

University of Nevada, Reno

**Predictors of Food Insecurity and Their Relationship to
Academic Achievement of College Students**

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Arts in
Sociology

by

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Abstract

A study was conducted at a mid-sized, western university to test and understand the causes and consequences of food insecurity. This study draws on ecological systems theory to derive hypotheses that address the influence of the family microsystem on the college microsystem over time. Data were analyzed from an existing study conducted on-campus in the spring of 2016. The focus of the analysis was on student race/ethnicity, Pell Grant status, first-generation college student status, employment status, living circumstances, and their relationships with food insecurity and academic achievement. Food insecurity and student GPA were predicted by student characteristics, and food insecurity was tested as a mediator between student characteristics and GPA. Results indicate that food insecurity mediates the relationship between several student characteristics and GPA, specifically, they indicate that students eligible for Pell Grants, first-generation college students, students living off-campus and students employed for more hours per week had lower GPAs, in part, because they had higher levels of food insecurity. This study highlights the importance of food security status amongst vulnerable college student populations and its implications for their academic performance.

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Food Insecurity and Purpose of Study

Food insecurity is a problem that affects vulnerable populations around the world. When thinking about vulnerable populations, one may think first of impoverished children and families, displaced persons, or the elderly. However, many college students are also part of this vulnerable group. The U.S. Department of Agriculture (USDA) defines food insecurity as the “household-level economic and social condition of limited or uncertain access to adequate food,” which can lead to hunger, defined as an “individual-level physiological condition as a result of food insecurity” (“Definitions of Food Security,” 2016).

Food insecurity may lead to physical health issues that present themselves in the form of nutritional deficiencies, fatigue, stress, weight loss or gain and lack of focus. These health issues may be barriers to achieving what should be most important while in college, academic performance. Therefore, the following questions are posed: what student characteristics predict food insecurity and how does being a food insecure student relate to GPA? Also, does being food insecure have long-term negative effects on GPA? The literature suggests that food insecurity is tied to student’s socioeconomic status (SES). This study explores the relationship of food insecurity as a mediator for GPA and the following student characteristics: race/ethnicity, Pell Grant status, first-generation college student status, being employed, and living on- vs. off-campus.

In sum, the purpose of this study is to (a) understand the predictors of food insecurity among college students, (b) study the effects of food insecurity on college students' academic performance, and (c) assess the extent to which food insecurity is a mediator between student characteristics and academic performance. This thesis is based

on the theoretical model of ecological systems, which is applied to the experiences of college students in explaining the determinants and consequences of food insecurity. Secondary data from a survey of students at a mid-sized, western university were analyzed to see what factors predict food insecurity, how food insecurity relates to academic performance, and how food insecurity mediates the relationship between certain student characteristics and academic performance.

Literature Review

Research about food insecurity on college campuses typically considers predictors of food insecurity, or the influence of food insecurity on academics, but usually does not consider the predictors (student characteristics) of food insecurity and GPA, and the impact that food insecurity may have on academics. The literature review will cover the predictors of food insecurity among college students, its impacts on academics, and how food insecurity may mediate the association between student characteristics and academic performance (GPA). Furthermore, policy and programs implemented at some campuses attempting to alleviate this issue will also be discussed.

Food Insecurity

As stated above, the USDA defines food insecurity as the “household-level economic and social condition of limited or uncertain access to adequate food.” which can lead to hunger, defined as an “individual-level physiological condition that may result from food insecurity” (“Definitions of Food Security,” 2016). Another definition is the “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (Anderson, 1990, p. 1559).

Current Rates of Food Insecurity on College Campuses

As of 2015, the United States has a household food insecurity level of 12.7% (Coleman-Jensen, Rabbitt, Gregory, & Singh, 2015). This indicates that about 13% of households in the United States are experiencing low to very low food security. Comparing these to university findings, there is an inconsistency between current food insecurity levels at the national level and those faced by college students. In fact, research suggests that the percent of food insecure college students is even higher than the national average. Studies assessing the level of food insecurity across college campuses have found varying rates of food insecurity. One example was a rural university in Oregon with a food insecurity rate of 59%. This study was conducted in 2011, based on a non-probability sample of 354 students that completed a 40-item email questionnaire, including the six-item U.S. Household Food Security Survey Module (HFSSM), demographics, and financial behaviors. However, since the data are not necessarily representative of the student body, this rate may be artificially higher (or potentially lower) than the rate for all students at this university (Patton-Lopez, Lopez-Cevallos, Cancel-Tirado, & Vazquez, 2014).

In comparison to the university in Oregon, The University of Hawaii, Manoa reported a rate of 21% food insecurity. In this study, 410 graduate and undergraduate (excluding freshmen) students were surveyed from 31 randomly selected classes. An in-class survey, utilizing the 10-item USDA food security survey module, questioned students about their food insecurity over twelve months along with other demographic and spending measures (Chaparro, Zaghoul, Holck, & Dobbs, 2009). Since a random sampling method was employed in this study, the rate of 21% may be relatively accurate.

Furthermore, the University of Alabama reported a rate as low as 14%, comparable to the average household level (12.7%) among a sample of 557 students age 19-25. This study sampled sixteen classrooms and had a response rate of 87.4%. It excluded freshmen, graduate students, students who were pregnant, other “non-traditional” students, and measured food insecurity with the 10-item USDA scale. Results indicated that students receiving financial aid, or supporting themselves, were at “significantly greater risk for food insecurity.” (Gaines, Robb, Knol, & Sickler, 2014, p. 379).

Other studies considered multiple campuses. For example, a study of four campuses, Northern, Southern, Eastern and Western Illinois University showed that across these four schools, 35% of respondents were food insecure. This particular study of 48,658 possible respondents had a 3.87% response rate with most of the respondents from Southern Illinois University (N=812). Students were emailed a survey that included socio-demographic questions and the 10-item USDA scale. The inclusion criteria for this study were: being an undergraduate student, access to university email, fluency in English, and being at least 18 years old. This survey study also included an incentive for student survey completion of a drawing for a \$100 gift card for books or groceries (Morris, Smith, Davis, & Null, 2016). Given the very low response rate, this estimate of 35% food insecurity may well be different from the value for the population of students as a whole.

Meanwhile, a study conducted by the City University of New York (CUNY) system reported a rate of 39% food insecurity amongst its students. This study considered a representative undergraduate sample of 1,086 CUNY students. This study was conducted through online and telephone interviews, and included four questions about

food insecurity over the past 12 months (Freudenberg, Manzo, Jones, Kwan, Tsui, & Gagnon, 2011). Lastly, the California State University (CSU) system reported 24% food insecurity across some CSUs. This study included open-ended interviews, focus groups, surveys, and document analysis to understand their student's food insecurity, along with faculty and administration sentiments on the issue. In addition, a random sample of 1,039 students was surveyed from CSU Long Beach, but this sample may not reflect all of the CSU campuses (Crutchfield, Clark, Gamez, Green, Munson, & Stribling, 2016).

