurity among college students.[67] While campus food pantries exist on college campuses, their utilization by students is not always consistent, however.[94] A limited number of articles on food pantries on college campuses and their efficacy exists within the literature. When looking at 899 undergraduate and graduate college students across different colleges and universities, there was a discrepancy between students' knowledge of the existence of a food pantry on their campus and their use of the food pantry.[94] Despite 70% of students saying they were aware of a campus food pantry, only 15.6% of students had made use of the pantry.[94] Those students who did use the food

pantry were more likely to have been rated as having low or very low food security.[94]

More research is needed on the efficacy of on-campus food pantries as an intervention for

college food security and how to encourage students to utilize them. The table below

summarizes the aforementioned interventions.

Table 1: Interventions to Address College Student Food Insecurity

Type of Intervention	Examples
Policies[35-38]	• California SB 85- Help colleges and universities fund food insecurity interventions for their students • New Jersey bill A4702- Grant that could be used to fund initiatives to fight food insecurity on college campuses • Changes in SNAP eligibility due to COVID-19 pandemic • University of Houston- Meal Plan Scholarship and Urban Experience Program Scholarship
Systems[39,40]	• Swipe Out Hunger Initiative
Environments[41,42]	• Portland State University- Free Food Market • On-campus food pantries

Approaches at Texas State University

At Texas State University (TXST) at San Marcos, college student food security is

being researched by the Food Security Learning Community (FSLC). The FSLC is made

up of two faculty directors, graduate thesis students, graduate student coordinators,

dietetic interns, independent student researchers, undergraduate research and operations

interns, and volunteers. The FSLC primary goal is to get a comprehensive understanding

of college food insecurity at TXST while conducting projects that allow for students and

interns to engage in community research and intervention development.

The FSLC has included several projects, most notably Bobcat Bounty (BCB).

BCB is a student-led, on-campus food pantry that provides a sustainable approach to

providing emergency food assistance. Through its partnerships with organizations like

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the Hays County Food Bank, BCB provides its clients with food and necessities, along with nutrition education. Other projects undertaken by the FSLC include Project Food Locker, a project to provide food assistance to military-affiliate students, and the Household Observations of Meals and Environment (HOME) Study which aims to gather a more comprehensive understanding of the experiences of food insecure college students through observation of their home-food environment, the assistance they utilize, and other factors related to their food security while attending TXST.

The approaches of the FSLC have followed the evidence-based Nutrition Care Process and theoretical frameworks for assessment, planning, intervention, evaluation, and policy recommendations. Through an ongoing assessment process, the FSLC has identified unique characteristics of college student food security, the home food dynamic, inter-personal relationships, and behaviors. These unique dynamics of college student food security are under studied and sparsely represented in the literature. A recent surge of college student food security literature can be found in prominent nutrition and public health journals from 2014 to present. These studies have begun to establish a case that college student food security demands policy, systems, and environmental approaches, the dearth of evidence exists for the suggested approaches needed. Furthermore, unique attributes of this population, their knowledge, attitudes, beliefs and self-efficacy, their built environments need to be described.

What Is Missing

There have been limited studies on food insecurity among college students specifically.[72] There are even less studies on how campus food pantries have or have not

worked as an intervention or protective measure in reducing food insecurity on college campuses. There are few studies looking at the home environment of college students regarding food. There is similarly little literature on the food insecurity of college students and resources they utilize during times of crisis. There is a need for studies on the home environment of college students in relation to their food security. Measurements of food security and previous research tends to only consider households as having pooled income or shared food. There is little research on living situations where household income is not pooled or food is not shared among all individuals within the household, a living situation that is not uncommon among college students.[81]

Theoretical Framework

An appropriate theoretical framework to describe the college student food security dynamics and home food environment must include concepts of intrapersonal, interpersonal, and community health and planning theory. The SEM, originally developed by Bronfenbrenner and later translated to a framework for obesity prevention by Story and colleagues provides a context of the interrelated spheres of influence of a concept such as food security. Additionally, a framework can be informed by the social determinants of health as a rationale to investigate college student equity. To begin this discussion, the following combined theory model is illustrated in Figure 2. The figure has been created using constructs from the Social Cognitive Theory (SCT), Social Ecological Model, the Health Belief Model (HBM), and the Social Determinants of Health (SDOH). Being informed with the above literature on the college student population defined as a high school graduate who is attending a 2- or 4-year higher education institution on a part-time or full-time basis at an undergraduate, graduate, or certificate level.[5]

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Figure 2: Combined Theoretical Framework Model

The theoretical constructs used in this study are depicted in table 2 as part of the combined theoretical model. The SEM houses the domains of food security and how the different domains interact from the individual to meso to macro levels. The SDOH describe the disenfranchisement and barriers that affect college students at the individual and meso levels. The HBM expands upon the individual level to describe what college students experience while navigating their food security journey. The SCT explores the interaction between the individual and meso levels, and the human behaviors (knowledge, attitudes, and beliefs) of college students and how those impact the food security of students.

Social Ecological Model

The SEM has been used as a basis for the conceptual framework of health

promotion programs since its conception in 1988.[95,96] The SEM allows for an

understanding of how different factors affect and are affected by behavior while also

acting as a guideline for the development of programs trying to exact change.[95,96]

Examples of health promotion programs that have used the SEM as a basis for exacting

change include the Dietary Guidelines for Americans and the SNAP-ed program.[97-99]

This model was created to address criticisms of health promotion activities

focusing solely on changing individuals' health behaviors as a means of exacting change

in health status.[96] This form of health promotion activity can result in a form of victim-

blaming that treats ill health as a personal failure, and ignores the societal and

environmental factors influencing the health status of individuals.[96] The SEM instead is

an ecological model, as proposed by Urie Bronfenbrenner, combined with models that

focus on individual behavior to gain a more comprehensive look at the influences on an

individual's behavior.[95,96] The systems in the SEM emphasizes are as follows:[95,96,100]

- *Individual*, defined as the characteristics of the singular person. These
  characteristics include knowledge, attitudes, skills, beliefs, behaviors, and
  self-concept.
- *Interpersonal*, defined as the primary social networks and close support
  systems of the individual that can be used to define one's social identity.
  These can be formal or informal and include family, friend, and work
  networks.
- *Organizational*, defined as social institutions with policies, rules, and
  regulations on how they operate. These can include work, school, and
  religious or other groups.

- *Community*, defined as the relationships and social networks between institutions, organizations, and other informal networks.

- *Public Policy*, defined as the laws and policies on the local, state, and federal levels.

The SEM has been used both to assess variables related to an individual's or community's susceptibility to food insecurity and nutrition-related health outcomes, as well as to assess responses and intervention strategies by public health entities.[101,102] The SEM is applicable to this study in assessing the different levels of influence on the participants' behaviors and beliefs related to their food security and utilization of resources. As shown in the integrated model, the SEM acts as the overarching framework that other theories can be integrated into to form a comprehensive approach to studying the food security of college students.[103] This model provides a framework to examine approaches to address the components of food security.

Social Determinants of Health

The SDOH are the way in which the social environment influences the health outcomes of people.[104,105] Social determinants include access and quality of healthcare and education, social and community context, economic stability, and the built environment.[104,106] More awareness of the SDOH and how they affect health beyond an individual's actions started in the 1970s and 1980s.[103] SDOH were brought into theoretical frameworks to describe the social, political, and economic influences on health and behavior.[103]

The SDOH describe disenfranchisement and barriers, and have been used

extensively when researching factors that make households and individuals more susceptible to being food insecure.[107] In a similar manner, the SDOH are being used in this study to help characterize the sociodemographic characteristics of the participants and how those characteristics influence their home food environment and food security levels. These determinants complement the theoretical backbone of the SEM. Each level of the SEM will vary based on the SDOH that exist. This provides a framework to discuss equity in college student food security.

Health Belief Model

The HBM is one of the first and one of the most widely utilized theories when looking at health behaviors.[95,108] The HBM was proposed to help understand why people make certain choices regarding actions related to their health, such as seeking preventative health services.[95,109] When observing health behaviors, there are six constructs that can be used as predictors: perceived risk severity; perceived risk susceptibility; benefits to action; barriers to action; self-efficacy; and calls to action.[110] These constructs as related to health and health behaviors are defined as follows:[95,108,109,111]

- *Perceived susceptibility*: A person's perceived risk of becoming ill or contracting a certain health condition
- *Perceived severity*: A person's perception on how negatively the health condition will affect them or the perceived negative outcomes of the condition

- *Perceived benefits*: A person's perception on how their actions will reduce the risk of contracting a health condition or lowering the perceived risks of the condition

- *Perceived barriers*: The barriers or costs a person perceives they will be faced with when undertaking and maintaining a certain health behavior

- *Calls to action*: Internal or external cues to instigate a change in health behavior of the person

- *Self-efficacy*: The belief a person has that they can enact change to reach a desired outcome

The HBM has been applied to college students and their intended health behaviors and practices. A study was conducted on the nutrition knowledge and intended health behaviors of 251 college students through an online survey.[112] The study looked at the intentions of students to engage in healthful behaviors, either physical activity or healthy eating, based on their perceived benefits and barriers to eating healthy food.[112] The results found that students who saw a high benefit in eating healthy along with a low barrier to being able to eat healthy were more likely to express intent to engage in healthful practices.[112]

The constructs of the HBM can be used to interpret the individual-level factors of college student food security. The HBM provides insight into the perceived barriers and benefits participants have towards utilizing assistance both before and during the pandemic. The HBM expands within the individual level of the SEM regarding what college students are experiencing while navigating their food security journey.

