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Food Insecurity at a Four-Year College Campus

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Capstone Paper
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Executive Summary

Research Questions: This paper, through an adaption of the United States Department of Agriculture Adult Food Security survey tool, aims to identify food insecurity rates at the University of Massachusetts Amherst, the demographic characteristics associated with food insecurity, potential financial factors that contribute and predict food insecurity rates, and the relationship between food insecurity and academic performance. Lastly, this paper examines on and off campus resources available to students and students perception of food insecurity before college as compared to actual food security status in college.

Background: Food insecurity rates for students at four-year universities are at 36% nationwide. Factors such as living off campus, being financially independent, and having a job have all been correlated with student food insecurity.

Methods: This study is an exploratory study that aims to determine rates of food insecure and food secure students using quantitative data obtained from surveys. Random sampling was based on students enrolled in 100-, 200-, 300-, and 400- level courses in most popular majors. The survey developed is original data coupled with the USDA survey (questions 15-25: see appendix) with questions ranging from access to transportation to living arrangements. Multivariate regression analysis with STATA identifies financial predictors of food insecurity amongst four-year college students.

Results: Results conclude that overall rates of food insecurity at the University of Massachusetts Amherst are 11.7%. This is compared to four-year universities nationally, where 36% of students are food insecure. Both living off campus and being financially independent are the largest predictors of food insecurity, consistent with literature, whereas having a meal plan greatly reduces a students' likelihood of being food insecure. Food insecurity status also has a negative impact on grade point average. Students experiencing food insecurity have lower grade point averages than food secure counterparts. Very low food secure students stated experiencing less food security upon coming to campus, however students with meal plans felt more food secure in college as compared to high school.

Policy Recommendations: Moving forward, it is important that this analysis identified groups at the University of Massachusetts Amherst that are food insecure to best help accommodate these students. The university is currently offering a wide variety of resources to food insecure students, however exploring a meal swipe donation program may help food insecure students in the future at this university. Further, raising meal plan prices could increase food insecurity rates on campus and considering serving leftover foods from campus events to students experiencing food insecurity could be beneficial.

Introduction

Food security has long been an issue in the United States. However the predictors and solution associated with food insecurity at four-year college campuses have only recently been studied. Further, this concept has only very recently been applied to students, specifically college students at four-year universities. Therefore, this paper aims to develop a more clear understanding of food insecurity on four-year college campuses through the examination of rates of food insecurity at a public, four-year university in New England. This paper identifies demographic characteristics associated with food insecurity, potential financial factors that contribute to food insecurity rates as a main research question, and the relationship between food insecurity and academic performance.

This paper includes a background on the history of hunger and food insecurity programs and measurement tools, leading to the discussion of the robustness of the USDA U.S. Adult Food Security Survey tool that was adopted for a college population in this paper. Further, the reviews lay a framework for analyses and gaps in current research, as well as how this analysis fills those gaps. Research methods are discussed through the explanation of the survey instrument and discussion of methods of statistical analyses. Through a multivariate regression analysis, this paper identifies predictors of food insecurity on campus. This paper examines on and off campus resources available to students and students' perception of food insecurity before college as compared to actual food security status in college, followed by a discussion of results. Lastly, this paper discusses the policy implications of this research and of the emergence of research related to food insecurity on college campuses and closes with concluding remarks.

Background/Literature Review

Interest in food insecurity and hunger since the 1960s has been consistent, but rising amongst scientists and politicians in recent years. Recent research turned food insecurity into a national topic of conversation. The United States Department of Agriculture estimates that the annual shortfall in dollars that food insecure individuals report needing to meet the most basic of food needs is \$22,267,592,013 (Feeding America 2018). Therefore, propelling and increasing research in food insecurity is ever more important to understand the issues those who are food insecure are facing and the best steps to take in order to ensure that basic food needs are met.

Hunger efforts can be traced back to the 1930s during the Great Depression (Poppendieck, chap. 6). In this era, the contrast of hunger existing when farms were thriving was dubbed the ‘paradox of want amid plenty (Poppendieck, chap. 6, 135).’ Presidents Hoover and Roosevelt responded to the spectrum of needs with programs that provided those facing hunger with food from farms with ample surplus (Poppendieck, chap. 6). The idea of providing surplus foods to populations facing hunger led to the creation of the food stamps program and the national school lunch program in 1964. World War II drastically diminished these programs, but they prevailed.

Hunger, again, came to the forefront in the late 1960s after the televised CBS documentary titled, “Hunger in America” (National Research Council, chap. 2). This documentary sparked widespread increases in food assistance efforts. Up until the 1980s many groups aimed to define and determine hunger rates, but the outcomes amongst studies varied due to conflicting definitions related to hunger. Some researchers used

surveys, others used poverty data, but no formal data collection process had been created up to this point.

In 1980, President Reagan developed a task force to address the concern of widespread hunger in the United States (National Research Council, chap. 2). The task force looked at existing food programs and determined that those facing hunger were a diverse group, and as a result, the task force formally defined hunger. Hunger was split into two categories of malnutrition and “the inability, even occasionally, to obtain adequate food and nourishment. In this sense of the term, hunger can be said to be present even when there are no clinical symptoms of deprivation (National Research Council, chap. 2).” The task force further stated that there was an increased need for proper measurements of hunger.

In the mid 1980s, the United States Department of Agriculture, the Community Childhood Hunger Identification Project under the Food and Research Action Center, and the Cornell University Division of Nutritional Sciences attempted to develop surveys and indicators of hunger in adults and children (National Research Council, chap. 2). The 1990s were a turning point for hunger due to the emergence of defined terms, as well as the determination that there would be a cumulative source to measure hunger. Further, this was aided by the emergence of the term “food insecurity.” The Life Sciences Research Office of the Federation of American Societies for Experimental Biology in conjunction with the Department of Health and Human Services defined hunger and malnutrition in terms of food security and food insecurity (Anderson 1990, 1559-1560). Food insecurity was defined as “limited or uncertain availability of nutritionally adequate

and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways (United States Department of Agriculture 2017).”

Nationally, according to the USDA Economic Research Service in 2016, 10.8 million adults lived in households with very low food security, whereas 41.2 million adults lived in food secure households (United States Department of Agriculture 2017). Rates of food insecurity in the Northeast were 10.8% in 2016. Bringing the scope in further to food insecurity rates in Massachusetts, food insecurity rates are below the U.S. average (Martinez, Maynard, and Ritchie 2016). The average rate of food insecurity in 2015 in Massachusetts was 10.6% (Feeding America 2018).

