**TITLE** Food insecurity on a college campus: prevalence, determinants, and solutions

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ABSTRACT

Objective: Students are at risk of food insecurity. We aimed to determine the prevalence of food insecurity among students; the variables associated with student food insecurity; and appropriate solutions. Participants: We collected data from 339 students at a large state university in the western United States between December 2016 and February 2017. Methods: We used an anonymous online survey that incorporated the USDA U.S. Six-Item Short Food Security Survey. Results: First, 54% of respondents had been food insecure within the last year. Second, students in receipt of financial aid were significantly more likely to be food insecure. Third, respondents proposed solutions to student food insecurity that included on-campus food assistance programs, education initiatives, and off-campus food assistance programs. Conclusions: Our paper contributes to a growing body of knowledge about the extent and causes of, and solutions to, food insecurity among college students.

KEYWORDS
administration, community health; food security; mental health
INTRODUCTION

Food insecurity, which occurs for a plethora of reasons, is not just a problem of being hungry; it also encapsulates a much broader spectrum of wellbeing. The Food and Agricultural Organization of the UN (FAO) recognizes four components of food security: availability, access, utilization, and stability. Availability refers to the physical amount of food that is available to a person, whether it is bought or grown; access refers to economic factors that determine whether a person is able to buy food or not; and utilization refers to the ability of a person to utilize their food through cooking practices that ensure they are eating enough calories, nutrients, and micronutrients. Finally, stability refers to the consistency of availability, access, and utilization over time. When one or more of these conditions are not met, then an individual is considered to be food insecure. Food insecurity can also be described as chronic or transitory. Chronic food insecurity is when access to food is unavailable over an undefined period of time and usually occurs in communities where there is inadequate access to productive or financial resources and where poverty is deep-rooted within a community. Transitory food insecurity is when proper access to food is intermittent and occurs when there is a sudden inability to produce or access enough food.

Food insecurity of any kind can be extremely detrimental to the parties involved. Health consequences of food insecurity can include poor cognitive, social, and emotional development among young children; depressive symptoms and suicidal ideation among adolescents; increased risk of diet-related chronic diseases and associated effects among adults; and malnutrition among all age groups. Malnutrition alone can have psychosocial effects of many kinds that are often depictive of mental illness.
Food insecurity among students is prevalent across campuses in the US, as demonstrated by multiple studies (Appendix 1). Thirty nine percent of college students from City University of New York campuses across New York state were reported to have experienced food insecurity. Similarly, 48% of students at the University of Ohio reported either having insufficient money to buy enough food, having had to stretch their food budgets by eating cheaper and less nutritious food, or having had to cut back on the amount of food they would normally eat. At the University of Hawaii at Manoa, 21% of students were food insecure, while a further 24% of students were reported to be at risk of food insecurity. A survey of four thousand students from 10 community colleges across the nation found 52% of those students to have experienced food insecurity over the 30 days prior to taking the survey. Of that 52%: 13% were marginally food insecure (defined as having problems at times, or anxiety about, accessing adequate food, but for whom the quality, variety, and quantity of food intake were not substantially reduced); 19% were categorized as having low food security; and 20% were categorized as having very low food security. A study at Western Oregon University found that 59% of students had been food insecure within the past year, and research at George Washington University campus in Washington D.C. found that 48% of respondents had experienced food insecurity.

College students are at risk of being food insecure as a consequence of a number of unique factors. First, it can be challenging for college students to qualify for food assistance programs that help to combat food insecurity among other demographics. Specifically, the Supplemental Nutrition Assistance Program (SNAP, formerly known as food stamps) requires that applicants work 20 hours per week for three or more months within the last 36 weeks prior to application, if they are an able-bodied adult without dependents. This requirement can disqualify most college students, most of whom are unable to work 20 hours or more per week.
while in school. Second, college students face financial burdens that may restrict food access. Financial assistance in the form of scholarships and grants has not always been able to keep up with rising college costs. According to The Institute for College Access and Success, in 2016 the average debt figures ranged from $4,600 to $59,100 among the 936 schools in the United States. This figure shows that financial constraints on college students can be severe. Third, some authors have suggested that food insecurity among college students can be related to poor financial budgeting and fiscal monitoring by this demographic. Budgeting is a skill developed over time, and many students have not had prior experience with budgeting and personal finances before college.