Social Cognitive Theory

The SCT is a common behavioral change and health intervention theory.[95,113] The theory is based on the belief of health being an individual and societal issue.[114] The theory was proposed by Albert Bandura to explain that the actions of a person are based on the dynamic and reciprocal interactions of three components: personal factors; behavior; and environmental factors.[95,113,115] In this way, a person can both enact change and respond to change, referred to as reciprocal determinism.[95,116] The agency of the person is at the core of Bandura's SCT.[117] He describes the SCT through different modes of agency that a person can learn through: personal agency; proxy agency; and collective agency.[117,118] These components of the SCT can also be defined as people learn through their own experiences, by observing the actions of others, and by seeing the results and/or consequences of those actions.[95,113] Bandura puts forth that self-efficacy is the central belief by which people can exact change for themselves.[114] Other factors that influence the aforementioned interactions include self-regulation, reinforcement, and observational learning.[95,113,118,119] These factors include: self-efficacy; reinforcement and punishment; observational learning; collective efficacy; outcome expectations; knowledge; normative beliefs; social support; barriers and opportunities; behavioral skills; and intentions.[103]

SCT was used to guide the study through understanding and analyzing a college student's personal cognitive factors and the surrounding socioenvironmental factors as they pertain to the student's food security status and experience during the COVID-19 pandemic.[103] SCT has been previously applied in research on college students in conducting interventions on college student behavior in relation to certain health behaviors, primarily physical activity.

The main constructs of the SCT being applied in this study are the concepts of self-efficacy and social support. Social support is the support an individual believes they are receiving from their surrounding social network.[103] Self-efficacy is the key construct of both the SCT and other health behavior models.[103] Self-efficacy is defined as the confidence in the ability of an individual to enact the desired change through their knowledge, actions, and behaviors.[103] Previous research on interventions targeting food insecurity have found that individual-level self-efficacy is associated with food security.[120] This study is aiming to see how the participants' self-efficacy influences their decisions in regards to their food security. For example, the SCT theorizes that self-efficacy is based on the previous experiences of an individual.[103] As such, participants were asked about their previous experiences with food insecurity and how those experiences have influenced their current behaviors and beliefs.

As displayed in figure 2, the aforementioned theories are combined to form a framework to better understand and describe the college student food security experience. The following table summarizes the different theories and how they relate to the purpose and goals of the study.

Table 2. Combined Theoretical Framework Summarization

Theory	Relation to Study
Social Ecological Model	Acts as overarching framework
Social Determinants of Health	Describe the sociodemographic characteristics of the participants and how those characteristics influence their home food environment and food security levels
Health Belief Model	Providing insight into how the participants make certain choices regarding their food security and health; Provides insight into the perceived barriers and benefits participants have towards utilizing assistance both before and during the pandemic
Social Cognitive Theory	Concepts of self-efficacy and social support; Interactions between human behaviors, individual factors, and environmental factors

Research Purpose

There is a lack of research on the home food environment of college students, the determinants of food insecurity among college students, and the support structures college students do or do not utilize to ensure their food security. A study is needed to pull all of these together and work with the combined theories of the proposed framework model to gather a better understanding of college student food security. This research study aims to classify the characteristics and determinants of food insecurity among college students and to understand the home food environment of the college student in relation to their food security.

Study Aims and Objectives

- Describe the food security safety net of college students
- Describe the characteristics of the home food environment that lead college students to be food secure or food insecure
  - Participants will be asked about categories of their built environment through weekly prompts

- Describe what promotes food security within college students struggling with food insecurity

    - Participants will be interviewed and asked about their perceived facilitators and barriers towards food security

<center>**III. METHODS**</center>

Conceptualization of Study

This study is a continuation of previous research conducted the FSLC on food insecurity among college students. A previous study was conducted on the factors needed for sustaining an on-campus food pantry.[121] This study aims to build on the establishment of the on-campus food pantry to understand the characteristics of the participants who utilize the food pantry.

Obtaining IRB approval

An application for approval of the study by the Institutional Review Board (IRB) was opened on June 24, 2020. The pre-interview survey, interview guide, photo-texting prompts outline, and end of project survey outline were created and submitted to the IRB over the course of the following months. Approval for the study (#7319) was obtained from the IRB on August 13th, 2020.

Recruitment and Pre-interview Survey

A convenience sample was used for the study. Participants were recruited from a pool of Bobcat Bounty spring, summer, and fall 2020 participants who gave their email information to be contacted. Participants were also taken from an End of Semester survey asking if they would like to participate in a research study. Recruitment for the study was done in stages via email. For the first stage, 26 Bobcat Bounty participants were emailed. For the second stage, 50 Bobcat Bounty participants were contacted. For the third stage, another 50 participants were contacted via email. Participants were also recruited through

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Bobcat Bounty social media (Twitter and Instagram). If participants expressed interest in partaking in the study, they were then emailed a pre-interview survey with a consent form.

The pre-interview survey consisted of 19 questions and was administered through Qualtrics. Information collected during previous research conducted by the FSLC from an outcome survey that gathered information on participants who utilized the on-campus food pantry was used to inform questions. These questions asked about the demographics, living situation and assistance usage of the participants. Demographics included questions on race/ethnicity, age, gender identity, and enrollment status. The survey also included the USDA six-item short form to assess household food security.[122] Some language of the questions were changed to better fit the target demographic of the participants, such as changing "in the past six months" to "over the last semester". Interview scheduling was included at the end of the survey. Recruitment was continued until 18 participants (n=18) had taken the pre-interview survey and scheduled an interview. Inclusion criteria were that participants needed to be college students currently enrolled in the fall 2020 semester, were between the ages of 18 and 30, and had participated in Bobcat Bounty at least once. Participants were excluded if they were not TXST students or were not currently enrolled.

Interviews

To gain a better understanding of the determinants of college student food insecurity before and during a time of crisis, semi-structured, in-depth interviews were conducted with participants (n=18). Interviews were conducted with participants upon

completion of the pre-interview survey and scheduling of an interview date and time.

Interviews were conducted via Zoom to remain in-line with social distancing and safety

protocols. An interview guide was created to conduct semi-structured, in-depth

interviews with participants on their home environment, living situation, and food

security before and during the pandemic. The methodology for the interview was guided

by Kvale's and Brinkmann's InterViews Third Edition.[123] The interview was scripted

using theoretical constructs to guide what information was being collected by

participants. Questions were minorly adjusted during interviews to gather a better

understanding of the participants' responses while still following the guide.[123] Interviews

took 30 minutes to 1 hour to complete, with an outlier interview taking 2 hours to

complete. Once a participant completed an interview, they were given an incentive of an

electric kettle. Following completion of the interview, interviews were transcribed and

then coded to find key constructs and emerging themes from the responses. A code list

was created to identify common themes participants relayed during the interviews.[123]

Table 3: Interview Guide

Interview Question	Select Constructs
• **Where have you been receiving support regarding food from during this time?** • Follow-up Questions: *Are you using other food assistance programs during this time besides Bobcat Bounty? What food assistance programs, if any, were you using before the pandemic?*	
• **Do you know about financial resources that are available for you to benefit from?** • Follow-up Questions: *What TXST resources have you used? CARES Act? Emergency*	