The most pertinent statistics to this analysis are post-secondary education food insecurity rates. Many studies have been released in recent years that examine all types of post-secondary students and food security status. Researchers have been examining rates of food insecurity at four-year college students’ community college, and students attending vocational schools in rural suburban, and metropolitan areas (Martinez, Maynard, and Ritchie 2016; Chapparo et al. 2009, 2097-2103; Gaines et al. 2014, 374-384; Blagg 2017; Maroto, Snelling, and Linck 2015, 515-526; Patton-Lopez et al. 2014, 209-214). Previous post-secondary education food insecurity rates were higher in rural and community college students, but I compare four-year universities more generally with the university I study. Students at four-year institutions might have lower than national rates of food insecurity because students attending four-year universities tend to come from higher income families (Morris et al. 2016, 376-382). Rates of food insecurity at the college level vary greatly between studies, where researchers at a rural university in Oregon (Broton and Goldrick-Rab 2016, 16-25) found rates of food insecurity at 59%,

and researchers at a large, public university in the Southeast found food insecurity rates of 14% (Blagg 2017). A 2018 national study on 35 four-year institutions found that 36% of students experienced food insecurity (Goldrick-Rab et al. 2018).

Predicting factors of food insecurity amongst college students can include race factors, low personal income, working a full time jobs while attending college, and being financially independent, among others (Morris et al. 2016, 376-382; Broton and Goldrick-Rab 2016, 16-25; Fruedenberg et al. 2013, 422-430); Blagg 2017). Further, students from the University of California system were more likely to be food insecure in college if they were also food insecure as a child (Gaines et al. 2014, 374-384). Living off-campus comes up multiple times as being related to food insecurity rates (Maroto, Snelling, and Linck 2015, 515-526; Fruedenberg 2013, 422-430). Students living off-campus are largely dependent on shopping for food and making their own meals as opposed to students on meal plans, which provide students with meals.

A recent study found that, of the 35 four-year institutions surveyed, 26% of on-campus students were food secure and 39% of off-campus students were food insecure (Goldrick-Rab et al. 2018). These percentages show similar rates for students with (26%) and without (36%) meal plans. A large consensus between food insecurity rates seemed to lie in student employment, where students with jobs saw higher rates of food insecurity. Consequences due to food insecurity sustained over a college career can lead to poorer health, poorer academic performance and an increase in mental health symptoms (Brueing 2016, 1450-1457; Fruedenberg 2013, 422-430; Gaines et al. 2014, 374-384; Broton and Goldrick-Rab 2016, 16-25). These mental health symptoms can result in anxiety and depression for students who are concurrently facing food insecurity

stressors. Students who face poor health as a result of food insecurity may see poor health as a risk factor associated with their food insecurity (Fruedenberg et al. 2013, 422-430). Food insecurity before college predicting college food insecurity in college may also be associated with predicting poorer student health of students entering college.

Poorer academic performance amongst food insecure students has been thoroughly studied to include factors that lie outside of the primary measure of academic performance, which is grade point average. This can also include graduation rates and retention rates, which are further dependent on student health and chronic disease development (Fruedenberg et al. 2013, 422-430). Studies examining overall health outcomes and academic performance cannot be explored without considerations for student relationships with food and access to balanced meals, which are a core measurement on the USDA U.S. Adult Food Security survey tool.

This analysis aims to add to existing research on predictors of food insecurity at four-year universities. Further, studies examining food security in the New England area are few and far between leaving a gap in research to compare overall college rates of food insecurity with existing national rates discovered in the New England Area.

Methods

Sample

The Institutional Review Board at the University of Massachusetts Amherst approved this study on October 23, 2017. This study is an exploratory study using quantitative data provided by survey respondents from a large, public university in New England. This cross-sectional survey was used to determine food insecurity rates at the

university and possible factors that may contribute to increased food insecurity. The survey was distributed between November and December of 2017.

Academic majors for class selection were determined by cross-referencing most popular majors nationally via the Institute of Education Sciences, National Center for Education Statistics (United States Department of Education 2018) with most popular majors at the university. Most popular majors at the university were identified using college scorecard from the U.S. Department of Education (College Scorecard 2018). The most popular majors nationally were business, biological and biomedical sciences, social sciences, health professions, and psychology. This research selected at the university were business, psychology, and nursing, to capture the majors with the largest draw and interest at the university and to reach the greatest number of students. Within each discipline, 100, 200, 300, and 400 level class strata were selected to target individuals in each grade level (i.e. freshman, sophomore, junior, senior) in order to maintain an equally distributed sample. This sample selection method was chosen due to time and resource constraints, as researchers could not distribute the survey to the entire university and choosing most popular majors made the distribution more manageable. Further, distributing the survey to all large lectures was not feasible due to resource constraints.

Classes in each stratum were randomly selected and professors for the classes were emailed for inquiry about survey distribution. Due to monetary and time constraints, four classes were selected within each discipline at each of the grade levels, for a total of 16 classes. Each professor was received up to three emails in the fall of 2017, after which a replacement professor was chosen if no response was received or a professor refused to participate. If the replacement professor did not answer three attempts at contact the class

level was not reached. A total of 14 professors were contacted. Seven professors responded with interest in distributing the survey (50%). Each discipline was represented. Business professors in the 100, 200, and 400 level classes, and psychology and nursing professors in the 200 and 400 levels classes all responded to distribute the survey. Professors were given a Qualtrics link to the survey and approved survey announcement to distribute to students via email or class webpage. The seven professors that distributed the surveys consisted of a 1,446 students. Of this, 497 students responded to the survey (34%). Responses were then sorted and disregarded if the survey was not finished or had incomplete answers. Therefore, the final number of valid surveys included 470 students. The survey consisted of 30 questions with an average response time of 6.5 minutes. Students further had the opportunity to include open-ended comments about food insecurity or any thoughts upon completion of the questionnaire.

Further, a multivariate logistic regression analysis is used to discover financial predictors of food insecurity. This method was chosen in order to assess financial variables chosen from the survey and to determine the likelihood at which they predict student food insecurity. Further, multivariate logistic regression is a regression technique that is used to analyze dichotomous dependent variables rather than a continuous dependent variable. This method will reveal factors that are the greatest contributors and preventers of food insecurity to make sound policy recommendations.

Survey Design

The emergence of the idea of food insecurity in relation to adults led to a more nationally situated approach to food access and ultimately the development of the USDA

U.S. Adult Food Security survey, the crux of this analysis. In 1990, the National Nutrition Monitoring and Related Research Act was passed and a ten-year plan was to be implemented (Economic Research Service 2018). This plan needed to address a way to measure and define food security and insecurity in a comprehensive and standardized way so that it could be nationally implemented.

The National Conference on Food Security Measurement and Research convened to develop the survey and define terms for a national survey on food insecurity, and the U.S. Census Bureau distributed a pilot survey in the mid 1990s (United States Department of Agriculture 2017). The survey was added to the nationally recognized Current Population Survey as a food security supplement. Both Abt Associates, Inc. and Mathematica Policy Research, Inc. in conjunction with the Food and Nutrition Service under the USDA tested the validity, reliability, and robustness of surveys from 1995 to 1997 and found that the questions were effective at measuring food insecurity across different households, populations, and years (United States Department of Agriculture 2017). In 1998, the USDA Economic Research Service became the main service head for data analysis and research. This survey has been used in numerous studies to find food insecurity rates and predictors (Maroto, Snelling, and Linck 2015, 515-526; Blagg 2017; Patton-Lopez et al. 2014, 209-214; Broton and Goldrick-Rab 2016, 16-25; Brueing 2016, 1450-1457).