Studies trying to understand the level of food insecurity at each campus show variation in their methods. Compared to the national rate of food insecurity, which has relied on the HFSSM and probability sampling methods, universities have shown much more variation, with only one study reporting a rate of 14% (Gaines et al., 2014), comparable, but still higher than the national rate of 12.7% (Coleman-Jensen et al., 2015) yet, others have reported rates as high as 59% (Patton-Lopez et al., 2014). In agreement with Cady (2014) the studies summarized in the literature all use different methods, and it is difficult to generalize about food insecurity at all universities. These variations in rates of food insecurity across campuses could be due to sampling biases, the variety of methods used for each study, and different student samples, such as traditional students vs. non-traditional students.

In addition to documenting the existence of food insecurity on college campuses, its association with academic performance has also been studied. For example, Morris et al. (2016) noted significance between GPA and food insecurity. College students with a GPA greater than 3.0 had the lowest amount of food insecurity, whereas students with GPAs between 2.0-2.99 had the highest rates of food insecurity. Students with less than a

2.0 GPA, however, did not experience high rates of food insecurity. Furthermore, a study by at an urban university in Massachusetts indicated that students identified their academic performance as being affected by their food security status, where being food insecure indicated greater risk for these students to withdraw or fail courses. In other words, the food insecure students in this study were found more likely to be “not completing their studies in this higher education institution” when compared to less food insecure students (Silva, Kleinert, Sheppard, Cantrell, Freeman-Coppadge, Tsoy, Roberts, & Pearrow, 2015, p. 10). Overall, the results suggest that food insecurity is likely to be higher among college students than among the general population, but further research is needed to confirm this finding.

Theory

This study applies ecological systems theory (Bronfenbrenner, 1977) to explain how characteristics of a college student’s social background may influence their exposure to food insecurity in college, their academic achievement in college, and how food insecurity may transmit the influence of their social background onto their academic performance in college. Ecological systems theory was developed to help understand human development from the most micro- to most-macro levels of the individual’s environment, over the course of the individual’s life beginning in childhood. The theory identifies five environmental systems that influence human development: the microsystem, mesosystem, exosystem, macrosystem, and chronosystem. Each of these systems will be explained from the perspective of a child and related back to the issue of food insecurity.

The microsystem revolves closely around the child, and includes the social groups and institutions in which the child is embedded, and the child's relationships with others in those groups. For example, the microsystem can include the child's family and school, and the child's social relationships within these domains. In the family, for example, a child may not be as food insecure even when their family is food insecure; their parents may diminish their food consumption to make sure their child gets sufficient access to food.

The mesosystem is described as the relationships between the microsystems within a child's life. This includes, for example, the relationships between the child's family and school peers. Food insecurity among children whose parents are poor may be kept to a minimum if other microsystems within the child's environment can provide food subsidies, such as free/reduced lunch at school or church potlucks.

Next, the exosystem refers to environmental influences that indirectly affect the child by affecting others within the child's life. For example, a child's food insecurity levels can be affected if their parents become unemployed or if they lose access to supplementary food resources.

The macrosystem, includes the culture in which the child lives, such as, political and economic conditions within their culture and subculture. The macrosystem can influence whether or not the child is in poverty or is food insecure depending, for example, on whether or not the government has programs to help families in need, or provides education or job training opportunities for parents that would make food insecurity less likely. The culture can also influence food insecurity. If the culture is more collective, people may be more likely to help each other out and fill in the gaps when one

family is in need. If the culture is more individualistic, however, families may be on their own when they are having financial problems.

Finally, the chronosystem considers the passage of time and how historical events and changes in society can affect a child's development. For example, some families may have been greatly impacted by the Great Recession, in some cases making them poorer and less able to support their children at home and later, at college.

This thesis focuses on the relationships between microsystems at the mesosystem level, and how these relationships are influenced by macrosystem factors. Specifically, it will look at mesosystem level relationships between the college-student's family and the student's school life and discuss how poverty may carry over from childhood into college life. Primarily, it will look at indicators of social disadvantage in the college student's family of origin, such as qualifying for the Pell Grant, being a first-generation college student, the student's working status, living conditions, and how these factors may affect food insecurity and academic performance in college. In terms of the macrosystem, this thesis considers societal factors that influence social disadvantage in college students' families of origin that may carry over into their college life.

When college students were children, their family and school microsystems likely interacted at the mesosystem more frequently, such as when parents met with their child's teachers, or were active in their child's school life. Once children become college students, interaction at the mesosystem between family and school may be more limited, especially when college students live away from home. However, the influence of parents' socioeconomic background may still influence the student once in college.

Thus, this thesis is concerned with the influence of the family microsystem on the college microsystem in terms of how social disadvantage in the college student's family of origin translates into social disadvantages at college. These disadvantages are rooted in the macrosystem of society that maintains social inequalities by race, ethnicity, and educational background. For example, when students' parents do not have a college education, they are more likely to be poor, and less likely to be able to support their child's college education, both financially and informationally. Thus, the social disadvantages of the child's parents may translate into social disadvantages once the child enters the college microsystem, and may struggle to navigate college to make ends meet. This transition from childhood to college occurs in the chronosystem of human development over time, capturing long term influences on development like parents' ability, or inability to support their child through their journey to college, and in college.

Independence, Finances, and Food Insecurity

Food insecurity research considers factors such as financial strain as potential reasons why students may be food insecure. Studies suggest higher rates of food insecurity among students who receive financial aid (Gaines et al., 2014), borrow money (Morris, et al., 2016), live away from home yet not in university housing (which typically includes a meal plan), and not with parents or relatives have lower food security (Chaparro et al., 2009; Morris et al., 2016). These patterns are also supported by Hughes, Serebryanikova, Donaldson, and Leverit (2011), who note that students who had a job or a financial budget were more likely to be food insecure. This is further confirmed by findings which indicate that students "who support themselves financially were 1.6 times as likely to report food insecurity as those not supporting themselves" (Freudenberg et

al., 2011, p. 3). This makes sense, since financially supporting oneself may indicate that the student is of limited means, which has been shown to put students at greater risk of food insecurity. This is also supported by Gaines et al., (2014). Thus, students that are working and living off-campus have shown higher risk of food insecurity.

Research from different universities highlights variation in food insecurity among different populations of students. Gaines et al., (2014) examined a population that was 82.19% White and significantly more secure than other groups, but lost significance through analyses, suggesting that student finances are the driving force behind food insecurity, and not race. In contrast, Chaparro et al. (2009) found that students with the most food security at the University of Hawaii, at Manoa were those that identified as Pacific Islander, Filipino, Hawaiian, and multi-ethnic in contrast to Japanese, which were more food secure. Results for the CUNY food insecurity report indicated that African Americans and Hispanics were 1.5 times more likely to be food insecure, compared to other groups (Freudenberg et al., 2011). This provides evidence that food insecurity is a problem for students from a variety of racial/ethnic backgrounds, particularly those that are disadvantaged socioeconomically. Nonetheless, even universities with a racial majority of White or Asian students still report food insecurity, although in the general population of the U.S., rates of food insecurity are higher among African Americans and Hispanics (Coleman-Jensen et al, 2015).