Food insecurity is a multi-dimensional concept that can be challenging to measure and that can be influenced by a large number of variables. However, studies of food insecurity among college students have identified a narrower number of factors that can lead to some students being at greater risk of experiencing food insecurity than others (Appendix 1). These factors include students’ race and/or ethnicity, gender, degree level, income, financial (in)dependency, spending habits, and housing arrangements (Appendix 1). Despite the elevated risk for college students of being food insecure, relative to the national average, and despite the concern that food insecurity can have major impacts on students’ lives, food security research on college campuses is relatively scarce. Indeed, there have been calls for an improved understanding of the prevalence and causes of food insecurity from college campuses across the United States. In particular, there is a need for additional work to determine a) the factors that might make students particularly vulnerable to food insecurity, and b) the solutions to campus food insecurity that might be most attractive to, and appropriate for, food insecure students. Therefore this study addresses three related questions: 1) What is the
prevalence of food insecurity among college students?; 2) What are the determinants of food insecurity among college students?; and 3) What are the solutions to food insecurity that are perceived as being most appropriate or useful to food insecure college students? We address these questions using the case study of a large state university in the western United States.

METHODS

We addressed our research question using a descriptive study that utilized a cross-sectional design. We used an online survey to collect quantitative and qualitative data on the prevalence and causes of food insecurity among college students.

Data Collection

We collected data from 339 undergraduate and graduate students using an anonymous online survey (Appendix 2). Our survey included questions to identify: the prevalence of food insecurity; student characteristics associated with food insecurity; and the perceptions of students about appropriate on-campus solutions to food insecurity.

Food insecurity

We used the USDA U.S. Six-Item Short Food Security Survey to define and evaluate the prevalence of food insecurity. This survey has been widely used to assess the food security of different populations. The USDA website provides a descriptive step-by-step guide on how to perform a survey using their six questions and how to assess the results. The survey asks six questions about the respondent’s experience of food security within the past 12 months. Questions are all of the nature, “...[I] couldn’t afford to eat balanced meals.” In the past 12 months was this often, sometimes, or never true for you?”. The responses to the survey questions code to an affirmative answer (“often true”, “sometimes true”, “almost every month”, “some months but not every month”, or “yes”, depending on the question) or a non-affirmative answer.
Respondents with no affirmative answers to any of the six questions are considered highly food secure; those with one affirmative answer are considered marginally food secure; those with 2-4 affirmative answers are considered to have low food security, and those with 5-6 affirmative answers are considered to have very low food security. The USDA considers respondents in the categories of low food security and very low food security to be food insecure (Table 1).

**Student characteristics**

Our survey also included questions that would help us determine whether there were particular student characteristics that were associated with food insecurity, or whether certain groups of students were at greater risk of food insecurity. Our choice of which variables to collect data on was guided by our review of findings of previous studies that have explored food insecurity among college students (Appendix 1). As such, we collected data for each respondent on their gender, race, dependents, housing, academic level, grade point average (GPA), financial aid, and employment status (Appendix 2). Our decision to be guided by the findings of previous research meant that we could explore those factors most likely to be associated with food insecurity while maintaining a short survey that would not overwhelm respondents. However, this approach did leave open the possibility that additional unmeasured factors could also be associated with food insecurity.

**Proposed solutions to food insecurity**

We also asked respondents for their suggestions for, and perceptions of, actions that could help to address food insecurity among students. The optional question enabled students to indicate what they feel would be most beneficial for students at the focal university, if the university were to provide assistance of any sort.
Survey design and dissemination

We used Qualtrics software to administer the survey and collate the results. The survey was open for two months, between December 5, 2016 and February 5, 2017. A link to the online survey was disseminated using two mechanisms. First, the survey link was included in a bulletin email to the entire student population of the focal university, which is approximately 32,000 students. Second, the survey link was distributed through the mailing lists of several campus organizations and class lists. Therefore, all students on campus were exposed to the opportunity to complete the survey, and some students were exposed to the opportunity to complete the survey more than once. However, there was no intentional or expected bias in the strength of this exposure relative to the outcome of interest (i.e. food security).