The USDA survey is an 18-question survey, shortened to 10 questions if there are no children in the household. There is a shorter 6-question survey developed for households with and without children (Alaimo 2005, 281-298). The survey asks

questions about changing eating habits due to lack of food and ability to eat balanced meals. The survey definitions include (United States Department of Agriculture 2017): *High food security* as no reported indications of food-access problems or limitations; *marginal food security* as one or two reported indications—typically of anxiety over food sufficiency or shortage of food in the house. Little or no indication of changes in diets or food intake; *low food security* as reports of reduced quality, variety, or desirability of diet. Little or no indication of reduced food intake; and *very low food security* as reports of multiple indications of disrupted eating patterns and reduced food intake. Both low and very low food security are conceptualized as “food insecurity.”

The goal of the survey was to determine the rates of food insecurity at a four-year college campus and to determine factors contributing to food insecurity rates. In order to accomplish this, a survey instrument was developed, which incorporates the United States Department of Agriculture (USDA) U.S. Adult Food Security (USDA, ERS 2012) survey module. The 10-question module is a modified version of the USDA U.S. Household Food Security survey module to reflect households without children. The use of this survey produces data that can be compared with national statistics and is considered reliable by previous literature and the USDA. The survey asked students to reflect on their food environment from the previous 12 months. Questions revolved around access to food, changing food habits due to lack of food, and availability to a variety of foods as a result of financial resource constraints (Food and Nutrition Service 2000). Students that answered “yes,” “often,” “sometimes,” “almost every month,” and “some months but not every month” were classified as affirmative answers. The ten-question survey (questions 15-25: see appendix) classifies adults as having high (0

affirmative answers), marginal/at risk (1-2 affirmative answers), low (3-5 affirmative answers), or very low food (6-10 affirmative answers) security based on responses.

The USDA states that adults in both the high and marginal food security categories are food secure and adults in the low and very low food security categories are food insecure. Students in the marginal category are considered at risk of becoming food insecure. These groups will be used for the remainder of the analysis. Students were additionally asked demographic questions. Topics included: academic year, race/ethnicity, gender, access to adequate transportation, living arrangements, meal plan participation, having dependents or being a dependent, being a first generation student, sending money home to dependents, and having a job. Students were further asked questions that students to make a self-determined comparison of food security at home in high school versus food security at university. Additionally, students were asked to evaluate if food resources on campus were available when needed. The survey had two open ended questions regarding opportunities students have used on campus to help with food insecurity and any additional comments students wished to provide to researchers.

A main research question for this assessment looks at financial predictors of food security. This includes being dependent on family for school costs, having a job, having a meal plan, and their living arrangement. Student living on-campus may only have access to the foods on campus, which may not be as affordable as a grocery store, however the requirement of on-campus meal plans may aid in student food security. Dependence on family for tuition costs may release a significant financial burden from the student, where individually paying for tuition may make students unable to afford food. Further, the students with full time jobs may be coming from backgrounds where they previously

experienced food insecurity and have to work a job in order to pay for food in college. Lastly, the exploration of students with meal plans is essential because students with meal plans may have very different eating situations and habits than student's off-campus or students without meal plans.

It should be noted that the survey asked participants for race/ethnicity, with possible answers being "African American or Black", "Asian or Asian American", "Latino/a", "Middle Eastern or Middle Eastern American", "Native American, North or South American Indian, or Alaska Native", "Native Hawaiian or Pacific Islander", "Biracial or multiracial", or "Other" with the option to define race/ethnicity. These responses were folded into a "Minority" category. This data would have been preferable to be reported separately, however, with a low number of total responses and for clarity, for the purpose of this analysis they are grouped together.

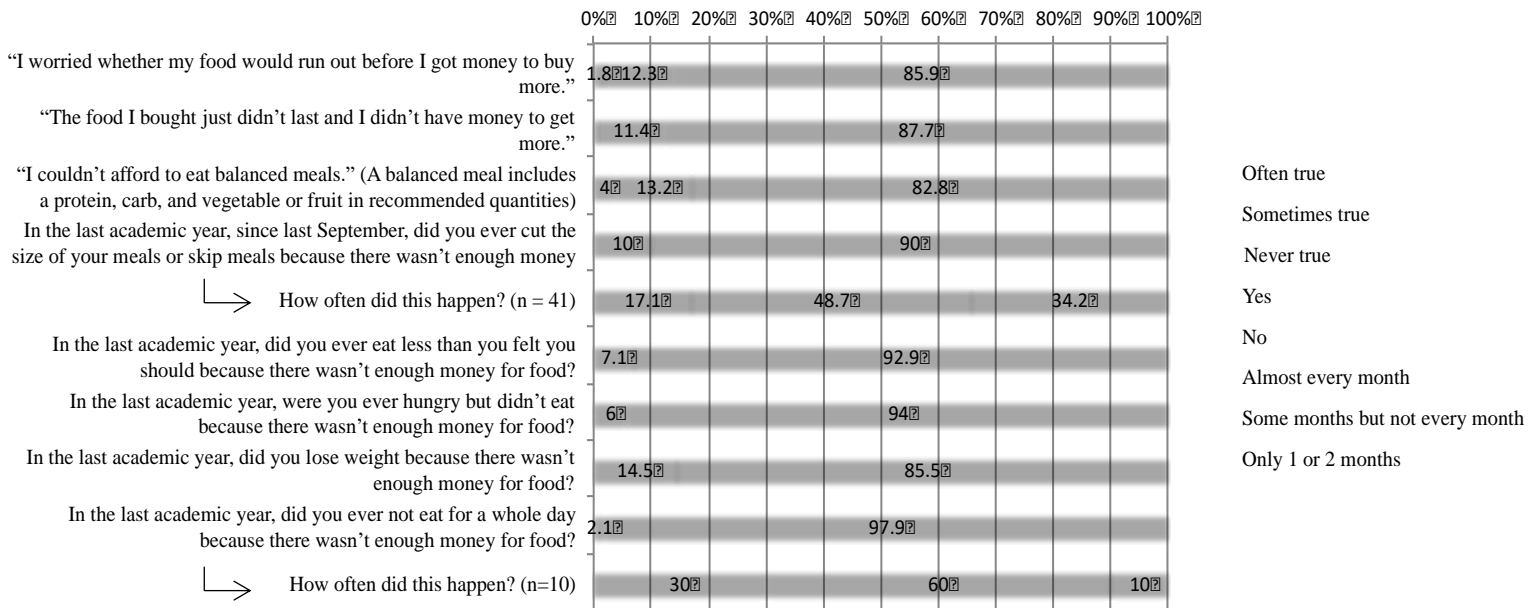
Analysis/Results

Analysis and results include general univariate and bivariate statistics for data collected. Overall percentages of food security categories are depicted, as well as a visual representation of responses from the ten core questions designed in the USDA Adult Food Security Survey tool. The overall rate of food insecurity on campus was 11.7% with major financial factors such as living off-campus and being financially independent predicting food insecurity, and having a meal plan significantly lowering a students likelihood of being food insecure. Bivariate statistics are discussed and assessed. Further, an additional table shows bivariate statistics of other variables discussed further throughout the paper that include grade point average and student perception of food

insecurity prior to college. This section concludes with a multivariate regression analysis, identifying the key factors predicting food insecurity for this sample, and comment results from open-ended survey questions.