Another predictor of food insecurity is borrowing behaviors. Students who borrow money to attend college have higher rates of food insecurity compared to students who do not borrow money toward their education (Morris et al., 2016). Again, borrowing money to pay for college may be an indicator that the student, or his or her family, do not

have the means to pay for college, possibly indicating financial strain. Increasingly, students are also concerned with accruing debt (Gaines et al., 2014), a burden some students may carry if they resort to paying their living expenses, such as food, with credit cards or loans. Recipients of Pell Grants that do not have to be paid back (unlike loans) may also have greater food insecurity because most students receiving this aid are usually receiving this grant based on need (Mahan, 2011).

Freudenberg (2011), indicates that students who were supporting themselves, were more likely to be food insecure than those who did not support themselves financially. In addition, students that worked more than 20 hours a week showed higher food insecurity than those working fewer hours (Freudenberg et al., 2011). This pattern likely reflects the higher financial status of students whose parents, or whom themselves, can afford to pay for college, versus students who support themselves while in school. Similar results were apparent in the study where students were more likely to be food insecure if they made less than fifteen thousand dollars a year (Patton-Lopez, et al., 2014). This has many implications for the type of eating habits students living on their own may have. For example, Brunt and Rhee (2008) have shown that students who live on-campus have better dietary intakes (i.e., consume more fruits and vegetables) than students living off-campus. This is probably due to the mandatory meal plans many students living on-campus have, providing them with the opportunity to eat regular balanced meals. In addition, it was found that students that lived with their parents were less likely to experience food insecurity than students who lived on their own (Hughes et al., 2011), perhaps because others were cooking for them, and they had more access to support.

The Implications of Food Insecurity on Academic Achievement

Starting early in life, food insecure children can face academic performance issues. Jyoti, Frongillo, and Jones (2005) observe relationships between food insecure children and academics, along with health, from kindergarten to third grade. However, these results are mixed, as the researchers report a fluctuation, over time, between food security and insecurity among the families studied (Jyoti, Frongillo, & Jones, 2005). Winicki and Jemison (2003) also report a relationship between food insecurity and children in kindergarten. In addition, studies have also shown that children between the ages of six and eleven are significantly more likely to have repeated a grade when they are food insufficient (Alaimo, Olson & Frongillo, 2001). Thus, the influence of food insecurity on school performance in elementary school may carry over into college. Whether or not food insecurity increases, decreases or is stable when students move away from home to attend college is uncertain. These students may be less food insecure than when they lived at home, or perhaps more food insecure than when they lived at home, depending on their parent's economic status, and their economic conditions in college. This fluctuation of food insecurity while in college, is an area for future research, as it has not been fully addressed in current literature.

Students often report that they are not in good health when they are food insecure. A study at an Australian university noted that, "students reporting to be food insecure according to the single-item measure were less likely to rate their overall health as good to very good, when compared to their food secure counterparts, 70% vs 87%...." (Hughes et al., 2011, p. 29). These students were also more likely to indicate they had lost weight due to being food insecure (Hughes et al., 2011). Though there is no medical evidence to

support these findings, being food insecure, and feeling less healthy could also have an impact on academic achievement.

Food insecurity can jeopardize health that in turn may affect academic performance. Understanding this issue is vital to protecting college students and enhancing their likelihood of successfully graduating, and becoming financially self-sufficient. While there is no evidence that shows that food insecure students are less likely to graduate from college, limited research indicates students who are food insecure tend to have GPAs between 2.0 and 2.9 (Morris et al., 2016), which could predict lower graduation rates.

Predictors of GPA and Food Insecurity

There are several factors that are related to both food insecurity and academic performance. This section examines these factors and builds a case for treating food insecurity as a mediator between certain student characteristics and student performance in school. That is, food insecurity may explain, in part, why certain groups of students are at higher risk of poor academic performance.

Considering that food insecurity and GPA are likely linked, and some groups of students are more at risk of both food insecurity and low GPA, food insecurity will be tested as a mediator of the association between certain student characteristics, such as Pell Grant status, and GPA. In other words, this study will reveal if part of the reason why students receiving Pell Grants, for example, have lower GPAs is because they are food insecure.

Students' race/ethnicity is related to both food insecurity and academic performance. Morris et al., noted that African American students had lower food security

compared to White students (2016). In addition, African American students and Hispanic students are more likely to come from poorer backgrounds than White students, and have been shown to have higher rates of food insecurity than other racial/ethnic groups (Coleman-Jensen et al., 2015; Freudenberg et al., 2011). This does not indicate different levels of intelligence between races, but is perhaps correlated with the likelihood that minority students more often are first-generation students, and therefore may be less familiar with university settings, and how to navigate the system.

First-generation college students may also be at risk of both poor academic performance and food insecurity. Research indicates that first-generation college students are more likely to be Black or Hispanic, and tend to come from low-income backgrounds, and when compared to non-first-generation students, they were more likely to take remedial courses, have lower GPAs, and complete fewer credit hours (Chen & Carroll, 2005). In addition, first-generation college students tend to be female, and Nunez & Cuccaro-Alamin, (1998), showed that first-generation college students are more likely to work full-time while enrolled and more likely to be financially independent when compared to non-first-generation students. Ishitani (2003) showed that over an observation period of nine semesters, first-generation college students had lower retention rates than students that were not first-generation. In addition, first-generation college students showed the highest attrition rates during the first year of college (Ishitani, 2003), a potential indicator of academic failure.

Students who work for pay may also have worse academic performance, in addition to food insecurity. Research by Dundes and Marx (2007) has shown that students who work off-campus 10-19 hours tend to have a higher GPA than students who

worked fewer than 10 or more than 20 hours per week. This study also found that students working more than 10 hours a week were studying more hours than students working fewer than 10 hours or not working at all. In addition, this study showed that students working more than 20 hours a week were less likely to “identify themselves as applying themselves fully,” were more likely to report feeling tired, and felt they had less time to study compared to students that did not work. Also, students that worked more hours reported the need to pay living expenses as a top reason for their employment status (Dundes & Marx, 2007, p. 113). It was noted by Hughes et al. (2011), that many of the students in this study reported they were working and going to school for about or greater than 40 hours a week, and many of these students reported feeling limited on their study time because of these commitments. In a particular study by Mamiseishvili (2010), 68% of the low income, first-generation sample worked, while 51% of the students sampled were working more than 20 hours a week, though the reasons this group of students were working is not clear. These results highlight how some hours worked can be beneficial, perhaps by providing students with some structure in their schedules, but working too many hours (or not enough hours) may predict lower academic performance. In addition, it is important to note that students aren’t always working out of financial need, but may be working to build their resume with relevant career experience.