Services? Counseling Center? What has been the most helpful method for you to receive information on the resources available to you (twitter, Instagram, Facebook, hard copy, email, text/phone call)? Why has that been so helpful?	
• **Are there other resources, not related to food or finances that you have had to utilize during this time, such as childcare services or counseling and mental health services?**	
• **Describe your family/friend network.** • Follow-up Questions: *How have they helped you in this situation?*	• Social support (SCT)
• **How would you describe your current household? Who is in your household? How has your living situation changed since before the pandemic?**	• Social support (SCT)
• **Do you cook and share meals with others in your household? Do you cook and share meals with any members outside of your household?** • Interview Notes: *Get participant to thoroughly describe the change in their home food environment before and during the pandemic*	• Social support (SCT) • Interpersonal support (SEM)
• **Are there any times, before you started college, when you had limited or no access to food? Please expand on this experience.** • Follow-up Questions: *How has this impacted how you plan today? Have you learned any skills/methods to help you through this time?*	
• **Walk me through how you would usually get food before the pandemic.** • Follow-up Questions: *What stores would you go to? How did you get to the stores? What types of food would you buy?*	
• **Now please explain your experience in getting food during COVID-19.** • Follow-up Questions: *What stores do you now go to? What forms of transportation do you*	• Self-efficacy (SCT) • Organizational support (SEM)

now use? Have you been using curbside pickup? Why did or didn't you choose to use these services? Were you able to get adequate food for your needs? Why or why not? What were your feelings of safety during the process of getting food for yourself/your household? Are you able to go to the grocery store as frequently as you need to?	
• **What meals have you prepared with food from the modified Bobcat Bounty distributions? Please note that the modified distributions have been taking place since March 23rd.** • Follow-up Questions: *Were there any food items you received that you were not able to use? What could have helped you to use these items? About how many meals per week were you able to cook with the foods from Bobcat Bounty?*	
• **In what ways has Bobcat Bounty been a helpful resource during this time?** • Follow-up Questions: *What non-food items from Bobcat Bounty have you received? Have you been able to make use of them?*	• Community support (SEM)
• **Describe the barriers you have faced during COVID-19 when cooking for yourself or those living with you.** • Follow-up Questions: *Do you have the adequate utensils to prepare foods? What cooking recipes/sites have you used? What food waste, if any, have you experienced with the foods/meals that you prepare?*	• Perceived barriers (HBM)
• **What kinds of foods do you usually keep stored in your pantry at home? Has this changed during COVID-19?** Follow-up Questions: *How adequate is the amount and variety of the food you have now? Does this food fit your dietary preferences?*	
• **How has your dietary intake changed during this time?**	

• Follow-up Questions: *How motivated do you feel to cook/prepare foods? Do you have the desire to eat healthy options? What do you consider to be "healthy" during this time? Are healthy food options easily available to you?*	
• **We understand that with the shut-down of businesses, and enforcement of social distancing, this time period has caused much change. How has this impacted your ability to carry out your normal daily activities?** • Follow-up Questions: *What normal activities are you no longer allowed to partake in?*	
• **Have you felt an increase or decrease in your ability to cope with stress? If so, please explain how you have adapted to this change.** • Follow-up Questions: *How have your coping strategies changed from before the pandemic? What have been the major stressors in your daily routine? What are any new activities/practices that have helped you to cope during this time?*	• Self-efficacy (SCT)

6-Week Photo-Texting of Home-Food Environment

Photo elicitation as a method was decided based upon previous research. Photo-texting as a method of home assessment has been found to be an effective assessment tool that participants view positively.[124] The prompts for each of week of the study were based off previous studies on food security and combined into a six-week format. Follow-up questions to gain a better understanding of the participants' situation and clarification was asked of participants for what they chose to photograph to fit the prompts they were given. After completion of certain prompts, participants received an incentive.

For the first week, the participants' home-food environments related to the

preparation and storage of food were investigated. Participants were asked to photograph areas in their household where food was prepared, stored, and cooked. A follow-up question was asked about how often they cooked per week. For the second week, participants were asked to photograph and detail the perishable foods that currently had in their household. The third week followed a similar theme by asking for participants to photograph and detail the non-perishable foods and food items they keep stocked.

For the fourth week, participants were asked to photograph the utensils and appliances that they use to make and eat food. This list is based on previous research on food security and ownership of household food preparation equipment.[125] Unlike the previous studies, participants were not required to answer how often they used the appliances and utensils.[125] For the fifth week, participants were asked to photograph what they were currently experiencing in regards to dining and eating food. Follow-up questions were asked regarding the barriers they face during this time when acquiring or preparing food and what influences their food choices.

The sixth week was focused on wrapping up the study. This involved making up any prompts that participants may have missed or asking for clarification on previous prompts and follow-up questions. By the end of the 6 weeks, some participants had not fully responded to all prompts. Participants were contacted to try and finish out the prompts. 14 participants had responded to all prompts that had been given (n=14), 3 participants had responded to some prompts but not all (n=3), while 1 participant did not respond to any of the photo-texting prompts (n=1).

Table 4: Photo-texting Schedule

Week	Prompt	Follow-up Questions
1	For the first prompt, you will be taking pictures of the areas where you make, store, and prepare food that is available to you. Take pictures of your kitchen, the inside of your fridge or pantry, etc. Think of it as giving a tour! Please don't clean up or censor anything, just take a picture of everything as it usually is. We want to see how it is in the moment!	1. About how much time would you say that you spend cooking and preparing foods in your household?
2	For the second prompt, you will be taking pictures of the perishable foods (this includes fresh fruits and vegetables, meat products, dairy products) that you have in your household. This can be pictures of the inside of the fridge and freezer, and areas of your counter where you might keep food. Please just make sure that we can see the food items clearly. Please take pictures of your food environment as it currently is! We want to see how it is in the moment!	1. Is this the normal amount of groceries you usually have each week? 2. Would you say you know how to use the foods you have photographed? 3. About how much of the food came from Bobcat Bounty? 4. Do you feel this is an adequate amount of food to fit your needs?
3	For the third prompt, you will be taking pictures of the non-perishable foods that you have in your household. This includes canned items, bread/grain products, snack foods (chips, pretzels, cookies, crackers, etc.), baking/cooking ingredients (pancake/cake mix, flour, seasonings, oil, etc.), rice, beans, etc. (You can also look at an item's expiration date. If it does not expire for 6 months or more since when you got it, then it can be considered non-perishable.) Please make sure that we can see the food items clearly. Please take pictures of your food	1. About how long have you had most of this food for? 2. Did you choose any of these foods for a specific reason? (ex. stocking up during the start of the pandemic) 3. Would you say you know how to use the foods you have photographed? 4. About how much of the food came from Bobcat Bounty?

	environment as it currently is! We want to see how it is in the moment!	
4	For the fourth prompt, you will be taking pictures of the kitchen appliances and utensils you have in your household that help you to prepare and make food. This can include cutting knives, an oven/stovetop, an InstantPot or crockpot, eating utensils (spoons/forks/chopsticks/etc.), can openers, pots and pans, a microwave, a sink, strainer, cutting board, etc. You do not need to have these items specifically; they are just examples. Please make sure that we can see the items clearly. Please take pictures of what you currently have! We want to see how it is in the moment!	1. Have you had any items or appliances that were not helpful to you? 2. What barriers or challenges have you experienced when trying to prepare foods? 3. Are there any skills or knowledge that you feel would help you to prepare/cook food? 4. What appliances/utensils do you think would be helpful for you to have? 5. Have you received any utensils/appliances from Bobcat Bounty?
5	For the fifth prompt you will be taking pictures of dining that show what you are currently experiencing during this time in regard to what you are eating. This includes interaction with other people, preparing/eating meals with others in or outside of the household, etc. Please see below for more specific instructions: • Take pictures of 2-3 of the meals (not including breakfast) that you eat this week. This can include meals inside or outside of your household. • Please have at least one of the meals be one that is happening inside your household • Include any person (or pet!) that is also dining with you in the picture (try not to include faces) If possible, please also take a photo of	1. What, if anything, prevents you from having meals during this time? 2. What influences what meals you decide to make and/or eat? 3. Do other people, inside or outside your household, affect the food choices you make? 4. Could you also describe to us the food in the pictures/what meal (dinner, lunch, etc.) they were for/etc. please?

	something that may have prevented you from eating what you wanted to during this time.	
6	For this week, there will not be a specific prompt. Instead, this will be a catch-up/make-up week to send in prompts that you may have missed or that need answers to the follow-up questions. We will be texting you prompts that you missed so that you can complete them this week.	

End-of-project Survey

Following the sixth week of the study, participants were then sent an end-of-project survey to complete. The survey questions pertained to participants' access to food items, beliefs and attitudes towards the food they did or did not have, and feelings towards how the study was conducted. 14 participants completed the survey (n=14).

Analysis

After each stage of data collection, participant responses were cleaned and checked for accuracy to be further analyzed and coded by researchers. Qualtrics survey results were exported to Microsoft Excel. Interviews were transcribed and responses were entered into Microsoft Excel. Relevant quotes were pulled to be coded for construct themes and emergent themes. An inductive coding scheme was created by two researchers who conducted interviews and collected data. Saturation in responses was considered to be 3 or more responses with similar themes, statements, or constructs. Text

responses to the photo-texting prompts were entered into Microsoft Excel, while photo responses were exported to a secure Microsoft Teams site.

Method of coding[123]

Key constructs, common themes, and emergent themes were pulled from interview responses and coded in Microsoft Excel. A code list was created *(Table 5)*, identifying common and emergent themes found during the interviews. A coding list was informed by key constructs of the combined theoretical framework and emergent themes related to coping strategies.