Stata 15.1 statistical software and Excel were used for the totality of this analysis. Univariate statistics were calculated to determine frequencies within categories and bivariate statistics were calculated in order to calculate frequencies across independent variables and food security status reported. Multivariate analyses were used to identify the key factors, controlling for other factors.

Figure I: Survey Results for USDA Adult Food Security Survey (Reflecting the 10 Core Questions)

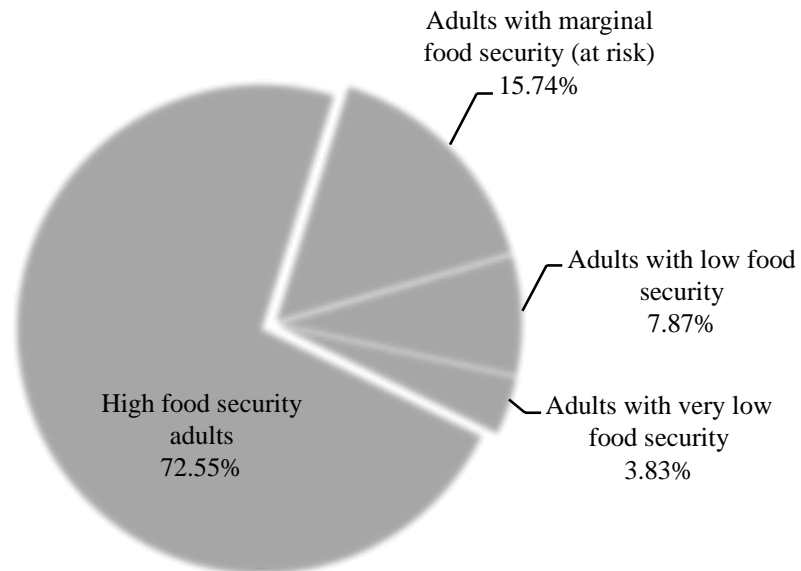


The most striking information from the above figure (Figure I) shows that 12.3% of students surveyed could not afford to eat balanced meals in the last 12 months. Additionally, 14.5% of students surveyed indicated that they lost weight in the last

academic year because there was not enough money for food. Of the 2.1 percent of students that did not eat for a whole day because there was not enough money for food, 30% of these students did so almost every month.

Results from the 10-question USDA U.S. Adult Food Security survey showed that out of the sample of 470 students surveyed, 341 students had high food security, or answered 0 questions on the survey as ‘affirmative’. This is a rate of 72.5%. Of the 470 students surveyed, 74 (15.7%) had marginal food security, 37 (7.9%) had low food security, and 18 (3.8%) had very low food security. This results in 415 (88.3%) students classified as food secure and 55(11.7%) as food insecure. The following image (figure II) depicts this graphically.

Figure II: University of Massachusetts Amherst Food Security Status Distribution



The following three tables depict column summary statistics for variables of interest discussed further in this analysis. The three tables show summary statistics for

controls used in the regression analysis, variables of interest used in the analysis, and variables discussed further in the analysis, but not used in the regression analysis. All tables show the categorical variable versus food security status. The tables are split into total sample, and food security categories (food secure and food insecure).

Table I: Column Percentages for Controls Used in Regression Analysis

Characteristics	Total Sample n(%)	Food Secure n(%)	Food Insecure n(%)
Gender			
- Woman	211 (44.89)	190 (45.78)	21 (38.18)
- Man	258 (54.89)	224 (53.97)	34 (61.81)
- Genderqueer	1 (0.21)	1 (0.25)	0 (0)
Race			
- White	346 (73.61)	306 (73.73)	40 (72.72)
- Minority	124 (26.38)	109 (26.27)	15 (27.27)
Academic Year			
- Freshman	1 (0.21)	0 (0)	1 (1.81)
- Sophomore	348 (74.20)	318 (76.81)	30 (54.54)
- Junior	86 (18.33)	71 (17.15)	15 (27.27)
- Senior	34 (7.24)	25 (6.04)	9 (16.36)
Do you have dependents?			
- Yes	26 (5.54)	23 (5.56)	3 (5.46)
- No	443 (94.45)	391 (94.44)	52 (94.54)
First Generation College Student			
- Yes	84 (17.87)	71 (17.11)	13 (23.63)
- No	386 (82.12)	344 (82.89)	42 (76.63)

Table I depicts gender, race, academic year, students with dependents, and first generation college students, all of which are used as controls in the regression analysis. For gender, the total sample was split fairly equally between women and men, with one genderqueer participant. Focusing on the food insecure category 61.81% of food insecure

individuals are men and 38.18% of food insecure individuals are women. Comparing this to the food secure group, 53.97% of the group is male and 45.78% of the group is women. Further, when analyzing race and food insecurity, the food insecure category contains 72.72% white students and 27.27% minority students. The food secure category was 73.73% white students and 26.27% minority students, making the groups fairly similar. An overwhelming amount of sophomore students responded to the survey with 54.54% of the food insecure category being sophomore students followed by 27.27% junior students and 16.36% of senior students. Comparing this to the food secure group, 76.81% of food secure students were sophomores followed by 17.15% junior students and 6.04% senior students. Fifty-two out of 55 food insecure students responded as not having dependents and three responded as having dependents amongst food insecure students. Lastly, of food insecure students 23.63% stated they were first generation students, compared to the food secure group where 17.11% of students stated they were first generation students.