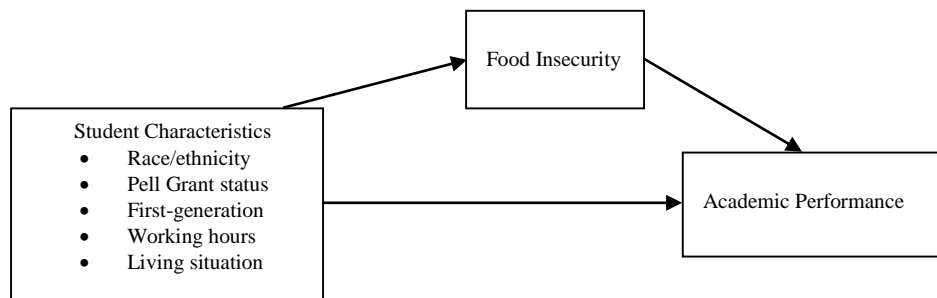
Lastly, living conditions also have an impact on academic performance. Low income, first-generation students that live on-campus have greater chance of persisting (Mamiseishvili, 2010). This may be due to the higher social integration that occurs when students live on-campus, which may influences higher persistence rates. Also, students who live on-campus or with their parents have reported preparing their own food less

often than students living in other housing (Larson, Perry, Story, & Neumark-Sztainer, 2006). This may be due to the meal plans many universities have, or parents/relatives preparing meals more often than students.

Conceptual Model and Hypotheses

To summarize, the purpose of this study is to (a) understand the predictors of food insecurity among college students, (b) study the effects of food insecurity on college students' academic performance, and (c) assess the extent to which food insecurity is a mediator between student characteristics and academic performance. More specifically, this study tests whether or not food insecurity is greater, and GPA is lower, among students who are African American, Asian, Hispanic or White, who receive the Pell Grant, who are first-generation, who were working relatively more hours for pay at the time of the survey, and who live off-campus vs. on-campus. Subsequently, it will examine food insecurity as a potential mediator that explains, in part, why some student groups are at greater risk of low GPA than others. These relationships are depicted in Figure 1. Following the conceptual model are the null and alternative hypotheses that are tested in this thesis.

Figure 1: Conceptual Model



Predictors of Food Insecurity (Hypotheses one through five)

(1) Null Hypothesis: There is no relationship between students' race/ethnicity and food insecurity.

Alternative Hypothesis: Relative to White and Asian Students, Black and Hispanic students have higher levels of food insecurity.

(2) Null Hypothesis: There is no relationship between a student's Pell Grant status and food insecurity.

Alternative Hypothesis: Relative to students that do not qualify for the Pell Grant, students who do qualify for the Pell Grant have higher levels of food insecurity.

(3) Null Hypothesis: There is no relationship between being a first-generation college student and food insecurity.

Alternative Hypothesis: First-generation college students have higher levels of food insecurity than students whose parent(s) went to college.

(4) Null Hypothesis: There is no relationship between students' working hours and food insecurity.

Alternative Hypothesis: The more hours per week a student works, the higher their level of food security.

(5) Null Hypothesis: There is no relationship between living off-campus and food insecurity.

Alternative Hypothesis: Students who live off-campus have higher levels of food insecurity than students who live on-campus.

Predictors of GPA (Hypotheses six through ten)

(6) Null Hypothesis: There is no relationship between students' race/ethnicity and GPA.

Alternative Hypothesis: Relative to White and Asian Students, Black and Hispanic students will have lower GPAs.

(7) Null Hypothesis: There is no relationship between a student's Pell Grant status and GPA.

Alternative Hypothesis: Relative to students that do not qualify for the Pell Grant, students who do qualify for the Pell Grant have lower GPAs.

(8) Null Hypothesis: There is no relationship between being a first-generation college student and GPA.

Alternative Hypothesis: First-generation college students have lower GPAs than students whose parent(s) went to college.

(9) Null Hypothesis: There is no relationship between students' working hours and GPA.

Alternative Hypothesis: The more hours per week a student works, the lower their GPA.

(10) Null Hypothesis: There is no relationship between living off-campus and GPA.

Alternative Hypothesis: Students who live off-campus have lower GPAs than students who live on-campus.

Influence of Food Insecurity on GPA

(11) Null Hypothesis: There is no relationship between food insecurity and student GPA.

Alternative Hypothesis: There is a negative association between food insecurity and student GPA.

Food Insecurity as a Mediator (Hypotheses twelve through sixteen)

(12) Null Hypothesis: Food insecurity does not explain a portion of the association between students' race/ethnicity and GPA.

Alternative Hypothesis: Food insecurity explains a portion of the association between students' race/ethnicity and GPA.

(13) Null Hypothesis: Food insecurity does not explain a portion of the association between students' Pell Grant status and GPA.

Alternative Hypothesis: Food insecurity explains a portion of the association between students' Pell Grant status and GPA.

(14) Null Hypothesis: Food insecurity does not explain a portion of the association between student's first-generation status and GPA.

Alternative Hypothesis: Food insecurity explains a portion of the association between students' first-generation status and GPA.

(15) Null Hypothesis: Food insecurity does not explain a portion of the association between a students' working hours and GPA.

Alternative Hypothesis: Food insecurity explains a portion of the association between students' working hours and GPA.

(16) Null Hypothesis: Food insecurity does not explain a portion of the association between a student's living conditions and GPA.

Alternative Hypothesis: Food insecurity explains a portion of the association between students' living conditions and GPA.

Data and Methods

The data utilized in this survey were taken from a survey about civic engagement at a mid-sized, western university. The survey was sent out during the spring 2016 semester to students' email addresses with the main objective of understanding their levels of civic engagement. It also included an exploratory section with questions about food insecurity to aid the food pantry on campus. The survey was sent to undergraduate and graduate students at the university, and a total of 4,243 students completed the survey online via the Qualtrics survey program, a 21% response rate.

Of the total, there were 3,591 undergraduate respondents. For the purposes of this study, cases were included based on the following criteria: age 18 to 26, enrolled in 6 credits or more, students who indicated that they do not have children, and students who indicated that they were currently working on their first undergraduate degree. The analyses were limited to reflect more traditional college students in age, without children as dependents, and working on their first college degree. These inclusion criteria were designed to limit the analyses to more traditional college students whose food insecurity is likely different than non-traditional students. For example, those who return to college later in life, or are taking less than half-time credits hours. Race categories were also filtered to exclude smaller groups leaving Asian, Black, Hispanic, and White. Samples with students that identified as Native American/Alaskan Native (14), Pacific Islander (22), foreign students (25), and unknown (21) were not included due to size, or not being able to categorize their race/ethnicity. Multi-ethnic students (146) were excluded because they did not report their multiple ethnicities. The total number of students in the sample after filtration was 2,033.

Measurement

Existing Measures of Food Insecurity: In the latter part of the twentieth century, efforts were made to understand the levels of food insecurity of Americans in order to “make the final measure appropriate and feasible for use in locally designed and conducted food-security surveys” (Bickel, Nord, Price, Hamilton, & Cook, 2000, p. 2). The 18-item core module that was developed, and is considered a “stable, robust, and reliable measurement tool” of food insecurity (Bickel et al., 2000, p. 3). Hunger, as mentioned by the Guide to Measuring Household Food Security, is not a primary focus of the 18-item scale, however, they do acknowledge that hunger can be a side effect of extreme food insecurity. As the guide recognizes, food insecurity is a measure of inadequate access to food that in extreme cases, can lead to hunger. The guide also acknowledges that food insecurity may only be a temporary condition where limited access to quality foods can happen only some months and not others, and that food insecurity may not be the same for all members in a household, and may be different for parents and children (Bickel et al., 2000).