Table 5: Code List

Theme (Code)	
Bobcat Bounty (BCB)	Location (L)
Changes in Food Intake (FI)	Nutrition Education (NE)
Experiences with Food Security (EFS)	Nutrition Knowledge (NK)
Financial Concerns (FC)	Relationships (REL)
Financial Resources (FIR)	Resources, in general (R)
Food Prep (FP)	Safety Concerns (SC)
Food Resources (FOR)	Stress/Mental Health (SMH)
Food Waste (FW)	Transportation (T)
Information (I)	Physical Health (PH)
Information Method (IM)	Lifestyle Changes (LS)
Learned Skills/Behaviors (LSB)	Food Access (FA)
Normal Life Activities (NLA)	Physical Activity (PA)
BCB Food Quality (BFQ)	Healthy Food Options (HFO)
Social Cognitive Theory (SCT)	Emergent Themes (**)
Social Determinants of Health (SDoH)	Health Belief Model (HBM)
Social Ecological Model (SEM)	Policies, Systems, Environments (PSE)

Introduction

The multilevel societal effects of the COVID-19 pandemic have dramatically increased food insecurity for some population groups, including college students.[3,126] Food security, and the lack thereof, is a major public health issue within the United States.[1] Nearly 14 million households in the United States lack access to enough food to maintain a consistent, safe, adequate, and healthy diet throughout the year and are considered food insecure.[1] Between 2011 and 2019, rates of food insecurity in the United States have declined overall.[1]

During times of stress and crisis, food security tends to decrease and reliance on food assistance increases.[15,127] This diminished food security can continue even after the major stressor or event has concluded.[15,16] Populations that were already at increased vulnerability to experiencing food insecurity can be especially impacted by major events. Government assistance programs like the Supplemental Nutrition Assistance Program (SNAP), school lunch and breakfast programs, and the Supplemental Nutrition Assistance Program for Women, Infant, and Children (WIC), attempt to address the needs of low-income households, single mothers with custody, and older adults.[1] Other vulnerable populations have not been considered in the design of assistance programs resulting in disenfranchisement that contributes to reduced food security. These groups include populations with multi-generational poverty, immigrants, and college students.

Since 2015, nearly 50% of college students have reported experiencing food insecurity during college, with college students experiencing higher rate of food

insecurity when compared to the general population.[7,67] Despite this, college students have been routinely excluded from receiving food assistance from both federal and regional programs.[5,7] Many food assistance programs, such as SNAP and some regional food banks, regularly exclude college students from being participating in or utilizing their services.[5,7] College students are restricted from participating in SNAP if they are enrolled in more than half the hours to be considered a part-time college student.[5] During the pandemic, eligibility requirements for SNAP were adjusted to allow for increased college student eligibility,[127] with new guidelines for students further extended through the Consolidated Appropriations Act of 2021.[128] These extensions are expected to end by fall of 2021 with previous SNAP restrictions for college students returning.

During the pandemic, unemployment rates have been highest among adults aged 18 to 24 years old, the predominant age range of college students.[74,75] Many college students are still claimed as dependents by their parents, making them ineligible to receive aid through stimulus packages.[75] As food insecurity negatively affects college students by lowering nutritional intake, decreasing academic performance, and worsening their health outcomes, both long-term and short-term, it is imperative that more is done to address college student food seecurity.[68,71]

The Social Ecological Model (SEM) has been used as a basis for the conceptual framework of health promotion programs since its conception in 1988,[95,96] and can be combined with models that focus on individual behavior to gain a more comprehensive look at the influences on a person's behavior.[95,96] The SEM allows for an understanding of how different factors affect and are affected by behavior on micro, meso, and macro levels.[95,96] The Health Belief Model (HBM) is a widely used theory to understand the

health behaviors of individuals.[95,103] There are six constructs in the HBM that act as predictors of an individual's behaviors: perceived susceptibility; perceived severity; perceived benefits; perceived barriers; cues to action; and self-efficacy.[95,103] Both the SEM and HBM have been used both to assess variables related to a community's or individual's susceptibility to food insecurity and nutrition-related health outcomes, as well as to assess responses and intervention strategies by public health entities.[101,102] The HBM can be utilized to expand upon the individual level of the SEM. This expansion helps to give more description to the experiences individuals face when navigating food security.

Objectives

To describe the levels of support and access, and the coping strategies of students who identified as food insecure during a time of crisis (COVID-19 pandemic), the unique food security safety net that is pulled together by the individuals in this study, and the unique characteristics of food insecure college students and their facilitators and barriers to maintaining food security. The purpose of this study is to provide information to strategically customize interventions to appropriately meet the needs of food insecure college students, specifically during a time of crisis.

Methods

The Food Security Learning Community at Texas State University (TXST) conducts research on food security on college campuses to gain a comprehensive understanding of college student food insecurity. Projects to date have included the implementation of an on-campus food pantry in 2017, Bobcat Bounty. In March 2020,

Bobcat Bounty switched from a client choice pantry to a pre-bagged, curbside distribution model to maintain safety practices recommended by public health officials to mitigate the spread of COVID-19. The Food Security Learning Community has conducted research projects to better understand how college students' food security has been impacted by the COVID-19 pandemic. The Household Observations of Meals and Environments (HOME) Study aims to gather information on experiences of food insecure college students and their food security safety nets through observations of their home-food environment and their utilization of resources.

The HOME Study consisted of multiple phases, starting with an initial pre-interview survey and interviews. The interview phase involved asking participants about their experiences with food security, both during and before the pandemic, knowledge of and access to resources, support networks, and general experiences during the COVID-19 pandemic. These interviews ae the initial phase of in-depth descriptive investigation and are a necessary step in intervention design. Previous research has been conducted by the Food Security Learning Community on the food security of college students. This study builds on a previous study that researched sustaining an on-campus food pantry.[129]

Sample and Recruitment

The intended sample was currently enrolled students at Texas State University, part-time or full-time, who experienced varied severity of food insecurity, including undergraduate and graduate students, in any major, on-campus or commuter/distance students. The study utilized a convenience sample of participants recruited from clients of the on-campus food pantry who had participated in the pantry during the spring, summer,

and fall of 2020. Clients who had provided contact information were emailed with information on the research study and asked if they would be interested in participating. Potential participants were also recruited from an End of Semester survey and via the food pantry's Twitter and Instagram. For the initial survey, eligible participants had to self-report past participation in the on-campus food pantry, food insecurity status, and interest in participating in an 8-week study. Participants were excluded if they were not currently enrolled, were not students at the university, or were not between the ages of 18 and 30. The research team emailed an initial, pre-interview survey with a consent form.

The Institutional Review Board (IRB) at Texas State University reviewed and granted approval for this study (Project #7319). Participants received incentives as they completed each phase of the project. For example, the participants received their first incentive of an electric kettle upon completion of the interview, two more incentives during later portions of the study, and a final incentive after completing the study.

Data Collection

Details on data collection are presented next in order of completion: initial, pre-interview survey, then interviews. Given the COVID-19 pandemic, all data were collected remotely without in-person interaction utilizing web-based platforms and email communication. Data were collected between August 2020 and October 2020. The initial, pre-interview survey was self-administered through Qualtrics and consisted of 19 questions on personal and household characteristics (e.g., enrollment status, living situation), food security status, utilization of assistance programs, and pandemic experiences.

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The USDA six-item short form was used to measure participants' household food security status.[122] This scale is widely used and considered valid and reliable for various households in the U.S. The United States Department of Agriculture (USDA) categorizes household food security based on affirmative responses to the 6 items. There are 4 levels of food security: high food security, marginal food security, low food security, and very low food security.[12] Low and very low food security are considered food insecure.[1,12] The reference period for food security was altered from "in the last 12 months" to "over the last semester" to better capture food insecurity for college students.

After the initial, pre-interview survey, eligible participants completed interviews via Zoom. An interview guide was created by two members of the research team with major questions for the participants' personal beliefs, household environment, food security, and access to resources, including food assistance programs and social support during and before the COVID-19 pandemic. The methodology and creation of the interview questions were guided by Kvale's and Brinkmann's InterViews Third Edition[123] and theoretical constructs. Semi-structured, in-depth interviews lasted 30 minutes to 1 hour. The average interview time lasted approximately 45 minutes, with one interview lasting 30 minutes and another interview lasting 2 hours.