Table II: Column Percentages for Variables of Interest Used in Regression Analysis

Characteristics	Total Sample n(%)	Food Secure n(%)	Food Insecure n(%)
Job			
- Yes	256 (54.46)	217 (52.28)	39 (70.90)
- No	214 (45.53)	198 (47.72)	16 (29.09)
Living Arrangement			
- On campus	333 (70.85)	307 (73.97)	26 (47.27)
- Off-campus	137 (29.14)	108 (26.03)	29 (52.72)
Dependent on family financially for school cost			
- Yes	303 (64.46)	282 (67.95)	21 (38.18)
- Partially	132 (28.08)	105 (25.30)	27 (49.09)
- No	35 (7.44)	28 (6.75)	7 (12.72)
School Meal Plan			
- Yes	425 (90.42)	374 (90.12)	51 (92.72)
- No	45 (9.57)	41 (9.88)	4 (7.27)

Table II depicts column percentages used as variables of interest in the regression analysis versus food insecurity statistics. The variables included are: having a job, living arrangement, financial dependence for school costs, and having a meal plan. The variables were chosen because were of interest, explored through the literature review, or directly supported the research questions. All explored variables are financial variables that were analyzed for predictability of food insecurity, therefore directly supporting the research question. Most food insecure students have a job (70.90%) and students living on versus off campus and experiencing food insecurity are very similar. A smaller percentage of food secure students have a job (52.28%). Forty-seven percent of food insecure students live on campus and 53% live off campus, while 73.97% of food secure students live on campus and 26.03% live off campus, showing that more food secure students are living on campus as compared to food insecure students. Large portions of

food insecure students are partially dependent on their family financially for school costs (49.09%), while a smaller percentage of food secure students (25.30%) are partially dependent on family for school costs. Exploring further, 92.72% of students experiencing food insecurity had some type of meal plan, while only 7.27% did not have a meal plan. Comparing this to food secure students 90.12% of food secure students had a meal plan and 9.88% did not.

Table III: Column Statistics for Variables Discussed Further in Analysis

Characteristics	Total Sample n(%)	Food Secure n(%)	Food Insecure n(%)
Food Security Compared to High School			
- Less than	44 (12.05)	27 (6.69)	17 (33.33)
- Same as	151 (41.36)	137 (45.66)	14 (27.45)
- More than	170 (46.57)	150 (47.63)	20 (39.21)
If you have experienced food insecurity, are there on-campus opportunities for help?			
- Yes	8 (3.51)	3 (0.67)	5 (14.70)
- No	220 (96.49)	191 (99.33)	29 (85.29)
GPA (standard deviation)	3.54 (0.38)	3.57 (0.36)	3.32 (0.35)

Table III represents variables that are further explored in this analysis, but not directly used in the regression analysis. These include student grade point average, student perception of food insecurity before attending university, and availability of on-campus opportunities to help mitigate student food insecurity. These variables were chosen to directly support the research question that explores academic performance

amongst food security groups and student perception of food insecurity before university to better understand how the student transition to college may affect food insecurity upon arrival to university. It should also be noted that the food insecure students had the lowest GPA out of all three categories (food secure, marginal food security, and food insecure) depicted in figure III.

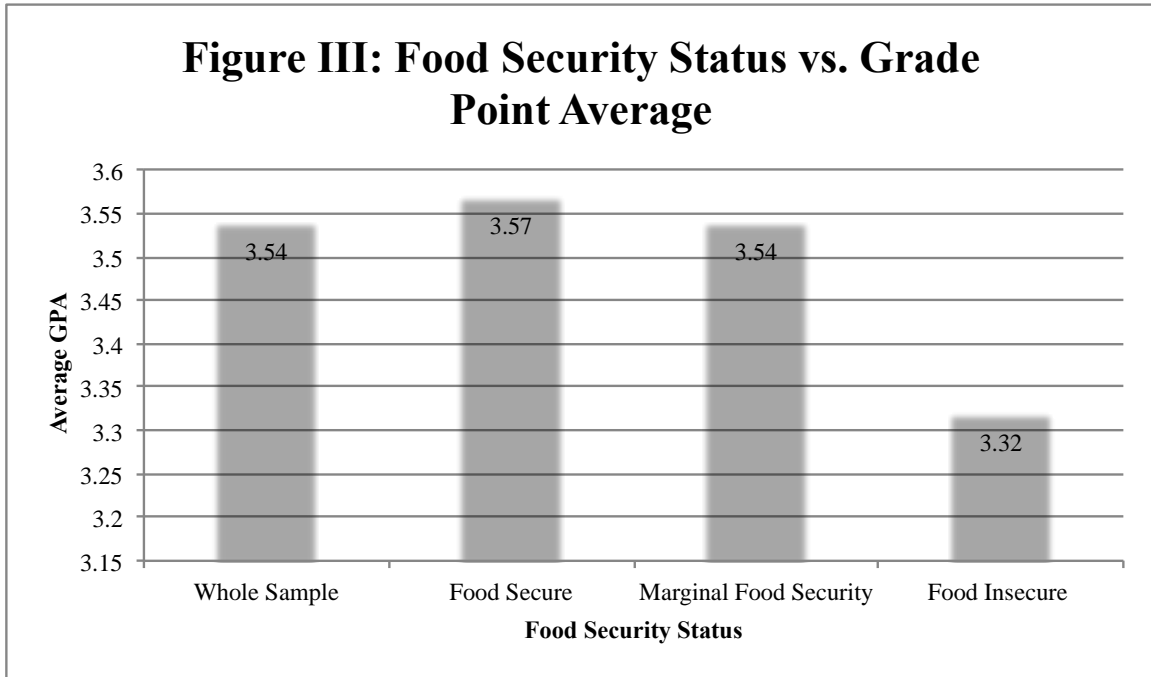


Figure III depicts student grade point average amongst food security groups as well as the entire sample. Overall the entire sample had a GPA of 3.54 out of 4.0. Within this, food secure students had an overall GPA of 3.57, marginal food secure students had a GPA of 3.54 and food insecure students had an overall GPA of 3.32. It should also be noted that the GPA of very low food security students was 3.2, very low food insecurity constitutes students that had an affirmative score between 6 and 10 on the 10-question USDA Adult Food Security survey tool. The grade point average of food insecure students was much lower than food secure and marginally food secure students.

This could lead to the conclusion that students that are food insecure are affected negatively academically by their food insecurity status. A oneway ANOVA test was used to calculate the statistical difference between the mean grade point averages in all of the food security groups. The analysis shows that there was a significant difference between group means and this showed an F statistic 6.68 with a significant level of 0.0002, indicating that the model is significant at the 0.0002% level. However, the Barlett's test for equal variances shows a significance level of 0.71, therefore we cannot reject the assumption that the variances are the same. To ensure that the F statistic was not due to chance, Bonferroni, Scheffe, and Sidak multiple comparison tests were used. All three tests have results that show there was a significant difference between the food secure and food insecure grade point average, marginal and food insecure grade point average and the entire sample average and the food insecure average. Further, there was no significant difference ($p < 0.05$) between the food secure and marginal food security GPA, whole sample and food secure GPA, and the entire sample and marginal food secure grade point average.

This reinforces the fact that food security status has a direct impact on academic performance between food insecure students and food secure students. However, more information may need to be collected in order to definitively determine that this is the leading factor for lowered academic performance. It should be additionally noted that grade point average is not the only measure for academic success in college students and that many other factors such as graduation rate and retention can be measured for academic performance and food security.

The existing literature and variables of interest drove variable selection for the multivariate regression analysis. To explore factors that could act as predictors for food insecurity, variables of interest include: working a job, living off campus, and being financially independent. Additionally, to further explore these outcomes, controls were added to the analysis including: gender, race, year in school, first generation students, and students with dependents. These controls were chosen in order to analyze independent variables with increased accuracy.