The 18-item HFSSM surveys levels of food insecurity. There is also a 10-item scale, the U.S. Adult Food Security Survey Module that has been utilized in some studies (Chaparro et al., 2009; Gaines et al., 2014; Morris et al., 2016). However, the Guide suggests that the six-item HFSSM is a “reasonably reliable substitute” when surveys cannot implement the 18-item core measure (Bickel et al., 2000, p. 60). It has been noted that the six-item scale does not capture severe ranges of food insecurity, such as extreme child and adult hunger (Bickel et al., 2000).

The focus of this analysis was on the subset of five questions pertaining to food insecurity similar to the USDA HFSSM six-item short scale. These two approaches to measuring food insecurity are presented and contrasted in Appendix A. On the left side are the six items in the USDA survey, whereas on the right side are the five items in the survey data analyzed in this thesis. The USDA survey uses different response options for different questions whereas the exploratory student survey uses the same response options across its five items. The USDA offers three options for the first two items (often, sometimes, never) and then offers “yes” or “no” for the remaining three items. In addition, it includes a follow-up to cutting meal size or skipping meals, asking whether or not this happens “almost every month,” “some months but not every month” or “only 1 or 2 months.”

Then the USDA creates three categories of food security from the size items: “very low,” “low,” and “high or marginal.” Respondents are categorized according to how many affirmative responses they give to the six items. “Affirmative” means “often” or “sometimes” for the first two items, “yes” for the three yes/no items, and “almost every month” or “some months but not every month” for the frequency of cutting meal sizes or skipping meals. Respondents who give zero or one affirmative response are categorized as high or marginally food secure, while those who offer 2-4 affirmative responses are categorized as low. Those who offer 5 to 6 affirmative responses are categorized as very low.

On the right side of Appendix A are the five items used to measure food insecurity in the student survey. Students responded to each item with the same four frequency options: never (1), once (2), sometimes (3), and often true (4). Students

responded very reliably low or high on these five items, given that the Cronbach's alpha reliability for the scale in the student data is .92. Rather than trying to collapse this highly reliable frequency scale into potentially artificial categories, we utilized the full variation of frequency options and treat food insecurity as the mean value across the five items.

In addition, many other variables were measured in the survey and descriptive statistics for those variables can be found in Table 1. There were 1,364 (67.1%) females compared to 669 (32.9%) males. The racial/ethnic composition of the sample was: 202 Asians (9.9%), 59 Blacks 59 (2.9%), 458 Hispanics (22.5%), and 1,314 Whites (64.6%). There were 428 (21.1%) freshmen, 478 (23.5%) sophomores, 583 (28.7%) juniors, and 544 (26.8%) seniors.

Students who were Pell Grant eligible (12.4% of all Asian student in the sample, 5.3% of all Black students in this sample, 32.2% of all Hispanic students in this sample, and 50.2% of all white students in this sample) at any point during their college enrollment, made up 38.9% of the sample or 761 of 1954, whereas 1193 have never received the Pell Grant at any point during their enrollment, and the remaining 79 cases did not provide information about whether they qualify for the Pell Grant or not.

Unfortunately, the survey did not include any other data on borrowing activities. In the sample, 806 (39.6%) identified as first-generation students, meaning that their parents have completed less than a two-year associates degree or they identified they do not know about their parent's educational history. Most respondents in the sample live off-campus 1,634 (80.6%) and work for pay 1,343 (66.1%). However, of the students who do work, 44.7% work between 10 and 30 hours a week. Living conditions show that 1634

(80.6%) of students lived off-campus, while 393 (19.4%) resided on-campus. However, the data do not indicate the specific off-campus living conditions, such as living with parents, roommates or alone, differences between students living on- vs. off-campus will be difficult to interpret in this study.

The overall mean level of mean food insecurity was 2.17 (SD = .95) on a scale from 1 to 4 where 1 means never food insecure, and 4 means often food insecure. The mean student age was 20.56 (SD = 1.77), and the mean number of units taken during the spring 2016 semester was 14.78 (SD = 2.61). The mean spring term GPA, taken from the institutional data, and not self-reported by the 2,033 respondents, was 3.16 (SD = .76). The mean number of hours students worked per week was 1.78 (SD = 1.55) on a scale from 0 to 5 where 0 means not working, 1=1-9 hours per week, 2=10-19 hours per week, 3=20-29 hours per week, 4=30-39 hours per week, and 5=40 or more hours per week.

Methods of Data Analysis

This study relied on a variety of methods to assess the relationships between food insecurity, and GPA to student characteristics. When student characteristics were measured with dichotomous variables, independent sample t-tests were estimated to compare mean food insecurity, and mean GPA between two groups of students (e.g., first-generation vs. not first-generation college students). One-way analysis of variance (ANOVA) was used to calculate between-group differences in food insecurity and GPA according to the four categories of racial/ethnic group status. Finally, the associations between continuous variables and both food insecurity and GPA were estimated with bivariate correlations.

The quantitative data were analyzed using multiple regression and structural equation modeling. First, food insecurity was regressed on race/ethnicity, Pell Grant status, first-generation college student status, and number of hours working per week, living on- vs. off-campus, year in school, gender, and age. GPA was then regressed on these same variables in addition to food insecurity. Lastly, mediation analyses were conducted to test the extent to which food insecurity explained the relationships between student characteristics and student GPA. For example, the negative association between being Hispanic and GPA may have operated, in part, indirectly via food insecurity where Hispanic students tend to be more food insecure, and food insecurity, in turn, tends to predict lower GPAs for this group.

In order to simultaneously assess multiple pathways through which food insecurity might mediate the association between students' characteristics and GPA, we estimated a structural equation model (SEM) with Mplus 7.4 software using full information maximum likelihood estimation (FIML) (Muthén and Muthén 2010). In a single model, (1) food insecurity was regressed on student characteristics, (2) student GPA was regressed on student characteristics including food insecurity, and (3) indirect effects from student characteristics to GPA via food insecurity were calculated for each of the corresponding hypotheses.

Overall model fit was assessed by the Chi-Square overall model fit, the root mean square error of approximation (RMSEA), the comparative fit index (CFI), and the standardized root mean square residual (SRMR). Non-significant p-values for the Chi-Square test represent good fit by indicating that the proposed model is not significantly different from the inputted variance/covariance matrix (Raykov & Marcoulides, 2006).

The other criteria used to estimate good model fit include values greater than .95 for CFI and values below .08 for RMSEA and SRMR (Hu & Bentler, 1999).