Analysis and Interpretation

Following completion of the interviews, audio of videos was transcribed using Zoom transcription feature, and were then checked for accuracy. Coding was conducted by two coders and a third reconciler. Key constructs, common themes, and emergent themes were pulled from interview responses and coded in Microsoft Excel. A code list

was created *(Table 6)*, identifying common and emergent themes found during the interviews. A coding list was informed by key constructs of the HBM, SEM, and emergent themes related to coping strategies. The code list consisted of three major themes: Support, Access, and Coping strategies. Support was defined as outside forces that supported the participants in having food or other necessities. Access was defined as the ability of the participant to access resources that provided food or other necessities, including physical access, environmental access, or practical access. Coping strategies were defined as methods and strategies participants used to cope with a lack of food security or to achieve and maintain food security. Intercoder reliability was calculated as 78%. Reconciliation of codes was conducted, and codes were collapsed to reconcile differences in perception of themes. The senior researcher was the tiebreaker on code disagreements.

Table 6: Code List

Support
Relationships (REL)
Resources (R)
Bobcat Bounty (BCB)
Food Resources (FOR)
Social Support (SOS)
Access
Transportation (T)
Financial Resources (FIR)
Information (I)
Location (L)
Job Loss/Change (JLC)
Financial Concerns (FC)
Coping Strategies
Learned Skills/Behaviors (LSB)
Physical Health/Activity (PHA)
Lifestyle Changes (LS)
Nutrition Knowledge/Education (NKE)
Experiences with Food Security (EFS)
Normal Life Activities (NLA)

Results

Interview Participants

All participants (n=18) were currently enrolled students between the ages of 18 to 30 years old, who lived off-campus (*Table 7*). Most participants (83%) were female. More than half identified as Black, Latino/a/Hispanic, Asian, Native American, or a combination of races/ethnicities. All participants were categorized as experiencing marginal, low, or very low food insecurity over the last semester according to the USDA's definition.[1] Participants commonly reported Bobcat Bounty as a food resource, and reported uncommon food resources, such as "donating plasma", "apartment complex", and "counseling/mental health services". Two students reported participation in SNAP.

Table 7: Participant Demographics

Characteristic	n	%
Age (years)		
18-19	3	17%
20-23	12	67%
24-30	3	17%
Gender		
Female	15	83%
Male	3	17%
Race/Ethnicity		
Black	2	11%
Latino/Hispanic	8	44%
White	5	28%
Asian	1	6%
Asian, Latino/Hispanic	1	6%
Native American, Latino	1	6%
Food Security Status		
Marginal	3	17%
Low	13	72%

Very Low	2	11%
Location		
San Marcos	17	94%
Outside San Marcos	1	6%

Table 8: Participant Reported Resources

Food Resources	n
Bobcat Bounty	17
Friends and Family	13
Student Emergency Funding	11
Food Banks	7
Religious/Charity Organizations	4
SNAP	2
Public Schools	1
WIC	1

Major *Themes*

Three major themes were identified: Support, Access, and Coping Strategies. Within these three themes, the constructs of the HBM were found to be demonstrated by the participants. The themes of support and access found in participant responses related to their perceived facilitators and barriers in relation to their food security, financial security, and health, both general and mental. The theme of coping strategies was characterized by the constructs of self-efficacy and cues to action.

Support

"Well, my family, it was a huge help because I was able to turn to them when I had to. When they kicked us out, essentially, from the dorms. They were able to help me move the stuff in such short notice and luckily here [at my apartment] we

[roommates] take turns, like grocery [shopping]. We don't have a list or anything

just whoever it's most convenient for will take the opportunity and go grocery

shopping or go to [on-campus food pantry]... We're very compassionate, we help

each other out." (P18)

Within participant responses about facilitators, the theme of support fell into two

categories: social support and systematic support. Social support came primarily from the

participants' friends, families, and surrounding community. Systematic support came

primarily from the university and government assistance.

Social Support

The subtheme of social support was reported by every participant to be a factor in

facilitating and maintaining food security. When questioned about where they found

support in maintaining a food security safety net during college and the COVID-19

pandemic, participants overwhelming responded that social support networks were a

major factor in maintaining food security. This reported social support network included

roommates, friends, classmates, partners, family members, student organizations, and

local churches.

The sharing of food and other food-related resources, including utensils, recipes,

and appliances, was also reported as the primary method of support participants received.

Social support for maintaining food security was also denoted in the sharing of

information about food resources. There was some reporting from participants about

receiving financial support from their social support networks, primarily from family

members, as well. Participant responses of how they became aware of an on-campus food

pantry also centered around their social contacts and networks.

Systematic Support

The primary forms of systematic support reported by participants came through the university's institutional operational structure. Participants listed financial aid in the form of COVID-19 relief funds and mental health counseling provided by the university as the primary means of systematic support. The on-campus food pantry was given as the primary source of systematic food assistance. Participants reported the food pantry as being a necessary resource for maintaining food security for various reasons, including the accessibility of the pantry both in terms of location and signing-up, provision of an abundance of certain food items, particularly fresh fruits and vegetables, by the pantry, an adequate level of safety measures during the COVID-19 pandemic, and the use of the pantry allowing for finances to go to non-food necessities. Participants also reported that nutrition education materials, utensils, and COVID-19 pandemic safety materials were helpful.

Access

"I tried to figure [WIC] out, and I went because of the booth lady that's there sometimes when you're waiting in line. I talked to her about it, and we tried to set it up and I can't remember what went wrong with it because we did it like a year ago. And then we tried to do it again during pandemic stuff but we only have one car in the house and my roommate works so he uses the car all day, so it was a lot of trying to figure out how to get on the Bobcat Shuttle with the new times or the bus with the new times and try to figure out how to work that which kinda made it

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more of a hassle than we could deal with." (P1)

Within participant responses on barriers, the theme of access was found to be split into the subthemes of physical access, systematic access, and access to financial resources.

Physical Access

A common theme among participants' responses to the barriers they faced in achieving food security was a lack of physical access. This was demonstrated by reporting a lack of access to full-scale grocery stores and the Feeding America-affiliated county food bank due to either a lack of transportation, or the changing of store hours due to the COVID-19 pandemic. A lack of physical access was also coded for when participants reported not having the ability or transportation to access food, including being unable to use transportation due to COVID-19 pandemic restrictions or safety concerns. In approximately half of interviews participants cited examples of food restrictions based on food availability and preferences that hindered their ability to maintain a food security safety net.

Systematic Access

Participants reported a lack of access to systematic assistance during interviews. Participants reported being unable to sign up for assistance resources, including SNAP and pandemic relief assistance. When participants reported not being able to access these systematic resources, it was primarily due to a not meeting eligibility requirements or having a lack of knowledge on how to access these resources.

When participants did have access to certain systematic resources, such as the on-campus food pantry, there were still reported barriers. Participants reported some issues with using the food pantry as a resource during the COVID-19 pandemic, specifically. These issues were that of food waste, lack of knowledge on how to use certain food items they had received, and a dislike of food items provided. These issues were reported as stemming from the change of a client-choice pantry to a curbside distribution model. Participants did not report these issues as being a major barrier to their accessing of the food pantry.

Financial barriers

Finally, participants reported a severe hindrance of their financial security due to the COVID-19 pandemic. This hindrance was reported to be due to a lack of access to the usual sources of income and money that participants relied on. This included job loss and reduced hours of pay for the participant or the person they relied on for help with finances.

Self-Efficacy and Cues to Action

"It's definitely like, I like to plan ahead, write down what meals I would like to make. Make a list and try to get as cheap as I can and stick to a budget, so I don't have to worry that much about if I have enough money to eat." (P16)

The third major theme of coping strategies was found in responses that demonstrated the constructs of self-efficacy and cues to action. Participant responses were coded for how the participant demonstrated self-efficacy or a lack of self-efficacy in

how they did or did not find ways to cope with their perceived barriers and stress. Participants routinely reported learned skills and behaviors developed during the pandemic to ensure and maintain their food security and reduce susceptibility to contracting COVID-19 and increasing stress.

The learned skills and behaviors that predated the participants' enrollment at college was a recurrent subtheme within coping strategies. Participants reported that these skills and behaviors enabled them to adapt to their college experience while maintaining food security. Parental and familial support pre-college was reported by participants to influence their current knowledges, attitudes, and beliefs, and the subsequent actions towards how they handle food and other resources. Multiple participants recounted learning cooking and preparation skills from parents, and spoke about how this previous knowledge contributed to their ability to cook while attending college. Participants also talked about previous experiences with food insecurity prior to college and how observing their family members, primarily parents, handled differing levels of food security. Multiple participants who relayed that their knowledge of cooking was learned from their family members, spoke about how this previous knowledge contributed to their ability to cook while attending college. Participants reported how previous experience with decreased food security or use of food assistance programs contributed to their current knowledge, attitudes, and beliefs about maintaining a food security safety net. Some participants, however, noted that growing up with a higher level of food security resulted in them struggling to cope with reduced food security during college.