The survey took approximately three minutes to complete. The survey was designed such that all respondents, whether food insecure or not, could respond to the questions. No students were pressured to take the survey, so data was only obtained from students who voluntarily chose to complete it. The first question of the survey was a consent agreement, to fully inform respondents about the purpose and scope of the survey. Respondents had the option to skip any questions that they did not feel comfortable answering. Participants were offered the opportunity to enter a random draw for a gift card, as incentive to complete the survey. To enter the draw, they had to elect to enter their email address, but it was explicitly clear that these email addresses were never associated with the data and were discarded after the gift card winners were selected.

Data Analysis

We analyzed the data using the R statistical software. We assigned respondents into USDA categories of high food security (zero affirmative responses), marginal food security (one affirmative response), low food security (two, three or four affirmative responses), and very low
food security (five or six affirmative responses) (Table 1). From there, we grouped respondents into USDA categories of food secure (i.e. high and marginal food security) or food insecure (i.e. low or very low food security) (Table 1). We then conducted three separate analyses.

We conducted a multivariate logistic regression analysis to determine which student characteristic variables were most associated with food insecurity. This analysis enabled us to identify the relative strength of association between food security and different student characteristics. We used a significance level $P < 0.001$. We used this more conservative significance level to avoid multiple testing bias.

Finally, we analyzed the qualitative data from question 20 of the survey (“What other food assistance programs would you find useful for the focal university to offer to students?”) to determine the types of solutions to food insecurity most favored by students. We coded these responses into three categories: on-campus food assistance programs, education initiatives, and off-campus food assistance programs. We quantified the frequency of responses that fell into each of these three categories. Finally, we extracted representative quotes from the data to illustrate the types of solutions that respondents proposed.

**RESULTS**

Three hundred and thirty-nine students responded to the survey. This represented approximately 1% of the focal university student population of 32,000 students, all of whom had access to the survey. Four surveys were incomplete. Seventy seven percent of respondents were female. Eighty six percent of respondents were undergraduate students as opposed to the fourteen percent of graduate student respondents. Additionally, thirty percent of respondents were living on campus at the time of the study vs seventy percent who were living off campus.

Here, we report the key findings that emerged from our analysis of the survey data.
Prevalence of food insecurity

One hundred and eighty-four respondents, or 54% of students that completed the survey, were food insecure. Categorized according to the USDA Six-Item Short Form Food Security Survey, 89 of these food-insecure students (26% of all respondents) had low food security, while 95 of these food-insecure students (28% of all respondents) had very low food security (Table 1). Of the 184 students that were food insecure (i.e. those that responded in the affirmative to two or more of the six USDA questions), more students (76 individuals) responded in the affirmative to all six questions than to any other count of responses (i.e. two to five affirmative responses) (Table 1).

Determinants of food insecurity

Our multivariate logistic regression model revealed that students that received financial aid that required repayment were statistically significantly more likely to be food insecure than students that did not receive financial aid that required repayment ($P < 0.001$; Table 2). Of all of the demographic, financial, and education variables included in our model, this was the only statistically significant predictor of food insecurity in the multivariate logistic regression (Table 2).

Solutions to food insecurity on a college campus

Seventy respondents suggested policy and programmatic solutions that they perceived could be useful ways to address food insecurity on the focal university campus. These suggestions fell into three broad themes. First, a majority of respondents (47/70; 67%) suggested solutions related to on-campus food assistance programs. These suggestions related principally to discounted or free meal plans. For example, one respondent suggested: “Free lunches for those who cannot afford to buy food when on campus”. Another suggested: “A limited amount of meal
swipes per semester to use for on-campus dining”. And a third respondent suggested: “With all
the food they [the campus dining services] throw away, they could use to give to students who
really need it.”