Results

Independent samples t-tests were estimated to determine if the frequency of food insecurity varied significantly between two groups, variously defined. Table 2 presents independent samples t-tests where there was a significant difference in food insecurity by Pell Grant eligibility ($M = 2.34$, $SD = .95$) and those who do not receive the Pell Grant ($M = 2.06$, $SD = .93$), $t(1952) = -6.292$, $p = .000$. There was a significant difference between first-generation college students ($M = 2.33$, $SD = .95$) and non-first-generation college students ($M = 2.07$, $SD = .94$), $t(2031) = -6.253$, $p = .000$ indicating that first-generation college students are more food insecure. There was also a significant difference in food insecurity between those who live off-campus ($M = 2.21$, $SD = .95$) vs. on-campus ($M = 2.03$, $SD = .91$), $t(2025) = -3.330$, $p = .000$ indicating that students who lived off-campus are more food insecure. There were no significant differences in food insecurity between males and females.

Table 3 presents an ANOVA of between-group differences in food insecurity by race/ethnicity. The F test was significant [$F(3, 2029) = 6.893$, $p = .000$], and the Levene test indicated that equal variances across the four categories can be assumed. The Bonferroni post-hoc test found the following between-group difference in food insecurity to be significant: Hispanic students have significantly higher food insecurity than do White students. Black students also have higher food insecurity than Whites, but the difference was not statistically significant.

Table 4 presents correlations between food insecurity and continuous variables. The correlation between food insecurity and age (.039) was not significant. Food insecurity and hours worked per week were significantly and positively correlated, $r = .130$, $p < .01$, indicating that the more hours per week a student worked, the more likely he or she was to be food insecure. The correlations between food insecurity and number of credits currently enrolled in (-.039) and academic level (-.25) were also not significant.

Table 5 demonstrates independent samples t-tests to determine if there were significant differences in average GPA between various categories of students. There was a significant difference in GPA by Pell Grant eligibility ($M = 3.11$, $SD = .77$) and those who do not receive the Pell Grant ($M = 3.20$, $SD = .74$), $t(1952) = 2.710$, $p = .000$, indicating that those on the Pell had lower GPAs. There was a significant difference between first-generation college students ($M = 3.08$, $SD = .76$) and non-first-generation college students ($M = 3.22$, $SD = .75$), $t(2031) = 4.195$, $p = .000$ indicating that first-generation college students have lower GPAs compared to students that were not first-generation. There was also a significant difference in living off-campus ($M = 3.14$, $SD = .78$) and living on-campus ($M = 3.27$, $SD = .66$), $t(2025) = 3.199$, $p = .001$ indicating that students who lived off-campus have lower GPAs. There were no significant differences in GPA between male and female students.

Table 6 presents the ANOVA of between-group differences in GPA according to race/ethnicity. The F test was significant [$F(3, 2029) = 7.858$, $p = .000$], and the Levene test indicated that equal variances in GPA across the four categories can be assumed. The Bonferroni post-hoc test found the following between-group difference in GPA to be

significant: Black Students had significantly lower GPAs than Asian, Hispanic and White students. Hispanic students had significantly lower GPAs than White students.

Table 7 presents correlations between GPA and continuous variables. The correlation between GPA and age (-.036) was not significant. GPA and hours worked per week were significantly and negatively correlated, $r = -.090$, $p = .01$, indicating that the more hours per week a student worked, the more likely he or she was to have a lower GPA. The correlation between GPA and number of credits currently enrolled in was positively and significantly correlated with GPA, $r = .141$, $p = .01$. Academic level was also positively and significantly correlated with GPA, $r = .121$, $p = .01$.

Table 8 presents the regression of food insecurity on student characteristics, and Table 9 presents the regression of student GPA on student characteristics (including food insecurity). Lastly, Table 10 presents the indirect effects of student characteristics on student GPA via food insecurity. The full model, including all the predictors of both food insecurity and GPA, had zero degrees of freedom, meaning that there was only one solution to the structural equation model so model fit could not be assessed. Because gender and academic level were not significantly associated with food insecurity, they were deleted from the first regression, resulting in two degrees of freedom, the possibility of assessing the best fit to the data, and multiple measures of model fit.

The overall fit of the model was acceptable, as shown on Tables 8-10. The Chi-Square p-value was non-significant indicating that the proposed model was not significantly different than the inputted covariance matrix. The other measures of model fit were all below conventional limits.

Table 8 indicates that several student characteristics were significantly associated with food insecurity. Students who had ever received a Pell Grant had significantly higher levels of food insecurity, as did first-generation students and students who lived off-campus. The more hours per week a student worked for pay, the higher their food insecurity tended to be, and the further along in school the student was, the lower their food insecurity tended to be. Being Black, Hispanic or Asian was not significantly associated with food insecurity compared to being White and neither was age. Thus, alternative hypotheses two, three, four, and five were supported but alternative hypothesis one was not.

Table 9 reveals that food insecurity is negatively associated with GPA, indicating that alternative hypothesis eleven was supported. In addition, being Black (compared to White) predicted lower GPA, supporting alternative hypothesis six. Students who work more hours per week tend to have lower GPAs as do students who live off-campus vs. those who live on-campus, this supported alternative hypotheses nine and ten. The further along students are in school (juniors and seniors), the higher their GPAs tended to be. In addition, females tended to have higher GPAs than males, and the more units a student is enrolled in, the higher their GPA tends to be.

Lastly, Table 10 presents food insecurity as a mediator of the associations between student characteristics and student GPA. Several indirect effects were statistically significant in a negative direction: Pell Grant recipients, first-generation college students, students who worked relatively more hours per week, and students who lived off-campus (rather than on-campus) all had significantly lower GPAs in part because they were more food insecure. In other words, these student characteristics

predicted greater food insecurity, which in turn predicted lower GPA. These results indicate that alternative hypotheses thirteen, fourteen, fifteen and sixteen were supported but alternative hypothesis twelve was not.

Discussion

This is a study of food insecurity among college students that shows what predicts food insecurity and how food insecurity predicts GPA. It is also the first study that shows that food insecurity is in part responsible for why students with certain background characteristics tend to have lower GPAs. These results suggest that students may not be meeting their full potential and may be doing poorly in college because they are not meeting their basic dietary needs. Thus, their minds may be preoccupied with obtaining sufficient, and nutritious foods, or with working more hours to support their basic needs, like being able to afford the rent. These findings highlight a perpetuation of social class conditions where these students may have come from a microsystem of poverty in their families, and continue to face poverty conditions in their microsystems while in college. This is further supported by the multivariate models that show there is no relationship between race/ethnicity and food insecurity after taking into account other indicators of family background. Thus, it appears that the reason racial/ethnic minority groups are more food insecure is due to factors associated with their greater likelihood of coming from impoverished families.

These results suggest that students tend to be more food insecure and have lower GPAs when they are Pell Grant recipients, first-generation, working, and living-off campus. Working students tend to show greater food insecurity, and lower GPA,

consistent with the literature (Freudenberg et al., 2011; Gaines et al, 2014; Hughes et al., 2011; Morris et al., 2016).