Participants who did feel more susceptible relayed changing behaviors to minimize their perceived susceptibility to unwanted outcomes, specifically contracting

COVID-19. Participants repeatedly reported finding their perceived need for safety as a cue to change behaviors in accordance with behavioral guidelines and perceived health behaviors that would lower their risk of infection. Participants also talked about feeling cues to action related to their health beyond wanting to avoid contracting COVID-19.

Participants also noted making changes in response to their mental health and general health. When questioned on their ability to cope with stress, some participants felt their ability to handle stress had increased over the course of the pandemic. The reasons given by participants for why they felt this way included the learning of new stress management techniques, having pets, family and/or friends, or dealing with stressful situations previously.

Susceptibility and Severity and Stress

"[Obtaining food] was more unsafe here, in [major city]. I felt more comfortable [in college town] but [in major city] there are just too many people. And especially when masks weren't being implemented and especially when I was around old people, I didn't want to be around them...It was just the amount of people I guess, I didn't like." (P4)

Throughout the themes of support, access, and coping strategies, participants repeatedly reported their behavior as being influenced by beliefs of being susceptible to adverse health outcomes. With respect to how the pandemic has affected their ability to be food secure, multiple participants relayed concerns about their safety while procuring food. Participants reported a change in their purchasing and eating habits during the COVID-19 pandemic. Participants reported their perceived susceptibility to the COVID-

19 virus as inhibiting their ability to access food. Some participants' actions, however, were not hindered by safety concerns as they perceived their susceptibility to illness as being low or non-existent.

Many participants reported feeling vulnerable to increased stress, particularly towards the beginning of the pandemic, with some participants noting feeling a decrease in their ability to cope with stress during the time of the interviews. Reports of perceived stress were related to changes caused by the COVID-19 pandemic, particularly changes to normal daily activities, including the shutdown of public events and spaces, an inability to be in the company of others, and changes related to their education. Few participants reported feeling increased stress related to their food security specifically, and instead reported stress related to finances, safety concerns, or changes related to the pandemic that then influenced their food security. Approximately half of participants reported using counseling services either within the university system or with outside sources and using medication.

When questioned on what they believed to be "healthy food options", if they desired to eat healthy foods, participants displayed varying levels of nutrition knowledge, regarding what "healthy food" was, and many noted a desire to consume "healthy food options". When questioned their access to "healthy food options", participants reported that food items and meals they believed to be healthier were not always accessible to them. Some participants reported being able to access food they believed to be healthy. Other participants reported not being able to obtain access secondary to either financial reasons or the lack of availability.

Discussion

The traditional image of a college student as someone who begins college after immediately graduating high school while working less than full-time and relying primarily on their parents for financial support is no longer the norm for the majority of college students.[5] College students are a vulnerable population that are increasingly coming from lower income and more diverse backgrounds, with 71% of students in the U.S. being considered "non-traditional".[5] The majority of the federal food security safety net programs are designed for households with children, children, or the elderly.

Although college students may reside in a household with children or elderly, it is common that college students may not fit the traditional model of an at-risk person. In Texas, 1,306,862 adults between the ages of 18 to 59 years were enrolled in SNAP as of May 2021.[130] Many college students would fall into this age range as around 62% of college students are under the age of 25.[64] There is little recent information, however, on enrollment of adults aged 18 to 25 in food assistance programs. Less than half of eligible college students in the U.S. applied for SNAP benefits in 2016.[5] Furthermore, the social interaction of the college student is an important piece of investigation. In the current study, all participants have roommates. This living situation is different than households where it is assumed that all members of the household are family members and/or are contributing to obtaining food for the entire household. We must examine the college living environment, both on-campus and off-campus as the environment of college students is different than the environment of other food insecure individuals. The aim of this part of the study was to gain an understanding of the food security safety net of college students, particularly in a time of crisis, and how this information can be used to

better interventions in college student food insecurity.

College students as a population are routinely underserved by current government assistance programs. Even when changes are made to include college students in federal assistance programs, such as changes to SNAP eligibility during the COVID-19 pandemic,[128] these changes are temporary and are not tailored to college students as a population. It is necessary for existing government assistance programs at the macro level to address the unique experiences of college students by looking at the interaction between the micro and meso levels of the college student food security experience.

Social support and social networks appeared to be a main facilitator to students being food secure and maintaining a food security safety net. Having had social support prior to college, during college, and during the COVID-19 seemed to allow for students to better maintain a food security safety net. The sharing of food resources and information about food resources was commonly reported by participants as a means of having food. For example, multiple participants stated they had heard about the on-campus food pantry from friends, classmates, or student organizations they were in. Social support appeared to be influenced by different factors, including culture and familial status. There were no participants that did not mention receiving some form of social support in maintaining their food security.

Access to the on-campus food pantry appeared to play a primary role in the food security safety net of the students. Unlike other university and government assistance resources, participants did not seem to report a lack of ability to access the on-campus food pantry once they had been made aware of its existence and services as a barrier.

Participants also noted throughout the interviews that the use of this food resource enabled them to put their financial resources towards other necessities, such as rent. This finding is compounded due to the participants of this study having been sampled from clients of the on-campus food pantry. However, this finding is still important to note as campus food pantries have become a primary intervention in addressing food insecurity among college students.[67] Despite this, there are few to no policies in place to ensure consistent access to food pantries is available for college students.

Similar to previous studies,[5,94,131] reporting of systematic support was more varied among participants. Participants appeared less likely to use systematic support in maintaining their food security safety net. While the intervention of an on-campus food pantry can mitigate some of the barriers students face, such as a lack of transportation, there is still the issue of students not utilizing this resource for a variety of reasons.[94] Likewise, as previously mentioned, less than half of students who are eligible do not utilize SNAP as a resource.[5] Based on the findings of this study, this lack of use appeared to be due to a lack of information on or a lack of access to systematic forms of support.

When participants did report using systematic support, it was the grants provided by the university for COVID-19 relief or use of mental health and counseling services, rather than systematic support for their food security specifically. When looking at the major theme of access, a lack of access was also given as a primary barrier by participants. This lack of access was shown to be compounding in many cases, such as a lack of physical access to food was compounded by a lack of access to transportation or to financial resources to obtain food by other means.

Limitations of the study can be found in the characterization of self-efficacy among the students. The participants of the study were already using an on-campus food pantry, displaying a sense of self-efficacy by using available resources. This limits the viewpoint from students who may not have had the means or ability to use the on-campus food pantry. Similarly, all participants reported social support as a key part of their food security safety net, making these findings not translational to students who do not have social networks to rely on. Due to the transitional state the pandemic caused for many, some participants also experienced changes in their situation in between when they took the pre-survey interview and when the interview was conducted. The pre-interview survey and interviews relied on self-reporting, leading to potential contradictions. For example, 1 student answered that they had not previously used Bobcat Bounty in the pre-interview survey due to misunderstanding the question, despite having been a listed client and stating that they had used Bobcat Bounty during the interviews.

A perceived strength of this study was the inclusion of marginal food security in the classification of food insecurity to better categorize food insecurity among the target population. The efficacy of the current USDA surveys and other assessments has been questioned,[5,40] due to a lack of understanding of different populations in regards to their food security. As the responses were self-reported, what some participants believed to be an adequate amount of food may not be what is the recommended amount of food and nutrients by the Dietary Guidelines of America. The study found that including participants who may have categorized themselves as having marginal food security allowed for a broader look at how college students face food insecurity.

The research for this study took place at a public, Hispanic-serving institution in

South Central Texas. The study population was matched to try and mirror the client demographics of the on-campus food pantry, and the student population of the university. There is a need for food security research from smaller universities and colleges, with college students spanning different backgrounds. Research on food security among college students from Hispanic-serving institutions, historically Black colleges and universities, community colleges and trade schools, with student populations from differing socioeconomic, geographic, and lifestyle backgrounds.

As found through the interviews, students showed a want to engage in healthy dietary habits. The concept of nutrition security emphasizes the need to integrate a focus on nutrition when discussing food security and food security interventions.[132] Even when able to access food, there may still be a lack of access to nutritious foods, specifically.[132] This lack of consistent access to nutritious meals can result in adverse health outcomes, even when access to food items is present.[132] Students discussed dietary habits they believed were healthy, their want to engage in healthy eating behaviors, and the extent to which they could carry out those wants based on their means at the time. Many college students are in a stage of emerging adulthood and are in a transitional state where they are undergoing physiological changes that require an adaptation of their dietary intake. This can be especially true of students who are athletes or who may have suffered from inadequate nutrition during childhood. Nutritional assessments of college students and interventions in their food security that emphasize nutrition security need to be conducted. We need to look at the built environment and community-based participatory model of looking at the food insecure college student.