Results for the multivariate logistic regression analysis are depicted in table IV and a second multivariate regression was run to include a meal plan variable. This separate regression was run to explore connections between living off campus and meal plan confounding one another. Further, meal plans were the most common factor mentioned in long answer survey questions. This regression analysis is important in determining factors that can predict food insecurity in future populations between dichotomous dependent variables. Food secure students were coded as “0” and food insecure students were coded as “1”.

Table IV: Logistic Regression Analysis Predicting Food Insecurity

Variable	<u>Equation (1)</u>		<u>Equation (2)</u>	
	Odds Ratio	Std. Err.	Odds Ratio	Std. Error
Working a job	0.546*	0.185	0.522*	0.189
Living off campus	2.453**	0.867	3.403**	1.258
Financially independent	1.829**	0.397	1.987**	0.444
Meal Plan			0.211**	0.126
Gender	1.206	.0367	1.131	0.353
Race	.969	0.072	0.970	0.073
Year in school	1.269	0.307	1.354	0.342
First generation	0.942	0.363	0.946	0.367
Do you have dependents?	1.316	0.886	1.188	0.802
Constant	0.011	1.34	0.038	0.071

*p < 0.10, **p < 0.05

Odds ratio is the likelihood that a student will be food insecure given exposure to each variable. When an odds ratio is expressed, a value over 1 indicates that a student is more likely to be food insecure and a value under 1 indicates that a student is less likely to be food insecure. Table IV shows four independent variables and the odds ratio at which they occur, along with the significance and standard error of each measurement. This table shows that all ratios for variables of interest, working a job, living off campus, and being financially independent are significant at $p < 0.05$ or $p < 0.10$ in equation (1). Further, students living off campus are two and half times more likely to be food insecure. This is consistent with existing literature that supports this outcome.

Continuing, a financially independent student is 1.8 times more likely to be food insecure. Working a job was marginally significant and therefore is a contributing factor to lowering a student's likelihood of being food insecure.

These effects are mediated by the controls (gender, race, and year in school, first generation students, and students with dependents), because additional variables make measurements more precise. Equation (2) adds the financial variable of having a meal plan. Students on campus are required to have a meal plan (Office of the Bursar 2018), but survey comments suggest that students buy the cheapest meal plan option because unlimited options are out of budget.

For example, the previous table (table IV) includes the addition of a meal plan variable, which was consistently mentioned in survey responses. A number of the survey comments include:

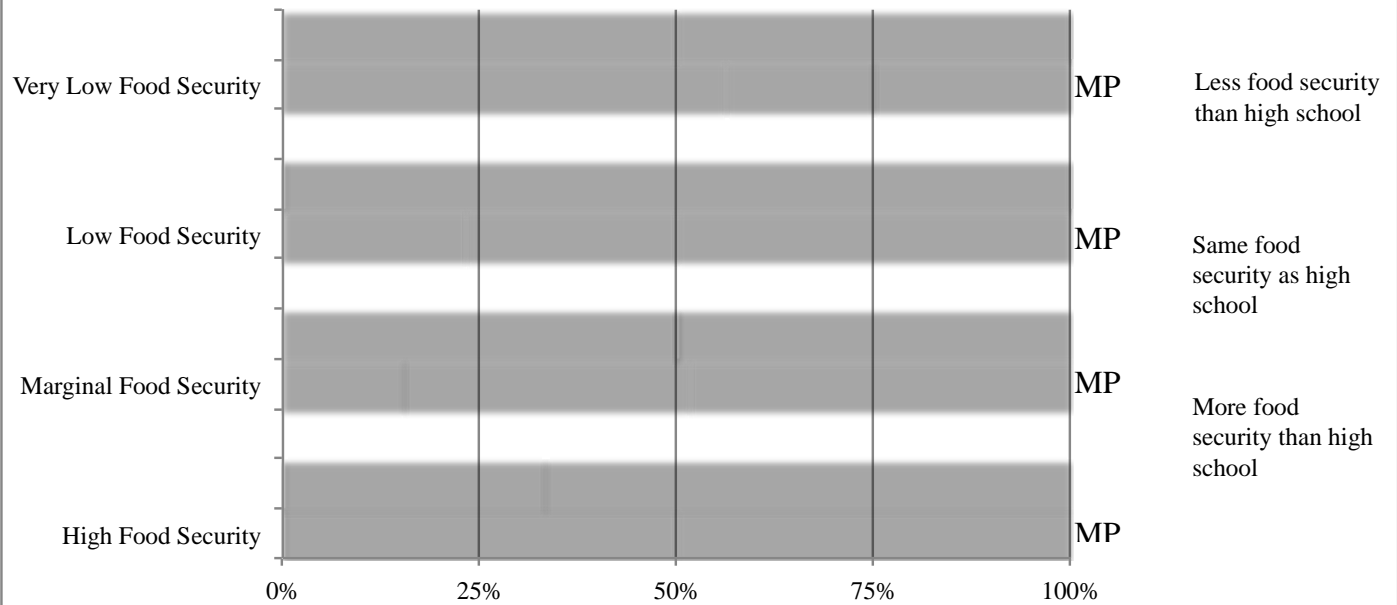
- *"I think food security is probably lower here, even though I haven't personally experienced it, I can imagine many people would opt out of the meal plan option because it is too expensive, furthering the food insecurity issue."*
- *"Some on campus students are on the lowest meal plan (because we are required to have one) and once they are out of meal swipes they are not able to swipe in, I feel for students in need like this there should be a system where they don't have to pay."*
- *"While the food security I have on campus is the same as in high school, the 5 years in between have been mainly on food stamps until the guidelines changed and I lost my only source of food income."*
- *"Food security is important. However, the school should lower the price of the meal plan. For example, the price of the unlimited meal plan is too high."*
- *"Eating a balanced meal is very expensive. I get money for food from my parents, but in order to make it last I eat pretty awful."*

The addition of a meal plan variable increased that likelihood of off-campus students being food insecure. Students are about 2 times more likely to be food insecure when controlling for meal plan, which is higher than in equation (1). Students are 3.4

times more likely to be food insecure off-campus, controlling for having a meal plan, while they were only 2.4 more likely to be food insecure when the meal plan was not included in the model. This suggests that students who are living off-campus are more likely to be food insecure because they do not have a food plan. Students with a meal plan are 80 percent less likely to be food insecure, which is particularly interesting because living arrangement is also being controlled for and meal plan continues to significantly reduce a student's likelihood of being food insecure. This indicates that having a meal plan is the most significant factor in reducing student food insecurity. Financially independent students are about two times more likely to be food insecure. These results suggest that living off campus and being financially independent are the greatest predictors of food insecurity of students at the University of Massachusetts Amherst, while having a meal plan gives students more food security. Students may be experiencing many other factors that are contributing to food insecurity that were not reflected in the initial survey or the logistic analysis and that further studies and analyses need to be concluded to determine other predicting factors or scenarios related to food insecurity.