Food insecurity served as a mediator to indirectly explain the relationship between several student characteristics and GPA. This mediator, food insecurity, can be related back to ecological systems theory to show how the college student's microsystems interact at the level of the mesosystem (the interaction between their family background and their college life). Understanding these two systems in a college student's life would allow for an examination of the macrosystem. The university microsystem, in part the culture, could be individualistic or collective which may ease or restrain needy students' access to resources. For example, if a university campus endorses their food pantry and encourages students to seek government assistance to alleviate food insecurity, students in need may feel less stigmatized and more comfortable seeking resources. On the other hand, if the campus culture is more individualistic, it may make needy students feel more stigmatized if they seek resources and are not able to fully take care of themselves. A microsystem like this could encourage or deter students from their academic achievement and persistence.

Study Strengths and Limitations

The main strength of this study was its sophisticated statistical analysis of what student characteristics predict food insecurity as well as predict GPA, and how food insecurity mediates several of the associations between student characteristics and GPA. Thus, the study goes further than any existing research on food insecurity among college students by demonstrating not only what predicts food insecurity, but how food insecurity affects academic achievement, and how it transmits the influence of family background

on academic achievement. In other words, this is the first study that explains the potential role of food insecurity in explaining why students from disadvantaged backgrounds perform more poorly in college.

The data used in this paper were collected as part of a larger survey about civic engagement at a mid-sized university. Therefore, many of the measures used in this study were pre-determined and were not necessarily the measures one would use if designing the survey for the specific purpose of studying food insecurity among college students. For example, the measure of food insecurity is different from the six-item HFSSM (example in Appendix A); thus, it is not possible to classify students into different categories of food insecurity. However, the five items measured in this survey had high reliability and the food insecurity scale is related to other measures in the data set in predictable ways, indicating construct validity.

Other variables that were not included in this study but that would be very useful include parents' financial status, students' income and debt, spending habits how students were paying for college, and where exactly students lived (if not on-campus). In other words, this study could not determine if students live with family members, roommates, or alone, which would provide a clearer understanding of living conditions as a predictor to food insecurity. The survey also does not consider student participation in food assistance programs. The survey data also do not allow for a test of whether or not the student was food insecure prior to attending college, which could help explain the dynamic relationships between family and school at the mesosystem level over time. In addition, questions about students being pregnant were not included in this study; pregnant students might be especially vulnerable to food insecurity.

Since information on financial factors was limited to Pell Grant eligibility, students who may have not completed their Federal Application for Federal Student Aid (FAFSA) but who were still Pell Grant eligible were treated as though they were not. In addition, there were no questions about physical health so it is not possible to determine if the negative association between food insecurity and GPA is mediated by poor health.

In terms of predicting GPA, it would have been useful to know students' academic major since some majors make obtaining a high GPA more difficult than others. Furthermore, the survey data were linked to students' current semester GPA at the end of the semester (spring 2016) in which the data were collected. Therefore, GPA reflected achievement for one semester rather than achievement or persistence over time. Nonetheless, GPA did reflect the student's performance at the end of the semester in which food insecurity was measured, so there is some degree of temporal order with food insecurity preceding academic performance in time. However, only a longitudinal study that tracked student performance and food insecurity over several years would be able to test how food insecurity affects academic achievement or persistence in college.

Another limitation of the study was the sample of students from whom the data were collected. All the students attended one mid-sized, western university so the results do not necessarily generalize to other colleges and universities in other parts of the county. In addition, the students in the sample do not necessarily represent all the students at the university. While the sample size was relatively high, it still only included about 10% of all students. In addition, because the inclusion criteria for this study included variables that were only collected from these students (as part of the civic engagement survey), but were not available for all students at this university (e.g., having

children or not), there was no way to make statistical comparisons between the study sample and all the students at the university who met the same inclusion criteria. As a result, it is not possible to know how similar the sampled students are to all students at the university who also met the same selection criteria. One final limitation of this study was that the data are cross-sectional, making it impossible to determine causality. Even though the hypotheses imply cause and effect, the analyses cannot confirm causality.

Potential Implications for Policies in Higher Education

Bringing light to this social issue should indicate to policy makers that today's college students are facing serious challenges beyond massive student-loan debt, and perhaps as a result of financial problems. It is important to note that not all college students who have low academic achievement are food insecure, or want to stay in college. There is variation in reasons why college students stay in college or not. However, university policy makers should consider making an investment in today's students and tomorrow's professionals by developing policies to reduce the incidence of food insecurity among college students.

In addition, universities should track students' potential unmet needs, such as surveying students about food insecurity on a regular basis. When students are found to be food insecure, universities should make them aware of the resources available to them such as the university food pantry, or government programs, such as, the Supplemental Nutrition Assistance Program (SNAP). The university could send out emails as a way to reach all students, and inform them about the resources available. In addition, resources for food insecure students could be discussed at new student orientations, and at tabling events. If students qualify for such assistance, universities should help ensure that

students are signed up and have destigmatized access to resources. Universities could work on destigmatizing services for students, such as the CalFresh approach noted by Crutchfield et al., (2016) where there is a day dedicated to getting students enrolled in services, with student-volunteer run tables, and high levels of student encouragement.

Directions for Future Research

Future research should collect data over time to test how food insecurity may be related to changes in academic achievement and to student persistence in college. Such data could help to assess how college students who identify as food insecure may take longer to finish college and may even drop out. Furthermore, future research should include many of the key measures discussed above that were not available in the data analyzed in this study. In addition, studies should track child development over time to see if poverty in childhood affects academic achievement via food insecurity in earlier years, which may explain poor academic achievement in college. In other words, it could be food insecurity in childhood that explains the relative low GPAs of students who are food insecure in college. Lastly, it would also be important to examine workforce patterns for students who are food insecure in college. Research should ask whether or not food insecurity in college predicts continued poverty in adulthood, continuing the cycle between microsystems over the course of the college student's life.

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Table 1: *Percent and Frequencies*

Demographic Characteristics		Frequency	Min	% or <i>M (SD)</i>	Max
Food Insecurity			1	2.17 (.95)	4
# of units taken in spring			6	14.78 (2.61)	24
# of hours worked per week			0	1.79(1.55)	6
Age			18	20.56 (1.77)	26
Sex	Female	1364		67.1	
	Male	669		32.9	
Race	Asian	202		9.9	
	Black	59		2.9	
	Hispanic	458		22.5	
	White	1314		64.6	
Academic Level	Freshman	428		21.1	
	Sophomore	478		23.5	
	Junior	583		28.7	
	Senior	544		26.8	
First-Generation College Student	Parents have < a two-year associates degree	806		39.6	
	Parents have > a two year degree	1227		60.4	
Pell Grant recipient	Student has ever received Pell Grant	761		38.9	
	Student has never received Pell Grant	1193		61.1	
Live off-campus	Yes	1634		80.6	
	No	393		19.4	
Work for Pay	Yes	1343		66.1	
	No	690		33.9	

Table 2: Average Food Insecurity by Student Group: Results of Independent Samples t-tests

	Yes			No			95% CI for Mean		t	df	
	M	SD	N	M	SD	N	Diff.				
Female	2.17	.94	1364	2.18	.97	669	-.08	.10	.194	2031	
Pell Grant Eligible	2.34	.95	761	2.06	.93	1193	-.36	-1.89	-6.292	***	1952
First-Generation college student	2.33	.95	806	2.07	.94	1227	-.35	-.18	-6.253	***	2031
Live off campus	2.21	.95	1634	2.03	.91	393	-.28	-.07	-3.330	***	2025