Other respondents (14/70; 20%) suggested solutions that fell into a second theme: that of
education initiatives. These suggestions related to assisting students in learning how to cook
cheaply, learning how to budget, and understanding whether and how they might access food
assistance programs. For example, one respondent suggested: “Outreach programs for students
with these problems. Many are unwilling to reach out for themselves so having a system that will
give students who are known to be financially at risk will receive the necessary help and
resources.” Another suggested: “Knowledge about food stamp programs.” And a third
respondent suggested: “Cooking on a budget classes.”

A third but smaller set of respondents (9/70; 13%) suggested solutions that fell into a
third theme: that of off-campus food assistance programs. These suggestions related to coupons
or financial aid with groceries. For example, one respondent suggested: “Discounts for CU
students at grocery stores.” And another suggested: “Coupons for healthy food options in nearby
grocery stores.”

COMMENT

We found a high prevalence of food insecurity among student respondents at the focal
university, including a high prevalence of students classified as having very low food security.
We found that students in receipt of financial aid that had to be repaid were more likely to be
food insecure. And we found that student respondents proposed a diversity of possible solutions,
focused primarily on on-campus food assistance initiatives. Here, we discuss the implications of
these findings, and situate them within the broader literature.
Prevalence

Food insecurity was highly prevalent among the focal university students that responded to our survey. Fifty-four percent of respondents were categorized as being food insecure, with 28% categorized as the lowest level of food security. This statistic is comparable to findings reported at other universities across the US: 39% across City University of New York campuses, 48% at the University of Ohio, 21% at the University of Hawaii at Manoa, 52% across US community colleges, 59% at Western Oregon University, 48% at George Washington University campus in Washington D.C., and 36% at a mid-sized private university in the midwestern U.S. While we cannot know to what degree food-insecure students self-selected into completing our survey, and therefore to what degree our respondent sample was representative of the larger focal university student population, prevalence among the focal university student respondents was extremely similar to most previous studies of food insecurity on college campuses.

Food insecurity among students at the focal university and elsewhere may be detrimental to student wellbeing in multiple ways. Food-insecure high-school students in Iran consumed healthy foods less frequently than food-secure students. Grade 5 students living in food-insecure households in Canada had poorer diets, higher BMI, and poorer psychosocial outcomes than food secure students. And college students with very low food security may be more likely to show signs of clinical depression and severe anxiety. Poor health outcomes that result from food insecurity can perpetuate unless the student becomes food secure. Students in receipt of financial aid were more likely to experience food insecurity.

The most significant indicator of food insecurity in our study was whether students received financial aid that required repayment. Students that fell into this category were much
more likely to be food insecure than those not on financial aid. At the focal university, 
“approximately 15,000 undergraduate students received over $255M in federal, state, and 
university aid in 2014-15. Of that total, almost $100M was in the form of grants, scholarships 
and work-study.” 29 While some forms of financial aid, including grants, scholarships and work-
study, do not require repayment, the majority of financial aid received by students at the focal 
university does require repayment. At a national level, a National Student Financial Wellness 
Study, which surveyed 18,795 undergraduate students at 52 colleges and universities across the 
country, found that 64% of students used loans to help pay for college 30.

Understanding the size of the population, both at the focal university and nationally, that 
receives financial aid therefore gives us a better insight to the possible number of students at 
higher risk of food insecurity. Decision-makers on the focal university campus, and on other 
campuses where financial aid is a good indicator of student vulnerability to food insecurity, 
might consider targeting policy or programmatic responses towards this group of students.

Students in receipt of financial aid that must be repaid are likely to be less financially secure than 
other students. Students that take out loans that require repayment likely do so because they do 
not have access to other financial capital to fund their education. Students who are dependents 
within a family that has an income in the lowest income quartile are expected to pay roughly 
40% of the family yearly income for one year of community college. Students in the lowest 
income quartile who are independents are expected to pay well over 100% of their yearly income 
to afford a year of community college 4. Four-year universities are more expensive than 
community colleges, and so the financial burdens of attending universities for low-income 
families and low-income independent students can be even higher. Students from low-income 
families who do not have financial support from their family often experience financial hardships
in college. Financial difficulties can be extremely stressful and cause students to perform less well or to drop out of college. Roughly 60% of students in a national survey said they worried about having enough money to pay for school, while 50% said they were concerned about paying their monthly expenses. Food is a large part of monthly expenses, so students who struggle to pay day-to-day expenses may prioritize other expenses over food and may be at risk of food insecurity.