<center>**V. MANUSCRIPT II**</center>

Introduction

College students as a population are more vulnerable to lacking food security compared to the wider general population, with around 43% of college students experiencing food insecurity at some point during college.[7,67] Over half of college students receive financial assistance of some kind, and college students are increasingly coming from low-income households.[5,6] Despite this, the share of college-related costs that students must pay for themselves is increasing.[5] Alongside tuition, students must also deal with expenses related to housing, transportation, food, and other necessities.[5]

The COVID-19 pandemic has further exacerbated issues with food security that students may face. During the pandemic, unemployment rates have been highest among adults aged 18 to 24 years old, the age that the majority of college students are.[74,75]

Current methods of categorizing and measuring food security are not able to gain a full understanding of how college students experience and combat food insecurity. Interventions for food insecurity among college students have been primarily found in on-campus food pantries.[67] However, studies on on-campus food pantries have shown that many college students will still not utilize the pantry even if they have knowledge of its existence and are experiencing food insecurity.[94] Interventions towards food insecurity among college students needs to be better informed by the population of college students. To understand the lived experience, there is a need to look at the relationship between the macro, or policy level, to the micro, individual level, of college students. There is a need to better understand food insecure college students to improve interventions. Looking at

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the home-food environment of college students will allow for a better understanding of how to tailor interventions to better suit college students.

The Social Cognitive Theory (SCT) is a common behavioral change and health intervention theory.[95,113] The theory is based on the belief of health being an individual and societal issue.[114] The theory was proposed by Albert Bandura to explain that the actions of a person are based on the dynamic and reciprocal interactions of three components: personal factors; behavior; and environmental factors.[95,113,115] The agency of the person is at the core of Bandura's SCT.[117] Bandura puts forth that self-efficacy is the central belief by which people can exact change for themselves.[114] The Social Determinants of Health (SDOH) are the way in which the social environment influences the health outcomes of people.[104,105] Social determinants include access and quality of healthcare and education, social and community context, economic stability, and the built environment.[104,106] The SDOH describe disenfranchisement and barriers, and have been used extensively when researching factors that make households and individuals more susceptible to being food insecure.[107] The SCT explores the interaction between the individual and meso levels, and the human behaviors (knowledge, attitudes, and beliefs) of college students, the types of agency they demonstrate, and how those impact the food security of students.

Purpose

This study aims to 1) chronicle the home-food environment of and 2) characterize determinants of health that influence the food security safety net of food insecure college students. The objectives of this study were to collect information using text messaging

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and photo elicitation over a 5-week period on how self-identified food insecure students describe their food security safety net. In this study, this safety net will include lived experiences of the college students, how they obtain food, how they utilize food and resources for food, and their attitudes, knowledge, and beliefs related to maintaining their food security.

Methods

Bobcat Bounty is an on-campus food pantry launched in 2018 that provides weekly emergency food assistance through a pantry style format. This pantry is located on the campus in a large public HSI and was a critical means of food throughout the COVID-19 pandemic. This study builds from previous research of the FSLC to investigate unique attributes of college student food security.

Photo elicitation as a method can be described as a combination as prompt-based photo elicitation through an interactive text messaging format between the participant and researcher. Photo-texting as a method of home assessment has been found to be an effective assessment tool that participants view positively. The present study utilizes this methodology and was approved by the TXST IRB (#7319).

Recruitment

A sample was taken from clients of the on-campus food pantry. Clients who expressed interest in participating in a research study were sent a pre-interview survey to determine if they fit inclusion criteria. When 18 participants matched inclusion criteria, the survey was closed, and the study was initiated. Inclusion criteria was that participants

were students currently enrolled in the fall 2020 semester, were between the ages of 18 and 30 years old, and had utilized the on-campus food pantry at least once. Following completion of the first portion of the study (interviews), participants were carried through and given a number to communicate with photos and messages for the photo-texting portion of the study.

Study

The study was a 6-week study, where each week had a unique prompt aiming to describe a theme of food security. The prompts for each week of the study were based off previous studies on food security. The prompts were created to elicit responses to gather data on the determinants that influence the food security safety net of college students. Participants were sent prompts on Sunday afternoon, upon participants responding, they were sent follow-up questions relating to each prompt to provide elaboration on the participants' description of the prompt. An incentive schedule was developed to provide stage-wise encouragement for participation. Incentives included an electric kettle, a knife set, a utensil set, and a personal blender.

The theme for each week was ordered. The table below details the general prompts given to participants each week. The order of prompts was intended to review the most basic, physical and environmental characteristics, and then expand into more social and experiential prompts.

Table 9: Weekly Prompts for Photo Elicitation

Week	Prompt

1	Food storage and preparation
2	Perishable foods
3	Non-perishable foods
4	Utensils and appliances
5	Meals and social networks
6	Make-up week

By the end of the 6 weeks, some participants had not fully responded to all prompts. Participants were contacted to try and finish out the prompts. 14 participants had responded to all prompts that had been given (n=14), 3 participants had responded to some prompts but not all (n=3), while 1 participant did not respond to any of the photo-texting prompts (n=1).

Following the sixth week of the study, participants were then sent an end-of-study survey to complete. The survey questions pertained to participants' access to food items, beliefs and attitudes towards the food they did or did not have, and feelings towards how the study was conducted. 14 participants completed the survey (n=14).

Data analysis and interpretation was conducted following completion of the study. Coding was conducted by two members of the research team. Microsoft Excel and MaxQDA were utilized to code for themes of self-efficacy and social networks in text responses of participants. Photos were coded for items in the photos and how they fit the prompts given to the participants for each week, and how these reflected the home-food environment of the participant.

Results

Demographics

      All participants (n=18) at the start of the study were currently enrolled students between the ages of 18 to 30 years old, who lived off-campus (*Table 7*). Most participants (83%) were female. More than half identified as Black, Latino/a/Hispanic, Asian, Native American, or a combination of races/ethnicities. All participants were categorized as experiencing marginal, low, or very low food insecurity over the last semester according to the USDA's definition.[1] Retention for the study was 14 participants (n=14).

Table 10: Demographics Table

Characteristic	n	%
Age (years)		
18-19	3	17%
20-23	12	67%
24-30	3	17%
Gender		
Female	15	83%
Male	3	17%
Race/Ethnicity		
Black	2	11%
Latino/Hispanic	8	44%
White	5	28%
Asian	1	6%
Asian, Latino/Hispanic	1	6%
Native American, Latino	1	6%
Food Security Status		
Marginal	3	17%
Low	13	72%
Very Low	2	11%

Table 11: Participant Demographics at End of Study

Characteristic	n	%
Age (years)		
18-19	3	21%
20-23	9	64%
24-30	2	14%
Gender		
Female	13	93%
Male	1	7%
Race/Ethnicity		
Black	2	14%
Latino/Hispanic	5	36%
White	4	29%
Asian	1	7%
Asian, Latino/Hispanic	1	7%
Native American, Latino	1	7%
Food Security Status		
Marginal	3	21%
Low	9	64%
Very Low	2	14%

Photo-texting

The result section overview is provided in the following tables. Results of the photo-texting portion of the study are provided in the tables below. Table 12 shows the general key findings found during photo elicitation. Table 13 shows the coded themes and how they demonstrated themselves through participant responses. Table 14 demonstrates the photos and associated themes elicited from participants.

Table 12: Photo-texting Results

Week	Prompt	Key findings

1	Food preparation and storage	• Participants reported spending anywhere between 1-3 hours cooking per day • Others living with the participants influenced how long they cook for
2	Perishable foods	• Some participants felt that they did not have an adequate amount of perishable foods for their needs
3	Non-perishable foods	• Stocking up on non-perishables • Majority provided by Bobcat Bounty • Participants rely heavily on food pantry
4	Utensils and appliances	• Cooking utensils, eating utensils, pans, stoves, knife sets, measuring cups, and microwaves were most common appliances/utensils • Participants try to make use of all appliances they own • Utensils/appliances participants thought would be beneficial included cutting boards, blenders or mixers, and replacements of old items they already owned
5	Eating and social networks	• Most foods made and eaten in participant households • Meal choices are influenced by their social network, specifically friends and roommates