Further, literature has provided information that suggests that students that are food insecure before high school will remain food secure upon transitioning to college. In order to explore this notion the following figure (figure IV) compares perceived food security status prior to college versus actual food security status in college as self-reported in the survey. Further, each category is separated between students with and without a meal plan, designated by the letter "MP".

Figure IV: Perceived Food Security Before College vs. Actual Food Security Status in College vs. Having a Meal Plan



It is important to note that the high food security category had many more respondents than the other three categories and that splitting students by meal plan reduced category sizes. Exploring the figure it is observed that low food security students with a meal plan feel more food secure than in high school, whereas those without a meal plan do not feel as food secure. The same trend is seen in the very low food security category where students without a meal plan did not report feeling more food secure than in high school. The same trend can be seen in marginal food security where more students with a meal plan felt more or the same food security as compared to high school than their counterparts without a meal plan. This can indicate that, overall, meal plans are making students feel more food secure upon transitioning to college. This notion is

further substantiated by the data from the multivariate regression analysis that showed that students with meal plans are 80 percent less likely to experience food insecurity.

Financial factors are crucial to the everyday life of students in college and determining the risk associated with these factors independent relationship to food insecurity can help schools better accommodate students.

Discussion

This analysis aimed to determine the rates of food insecurity at the University of Massachusetts Amherst and the stratification of students experiencing various each type of food security status (to include high food secure students, marginal food secure students, low food security students, and very low food secure students). Demographic characteristics of food insecure students were also determined. Further, this analysis aimed to determine financial factors that are predictors of student's food insecurity at the university and to determine these factors with confidence.

Rates of food insecurity at the university were concluded to show that 72.5% of students were highly food secure, 15.7% had marginal food security, 7.9% had low food security, and 3.8% had very low food security. This results in 415 (88.3%) students classified as food secure and 55(11.7%) as food insecure. In the state of Massachusetts, the overall rate of food insecurity in the state is 10.6%. Comparing this rate with the university rate of 11.7%, analysis shows that the university is experiencing a higher rate of food insecurity than state predicted numbers. Additionally, with 77% of the University of Massachusetts student body coming from in state, this may suggest that the university may not be adequately dealing with food insecurity issues that students may be facing on

campus (Undergraduate Admissions 2018.). These rates are, however, close to one another and a larger sample size in this study or more recent rates of food insecurity for the state may change results. Comparing the outcome of this analysis to rates of college food insecurity found in the literature, a rate of food insecurity of 11.7% is on the lower end of the spectrum, where other universities have measured rates ranging from 12% to 59% of the campus population being food insecure and a cumulative study of 35 four-year universities found rates of 36%.

One of the initial explorations of this analysis focused on student academic performance related to food security status. This analysis showed that student's academic performance, as rated by students' GPA, was statistically lower for food insecure students than food secure students suggesting that the two variables are related. Students may be experiencing lowered academic performance as a direct result of their food insecurity status because they are more preoccupied with where their next meal is coming from rather than having adequate time to focus on studies. This result may have direct impacts on a student's future in terms of job searching and overall success.

Variables of interest explored as predictors of food security using in the multivariate logistic regression include having a full time job, being financially independent, living off campus, and having a meal plan, while controlling for race, gender, first generation, students with dependents and year in school. Living off campus (Maroto, Snelling, and Linck 2015, 515-526; Fruedenberg et al. 2013, 422-430) and being financially independent (Blagg 2017; Fruedenberg et al. 2013, 422-430) were the largest factors that contributed to student food insecurity at the university and supports

previous literature stating that these variables were contributing factors, while having a meal plan significantly reduced a students' likelihood of being food insecure.

An emerging theme throughout these analyses was dependence of food security status on having a meal plan. Moving forward with the effect that meal plans had on student food security, students perceived food security before college was compared to actual food security in college, in order to observe how the university addresses food insecure students in their transition to college and to explore idea that students remain food insecure upon entering college. While the sample size is much smaller for the lower food security groups, which can be seen as a limitation, it is important to understand that students in the high, marginal, and low food security groups with meal plans feel more food secure in college than in high school. This suggests that the university is adequately accommodating students by offering a meal plan, however current talks of raising the meal plan price may end up increasing food insecurity on campus (Charpentier, Cote, and Keller 2018). This coupled with comments from students on the survey suggest that students are already struggling to afford meal plans should be considered in future decisions of the university.

Limitations to these analyses include a relatively small sample size compared to the entire student body at the University of Massachusetts Amherst. Survey answers were self-reported and due to the emotional nature of food insecurity students may not have accurately reported on the food insecurity they were experiencing. Additionally, when exploring students living arrangements, the student commuter nature of the university should have been considered and living arrangement should have been divided into more than just on and off campus living. Categories should have included students living off

campus alone, off campus with roommates, off campus with parents, and various on-campus options. Finally, getting a more stratified sample that more accurately reflects the student body of the University of Massachusetts Amherst would be more beneficial for future studies and provide a more accurate picture of the campus demographics.

Policy Recommendations

First and foremost, having the university be aware of the food insecure populations on campus is crucial to the development of new policies and procedures to ensure these students have successful academic and social careers at the University of Massachusetts Amherst. Therefore, determining the rates of food insecure students at this particular university and comparing this with demographic characteristics of students is crucial in providing resources that work for students. Further, it is important that predictors of food insecurity are determined to help the university better predict where, when, and why students will become food insecure and adopt a proactive rather than reactive approach to mitigating food insecurity on campus.

This section will examine current policies and resources available to students at the University of Massachusetts Amherst as well as resources other schools have adopted to deal with food insecurity. Resources from other universities will revolve around meal plans, as this was seen as a significant deterrent of food insecurity. Finally, recommendation for moving forward in preventing and aiding students experiencing food insecurity will be summarized.

The University of Massachusetts currently has a variety of resources available to students on and off campus. The university has a student life resource (UMass Amherst

2018.) that gives resources for students that need food, housing, or employment assistance. Under the food assistance section it lists a variety of resources. Off campus resources the website mentions include the Amherst Survival Center that has a food pantry and the Mobile Food Bank that distributes food in the area on a weekly basis. It further lists the Food Bank of Western Massachusetts as a resource for enrolling in the Supplemental Nutrition Assistance Program (SNAP). However, there are significant restrictions for students between the ages of 18 to 49 years old attending school half time or more, or working more than 20 hours per week (Morris et al. 2016, 376-382), making this not always a viable resource for students (Single Stop 2018). The website further states that dining services can help recommend meal plans to students, however the cheapest meal plan at the university is \$2,698 per semester and would only supply students with two meals per day, including weekends at roughly \$10 per meal (Umass Dining 2018). It further lists late night discounts for on-campus food, emergency meal swipes, microgrants, and short term and interest free loans, as well as a free cookbook with recipes that would only cost students \$4 per day. Additionally, there are five student care supply closets on campus that provide students with toiletries and household items, but no official food pantry exists on campus. Very recently, a co-ed service fraternity, Alpha Phi Omega opened a food pantry for students. Lastly, students can walk into any dining hall and get a meal free of charge and the student will be referred to the Dean of Students Office to come up with a long-term solution. Many of the resources the university offers are off-campus and may be difficult for students to access if need be.