Policies and actions to reduce food insecurity on campus

Food insecurity can be associated with social stigma, and so an important objective may be to develop solutions that are accessible and that make students feel empowered. Therefore, it may be important to develop solutions that are acceptable and appropriate to food-insecure students. For this reason, we asked open-ended questions that enabled respondents to state their preferences and ideas for solutions, rather than asking for their opinions on a pre-defined list of solutions.

In our survey, student respondents suggested on-campus food assistance programs, education initiatives, and off-campus food assistance programs as their preferred ways to tackle food insecurity among students at the focal university. The most common suggestion was for the university to offer free or reduced cost meal plans (e.g. "free meal swipes") for students at the on-campus dining halls. Such programs have been implemented elsewhere: for example, Oregon State University enacted a policy to address food insecurity: the university offers dining center meals to low-income, high-need students for less than $3 per meal.

Respondents also suggested on-campus education initiatives. Strategies of this sort have also been tested elsewhere. For example, the City University of New York’s Healthy CUNY program included an initiative to address food insecurity through on-campus centers that
screened students for eligibility for federal benefits, including food assistance programs. Students who may not otherwise have known about federal benefits were able to receive the assistance they needed and qualified for. Searching and applying for federal benefits can be time-consuming and difficult, and so this program also alleviated these stresses from students.

One way in which many colleges in the US are trying to address food insecurity among students is by establishing food pantries on campus. For example, George Washington University in Washington D.C. opened an anonymous food pantry that any student could access by providing only minimal personal information. Within one month, 150 students accessed the pantry, and the university reported positive feedback from the students who needed the assistance. However, only two respondents in our survey explicitly suggested a food bank as a useful response. While it is possible that our student respondents did not consider a food pantry or food bank as a possible option, it is also possible that they considered it but that it was not their preferred response. As with other federally funded programs, food banks are often associated with social stigma. This may cause students to feel that a food bank is not the best option.

Limitations

One limitation to consider is that, although the survey was equally advertised to all students, there was not an equal distribution of students who took the survey. That is, it is possible that the survey could have been more intriguing to students who felt that they were struggling with food security. One of our goals was to get a variety of students on all spectrums of food security to take the survey. However, students who are food insecure could have felt that by taking the survey they were helping themselves or other students in similar situations. In addition, the survey was sent out through mailing lists of certain campus organizations and
certain class lists. This was a more direct approach to reaching students, however, this was a more targeted method and not every student received this direct email.

Conclusions

Our study found a high prevalence of food insecurity on the focal university campus. This finding adds to a growing body of evidence that students are vulnerable to food insecurity in unique ways and that food insecurity is common across US campuses. Students in receipt of financial aid that needed to be repaid were particularly vulnerable to food insecurity. Students suggested that on-campus food assistance programs such as free or reduced meal swipes were a preferred way to address food insecurity. We therefore suggest that decision-makers at the focal university and other universities who are concerned with reducing food insecurity among students could consider programs that award reduced meal costs for food-insecure students. Such students could be identified through broad application of a survey such as the USDA U.S. Six-Item Short Food Security Survey. Alternatively, food assistance programs could be targeted at students in receipt of financial aid that requires repayment.
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Table 1. Number of student respondents categorized in each level of food security, as defined by the USDA.

<table>
<thead>
<tr>
<th>Number of USDA U.S. Six-Item Short Food Security Survey questions answered in the affirmative</th>
<th>Level of food security</th>
<th>Food secure or food insecure</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>High food security</td>
<td>Food secure</td>
<td>106</td>
</tr>
<tr>
<td>1</td>
<td>Marginal food security</td>
<td>Food secure</td>
<td>49</td>
</tr>
<tr>
<td>2</td>
<td>Low food security</td>
<td>Food insecure</td>
<td>39</td>
</tr>
<tr>
<td>3</td>
<td>Low food security</td>
<td>Food insecure</td>
<td>32</td>
</tr>
<tr>
<td>4</td>
<td>Low food security</td>
<td>Food insecure</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>Very low food security</td>
<td>Food insecure</td>
<td>19</td>
</tr>
<tr>
<td>6</td>
<td>Very low food security</td>
<td>Food insecure</td>
<td>76</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>339</td>
</tr>
</tbody>
</table>
Table 2. Multivariate logistic regression model that used a suite of demographic and financial characteristics to predict the likelihood of students experiencing food insecurity.