Table 13: Coded Results for Photo-texting

Coded Theme	Quote	Findings
Neighborhood/Built environment	"The chicken and ribs came from [on-campus food pantry]. I received two big packs of turkey bacon from [on-campus food pantry]. There's a head of lettuce in my fridge from [on-campus food pantry]. I also usually have some sort of bread from [on-campus food pantry] but I used it last night, they were hamburger buns. About	• Participants reported utilizing resources that were accessible to them in their living situations, specifically the on-campus food pantry • Participants reported barriers related to areas in which they lived

	half or more than half of my perishable items are from [on-campus food pantry]." (P6) "Hard to take a pic of but our fridge door broke, and we couldn't open it for 3 days. It led to strategically planning foods that wouldn't need the fridge door/using frozen food. Thankfully, maintenance fixed it yesterday evening before the kids got here" (P1) "…With student housing, maintenance doesn't really fix appliances, so our microwave is super hard to open right now so we have to plan in advance to use those" (P1)	
Social/Community Context	"Who is eating with me, (usually roommates) [influences meals] … what food we have that is up for grabs. (If my roommate is eating with me, I have her groceries, mine, and the "community" groceries we can work with." (P11) "I limit my eating out and get the majority of my food from the food pantry. Usually, the only time I spend money on food is when I'm eating with or around other people in a social setting" (P9)	• Participants reported relying heavily on social networks and food sharing for maintaining food security • Participants routinely share food both within and outside their home-food environment • Participants routinely report that social networks influence their food choices.
Economic Stability	"I keep myself too busy with my work and often work through mealtimes. The pandemic limits my options as I'm trying to avoid being out in public more than necessary. I have eaten out indoors, but I try to limit my exposure. Also, I don't make a lot	• Participants reported income, along with time, was a primary factor in food and meal choices

	of money, so I am conscious of my spending." (P9)	
Attitudes, Knowledge, Beliefs	"I don't have niche stuff like vegetable peelers, a food processor, or a grater. This stuff would be nice to have but since I can do without, I don't want to purchase them." (P14) "I would probably like to be able to plan out what I'm going to eat for the week. This way I can prepare for things instead of looking in the pantry and trying to see what I can come up with and resorting to the same thing every night." (P18)	• Participants repeatedly reported wanting more knowledge on foods and cooking/meal preparation • Participants reported relying on previous knowledge from pre-college and knowledge learned during college to maintain food security

Table 14: Photo Elicitation Themes

Theme	Photo Example	Photo Example
Home-food Environment		

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Social and Community Context		

End-of-Study Survey

Participants reported feeling secure in their food security when they had money to purchase foods or had basic food items and ingredients that they considered essential. When questioned on what food items participants would like to have if there were no barriers, many participants listed food items such as meats, fish, and fruits. Participants

also listed items that fit a "healthier" diet or were culturally appropriate to them. Participants reported that the primary barrier to them not being able to obtain foods they would prefer was a lack of money to purchase these items. Most participants also felt not being able to consistently afford food items was a normal occurrence for college students.

When questioned on how their ability to predict their access to food has changed over the course of the COVID-19 pandemic, most participants reported that having access to the on-campus food pantry allows for them to have a consistent food source. Some participants, however, felt like their ability to access food had become more unpredictable due to changes in their lives related to the COVID-19 pandemic, or general changes in their living situations.

Participant also reported feedback on study methodology. Participants reported finding texting as a method of communication as helpful to them. Participants reported that the use of text messaging allowed for them to stay engaged in the study. Participants reported that topics they believed the study might have covered to get a better idea of their home-food environment included, food waste, daily life experiences, and more focus on meals eaten outside the home.

Discussion

Across universities and college campuses in the US, the average rate of food insecurity is 32.9%, with some colleges having even higher rates of food insecurity among their students.[69] To gain a better understanding of how college students experience food insecurity and how to better tailor interventions to this target population, it is necessary to understand the different facets of the experience of college students. The

home-food environment of college students and how this influences their food security has not been extensively researched. This study looked at the different determinants, along with the attitudes, knowledge, and beliefs that influences and contribute to the home-food environment of food insecure students and their food security safety net.

Of the SDOH, the determinants of social and community context, neighborhood/built environment, and economic stability were found to primarily influence the food security safety net of students in relation to their home-food environment. The built environment of participants included the on-campus food pantry which was key facilitator in the participants being able to maintain a consistent food security safety net within their homes. The built environment also further influenced the home-food environment of participants, such as those who live in student housing or had to change living situations from student housing during the COVID-19 pandemic to non-student housing when the campus closed. Understanding the built environment and the access students have to resources within their environment is necessary to understanding food insecure college students. Similar to the neighborhood/built environment, economic stability was a determinant in participants' food security, with participants noting that money, and a lack thereof, influenced their foods and meals. The study found that social and community context was a major determinant that influenced participants being able to maintain their food security. Most participants mentioned the influence of their social network on their food stores and meals.

When looking at the theme of self-efficacy within the framework of the SCT, students appeared to demonstrate increased self-efficacy when they had personal and collective agency. Participants who reported relying on roommates, friends, family, or

significant others appeared to be more secure in their food security situations. Participants who relayed having a roommate that had cooking knowledge or who procured and prepared foods with others appeared to be less concerned about their food security net in their responses than participants who reported relying on themselves for most cooking and/or food procurement.

This study used the method of photo elicitation and text messaging to communicate and gather data from participants. Participants reported finding this method of communication as being beneficial to helping them stay engaged with the study. Although, some participants did note preferring the method of email for receiving prompts due to already checking their student emails on a consistent basis. The methodology used in this study is one that could benefit future studies when investigating food security with college students as the target population.

Limitations of the study include that some participants seemed to take photos of foods after having gone grocery shopping or visiting the on-campus food pantry, or had taken photos that included their roommates food items. This might not be a fully accurate depiction of the participants' typical food stores. 4 participants also dropped out of the study over the course of research. Attrition is likely due to a transitionary student body during the COVID-19 pandemic. Finally, the study was conducted on students who were already utilizing an on-campus food pantry and may not reflect the experiences of students who are not receiving food assistance in this way. For example, many participants reported photographing their food items after having already gone to the food pantry, which may not give an accurate depiction of what students' typical supply of food items.

Strengths of the study include the use of texting as a form of communication and photo elicitation as a means of collecting data appeared to help keep participants engaged. Many participants reported preferring communication by text message as it helped them to remember to participate in the study. More research is needed to better understand the lived experiences of college students and how their home-food and built environments influence their food security. While the built environment of college campuses and students who live on-campus has been investigated, there is still further need to investigate the built environment of students who live off-campus. The development of tools to evaluate students' home-food environments in relation to their food security is another next step to be taken.

VI. CONCLUSION

Food insecurity among college students is becoming an increasingly pressing issue. College students as a population are becoming increasingly diverse. This diversity includes an increasing number of students who no longer fit the mold of "traditional college students" who can rely on parents to pay for expenses related to college, food, and other necessities.[7] Students are also increasingly having to shoulder the cost of both college and other necessities.[5] With more students coming from lower income backgrounds, minority students, students leaving foster care, international students, and students from all different backgrounds and experiences, it is imperative for interventions in college food security to be tailored to the target population.

The COVID-19 pandemic has further brought college student food security into the public health consciousness. There have been changes to SNAP eligibility to allow college students to better utilize this resource, however, these changes will not be permanent.[127] There is still a need for further long-term interventions on the behalf of college students to ensure they are able to maintain a food security safety net.

The unique needs of this population require original investigation and intervention at each level of the SEM. This study was intended to better describe the experiences of food insecure college students and how they maintain a food security safety net. During the COVID-19 pandemic, many participants found themselves with decreased financial support due to job or income loss, that put strain on their ability to afford necessities. Many participants also had health and safety concerns for themselves due to the COVID-19 pandemic that limited their ability to access food. This study found that food insecure

college students rely primarily on social support networks to maintain a food security safety net, especially in times of crisis or stress. All participants in the study relied on friends, family, and/or roommates to help them maintain their food security.

Reliance on systemic support was found to be mixed. When it came to federal food assistance and COVID-19 relief support, many participants noted facing barriers to accessing this support. This study found that a lack of access to, both in terms of being unable to physically access a resource and not being eligible for assistance, and a lack of knowledge of federal and state food assistance was a consistent barrier for students.

Many participants did, however, report being able to utilize TXST COVID-19 relief resources, and other resources such as counseling. This study also found that the participants perceived the on-campus food pantry to be an integral part of their food security safety net. Participants noted that anywhere from ¼ to the majority of their food, particularly non-perishables, were obtained from the on-campus food pantry. Some participants reported relying on the on-campus food pantry as their primary source of acquiring food, while others used the on-campus food pantry to supplement their groceries. On-campus food pantries are a common form of intervention for college student food security. However, many students will not utilize food pantries for different reasons.[94] If on-campus food pantries are going to be a primary form of addressing college student food security, then it is necessary to tailor this intervention to be a more utilized resource by college students. This study found that students feel secure in their food security safety net when they have access to basic food items and ingredients that they are familiar with, basic cooking utensils and appliances, some form of social support, and access to a form of food assistance, in the case of this study, an on-campus

food pantry.

Next steps of this work include disseminating these findings and developing various, different validated tools to assess the domains of college student food security, including the home-food environment. Research will also be presented at conferences, and interview findings will be reported through the scope of the HBM, and publishing of a full manuscript on the photo elicitation of college student social networks and home-food environments. To further this work, the development of assessment tools designed to investigate college student food environments and PSE support are needed. Finally, interventions at the systems and macros levels that address food equity and food sovereignty beyond emergency food assistance are still needed at institutional, state, federal, and foundational levels.

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