***p<.001 **p<.01 *p<.05

Table 3: *ANOVA Results of Average Food Insecurity by Race/Ethnicity*

	Mean	SD	N
Asian	2.14	.95	202
Black	2.44	.96	59
Hispanic	2.32 ¹	.94	458
White	2.11	.94	1314

¹Higher than Whites

²F(3, 2029) = 6.893, p = .000

Table 4: *Bivariate Correlations with Food Insecurity for Continuous Variables*

	Food Insecurity
Age	.039
Hours worked per week	0.130**
Units enrolled in spring 2016	-.039
Academic level	-.025

Note: ***p<.000 **p<.001 *p<.05

Table 6: *ANOVA Results of Average Food Insecurity by GPA*

	Mean	SD	N
Asian	3.19	.72	202
Black	2.80	.82	59
Hispanic	3.08	.78	458
White	3.20	.75	1314

$F(3, 2029) = 7.858, p = .000$

Table 7: *Bivariate Correlations with GPA for Continuous Variables*

	Food Insecurity
Age	-.036
Hours worked per week	-.090**
Units enrolled in spring 2016	.141**
Academic level	.121**

Note: ***p<.000 **p<.001 *p<.05

Table 8: *Regression of Food Insecurity on Student Characteristics, N=1948*

Independent Variables	<i>B</i>	SE	<i>B/SE</i>	<i>p</i>
Black [^]	.220	.26	1.753	.080
Hispanic	.078	.055	1.429	.153
Asian	.014	.072	.197	.844
Pell Grant recipient	.168***	.047	3.534	.000
First-generation student	.128**	.047	2.706	.007
Hours worked each week	.065***	.015	4.387	.000
Lives off campus (vs. dorm)	.149*	.062	2.413	.016
Year in school	-.109***	.029	-3.729	.000
Age	.031	.018	1.715	.086
Constant	1.443***	.318	4.543	.000

[^]Reference category is white

p < .05. ** *p* < .01. *p* < .001

Model fit: Chi-square=.635, df=2, *p*-value=.7281; RMSEA=.000; CFI=1.00; SRMR=.002

Table 9: *Regression of GPA on Student Characteristics, N=1948*

Independent Variables	<i>B</i>	<i>SE</i>	<i>B/SE</i>	<i>p</i>
Food insecurity	-.120***	.017	-7.056	.000
Black [^]	-.363***	.095	-3.836	.000
Hispanic	-.046	.041	-1.119	.263
Asian	-.012	.054	-.219	.826
Pell Grant recipient	.013	.036	.372	.710
First-generation student	-.067	.036	-1.870	.062
Hours worked each week	-.029**	.011	-2.545	.011
Lives off campus (vs. dorm)	-.185***	.047	-3.977	.000
Year in school	.209***	.022	9.383	.000
Female	.242***	.034	7.181	.000
Units enrolled in	.036***	.007	5.398	.000
Constant	3.677	.296	12.427	.000

[^]Reference category is white

p < .05. ** p < .01. p < .001

Model fit: Chi-square=.635, df=2, p-value=.7281; RMSEA=.000; CFI=1.00; SRMR=.002

Table 10: *Indirect Effects of Student Characteristics on GPA via Food Insecurity*

Student Characteristic → Food Insecurity → GPA				
Independent Variables	<i>B</i>	SE	<i>B/SE</i>	<i>p</i>
Black	-.026	.016	-1.701	.089
Hispanic	-.009	.007	-1.401	.161
Asian	-.002	.009	-0.197	.844
Pell Grant recipient	-.020**	.006	-3.160	.002
First-generation college student	-.015**	.006	-2.527	.012
Hours worked per pay each week	-.008***	.002	-3.725	.000
Lives off campus (vs. in a dorm)	-.018**	.008	-2.283	.022

^Reference category is white

p < .05. ** p < .01. p < .001

Model fit: Chi-square=.635, df=2, p-value=.7281; RMSEA=.000; CFI=1.00; SRMR=.002

Appendix A: *Comparisons Between Six-item HFSSM and Survey Used in This Study*

Six-item HFSSM	Survey Data
<p>FILL INSTRUCTIONS: Select the appropriate fill from parenthetical choices depending on the number of persons and number of adults in the household.</p>	<p>Food scarcity among college students is an increasing problem nationwide. How true is each statement for you over the last 6 months?</p>
<p>HH3. I'm going to read you several statements that people have made about their food situation. For these statements, please tell me whether the statement was often true, sometimes true, or never true for (you/your household) in the last 12 months—that is, since last (name of current month). The first statement is, "The food that (I/we) bought just didn't last, and (I/we) didn't have money to get more." Was that often, sometimes, or never true for (you/your household) in the last 12 months?</p> <p><input type="checkbox"/> Often true <input type="checkbox"/> Sometimes true <input type="checkbox"/> Never true <input type="checkbox"/> DK or Refused</p>	<p>The food I buy each month does not last and I do not have money to buy more. (item 5 in survey)</p> <p>1="Never" 2="Once" 3="Sometimes" 4="Often true"</p>
<p>HH4. "(I/we) couldn't afford to eat balanced meals." Was that often, sometimes, or never true for (you/your household) in the last 12 months?</p> <p><input type="checkbox"/> Often true <input type="checkbox"/> Sometimes true <input type="checkbox"/> Never true <input type="checkbox"/> DK or Refused</p>	<p>I can't afford to eat balanced meals. (item 1 in survey)</p> <p>1="Never" 2="Once" 3="Sometimes" 4="Often true"</p>
<p>AD1. In the last 12 months, since last (name of current month), did (you/you or other adults in your household) ever cut the size of your meals or skip meals because there wasn't enough money for food?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No (Skip AD1a) <input type="checkbox"/> DK (Skip AD1a)</p>	<p>I skip meals because I don't have enough food. (item 2 in survey)</p> <p>1="Never" 2="Once" 3="Sometimes" 4="Often true"</p>
<p>AD1a. [IF YES ABOVE, ASK] How often did this happen—almost every month, some months</p>	<p>Survey does not include this item</p>

<p>but not every month, or in only 1 or 2 months?</p> <p><input type="checkbox"/> Almost every month <input type="checkbox"/> Some months but not every month <input type="checkbox"/> Only 1 or 2 months <input type="checkbox"/> DK</p>	
<p>AD2. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK</p>	<p>I eat less than I want to because there is not enough money for food. (item 3 in survey)</p> <p>1="Never" 2="Once" 3="Sometimes" 4="Often true"</p>
<p>AD3. In the last 12 months, were you every hungry but didn't eat because there wasn't enough money for food?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> DK [End of Six-Item Food Security Module]</p>	<p>I am often hungry because I don't have money for food. (item 4 in survey)</p> <p>1="Never" 2="Once" 3="Sometimes" 4="Often true"</p>