While the University of Massachusetts Amherst is giving students a variety of resources, other universities are exploring new ways to aid students in mitigating food

insecurity. Other universities including Boise State University are using meal donation programs so that students can donate unused meal swipes at the end of the semester for students to use in the following semester (Ellison 2017). Unfortunately, in recent months, the university has discussed raising the price of meal plans for students in the upcoming academic year (Charpentier, Cote, and Keller 2018). The price increase would add \$180 onto an unlimited meal plan that currently costs \$2,978 per semester in order to pay temporary workers health care costs. This increase may provide health care for workers, but in turn cause student food insecurity rates to continue to rise. Therefore, the university may need to consider this when deciding if a price increase of meal plans is the correct solution for temporary worker healthcare. To add, another possible solution may involve using leftover foods from catering events to serve food insecure students on campus. This food would otherwise go towards food waste and may be better-used serving students who do not have access to adequate amounts of food on campus.

Moving forward, exploring the development of a meal swipe donation program is an easy way for the university to provide assistance to the 11.7% of students experiencing food insecurity on campus and serving leftover foods from catering events to students experiencing food insecurity on campus. This percentage may not seem very large, but applied to a student body of roughly 22,000 students this leaves a large portion of the community experiencing food insecurity.

Conclusion

The analysis developed in this research found that a large portion of students at the University of Massachusetts in New England are experiencing food insecurity,

specifically 11.7% of students. This number will continue to increase and the ability of the university to accommodate students will help mitigate food insecurity on campus. This research explores rates of food insecurity on campus, as well as the demographic characteristics of students experiencing food insecurity. This research further explores financial factors that act as predictors for food insecurity on campus and the academic performance students of various food security groups (high, marginal, low, very low food security). On and off campus resources offered by the university were compiled and analyzed in conjunction with the determination of students actual food security status in college versus perceived food security in high school in conjunction with meal plan. Additionally, policy recommendations were made.

Key findings showed that students experienced food insecurity at a rate of 11.7% on campus and that a large portion of food insecure students had meal plans, were men, and partially financially on parents for school costs. Furthermore, the financial factors that most significantly increased a student's likelihood of being food insecure were living off campus and being financially independent. The factor that most significantly decreased a students' likelihood of a meal plan was having a meal plan. Students with meal plans experienced less perceived food insecurity upon transitioning to college.

The university is currently providing many resources for food insecure students, however more work can be done to ensure that food insecure students are given proper accommodations to help in overall success. Considering an increase in student meal plan price could be drastically increase food insecurity rates on campus. Exploring a meal swipe donation program could help supply many food insecure students with meals. Further, using leftover foods from catering events on campus and serving students

experiencing food insecurity may greatly help those who do not have access to adequate amounts of nutritious food on a daily basis. These analyses are meant to be used as preliminary research to aid the university in the determining the need and current resources for students experiencing food insecurity.

Appendix

A. Survey distributed to students at the University of Massachusetts Amherst

Survey	
We are interested in learning more about your time as a student at [college/university]. Please answer the following questions to the best of your ability:	
1. Please indicate school of attendance (open response)	
Gender	Woman
	<ul style="list-style-type: none">• Man• Genderqueer• Other gender identity: (open ended response)
2. Race/Ethnicity?	
	<ul style="list-style-type: none">• African American or Black• Asian or Asian American• Latina/o• Middle Eastern or Middle Eastern American• Native American, North or South American Indian, or Alaska Native• Native Hawaiian or Pacific Islander• White or Caucasian• Biracial or multiracial• Another race/ethnicity: (open ended response)
3. What is your academic year?	
	<ul style="list-style-type: none">• Freshman• Sophomore• Junior• Senior• Graduate Student
4. GPA? (open ended response)	
5. Are you an NCAA student athlete?	
	<ul style="list-style-type: none">• Yes• No
6. Are you dependent on your parents financially for tuition and other school costs?	
	<ul style="list-style-type: none">• Yes• Partially• No

7. Do you have dependents of your own?

- Yes
- No

8. Do you send money home to support your family/dependents on a regular basis?

- Yes
- No

9. Do you work a job on or off campus to supplement financial needs?

- Yes
- No

10. Do you have access to personal or public transportation to travel to an adequate food source (i.e. grocery store, food bank, etc.)

- Yes
- No

11. Are you a first generation college student?

- Yes
- No

12. Do you have a sibling also attending college?

- Yes
- No

13. Do you live on or off campus?

- I live off campus.
- I live on campus.

14. Do you have a meal plan?

- Yes
- No

Please indicate which situation applies to you/you have experienced over the last academic year (high school or college):

15. Which of these statements best describes the food eaten in the last academic year:

- Enough of the kinds of foods I want to eat
- Enough but not always the kinds of food I want
- Sometimes not enough to eat
- Often not enough to eat

16. "I worried whether my food would run out before I got money to buy more."

- Often true
- Sometimes true
- Never true
- Not sure/don't know

17. "The food I bought just didn't last and I didn't have money to get more."

- Often true
- Sometimes true
- Never true
- Don't know or refused

18. "I couldn't afford to eat balanced meals." (A balanced meal includes a protein, carb, and vegetable or fruit in recommended quantities)

- Often true
- Sometimes true
- Never true
- Don't know or refused

19. In the last academic year, since last September, did you ever cut the size of your meals or skip meals because there wasn't enough money for food?

- Yes
- No
- Unsure/can't remember

20. If yes to question 19: How often did this happen?

- Almost every month
- Some months but not every month
- Only 1 or 2 months
- Don't know

21. In the last academic year, did you ever eat less than you felt you should because there wasn't enough money for food?

- Yes
- No
- Don't know

22. In the last academic year, were you ever hungry but didn't eat because there wasn't enough money for food?

- Yes
- No
- Don't know

23. In the last academic year, did you lose weight because there wasn't enough money for food?

- Yes
- No
- Don't know

24. In the last academic year, did you ever not eat for a whole day because there wasn't enough money for food?

- Yes
- No
- Don't know

25. If yes to question 24: How often did this happen?

- Almost every month
- Some months but not every month
- Only 1 or 2 months
- Don't know

26. If you've ever experienced food insecurity, do you find that there are opportunities on campus to help with any food security issues you may be facing?

- Yes
- No
- Don't know

27. If yes, what opportunities have you used? (open response)

28. Thinking about the amount of food security you have on-campus, is it less than, the same as, or more than what you experienced while in high school?

- Less than
- Same as
- More than
- Don't know

29. Is there anything else you would like to tell the researchers? (open ended response)

30. If you are interested in being contacted about a follow-up interview, please enter your email here: (open ended response)

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