<table>
<thead>
<tr>
<th>Demographic and financial characteristics</th>
<th>Estimate</th>
<th>Standard Error</th>
<th>t value</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>6.887</td>
<td>2.93</td>
<td>2.351</td>
<td>0.0194</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>-0.55</td>
<td>0.299</td>
<td>-1.84</td>
<td>0.067</td>
</tr>
<tr>
<td>Other</td>
<td>0.461</td>
<td>0.962</td>
<td>0.479</td>
<td>0.632</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>-2.232</td>
<td>1.65</td>
<td>-1.353</td>
<td>0.177</td>
</tr>
<tr>
<td>Black or African American</td>
<td>-1.593</td>
<td>1.729</td>
<td>-0.921</td>
<td>0.358</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>-2.2</td>
<td>1.645</td>
<td>-1.336</td>
<td>0.183</td>
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<tr>
<td>Native Hawaiian or Pacific Islander</td>
<td>-1.317</td>
<td>2.213</td>
<td>-0.595</td>
<td>0.552</td>
</tr>
<tr>
<td>Other</td>
<td>-1.7</td>
<td>1.74</td>
<td>-0.977</td>
<td>0.329</td>
</tr>
<tr>
<td>Prefer not to respond</td>
<td>-2.763</td>
<td>1.802</td>
<td>-1.533</td>
<td>0.126</td>
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<td>White</td>
<td>-2.778</td>
<td>1.624</td>
<td>-1.711</td>
<td>0.088</td>
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<td>Have Children</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-0.418</td>
<td>1.39</td>
<td>-0.302</td>
<td>0.762</td>
</tr>
<tr>
<td>Living Arrangement</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Off-campus alone</td>
<td>-0.214</td>
<td>2.239</td>
<td>-0.096</td>
<td>0.924</td>
</tr>
<tr>
<td>Off-campus with parents</td>
<td>-1.357</td>
<td>2.215</td>
<td>-0.613</td>
<td>0.541</td>
</tr>
<tr>
<td>Off-campus with roommates</td>
<td>0.216</td>
<td>2.175</td>
<td>0.099</td>
<td>0.921</td>
</tr>
<tr>
<td>Off-campus with spouse and/or children</td>
<td>-0.521</td>
<td>2.386</td>
<td>-0.218</td>
<td>0.827</td>
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<td>On-campus</td>
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<td>-0.385</td>
<td>0.701</td>
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<td>Other</td>
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<td>2.361</td>
<td>0.292</td>
<td>0.77</td>
</tr>
<tr>
<td>Year in School</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd year</td>
<td>0.142</td>
<td>0.479</td>
<td>0.296</td>
<td>0.767</td>
</tr>
<tr>
<td>3rd year</td>
<td>-0.145</td>
<td>0.548</td>
<td>-0.265</td>
<td>0.791</td>
</tr>
<tr>
<td>4th year</td>
<td>-0.768</td>
<td>0.562</td>
<td>-1.366</td>
<td>0.173</td>
</tr>
<tr>
<td>5th year</td>
<td>-0.023</td>
<td>0.812</td>
<td>-0.028</td>
<td>0.978</td>
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<tr>
<td>Graduate student</td>
<td>-0.043</td>
<td>0.604</td>
<td>-0.071</td>
<td>0.944</td>
</tr>
<tr>
<td>GPA</td>
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</tr>
<tr>
<td></td>
<td>2.00-2.75</td>
<td>2.76-3.49</td>
<td>3.5-4.00</td>
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<td></td>
<td>-0.306</td>
<td>0.888</td>
<td>-0.344</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-0.802</td>
<td>0.811</td>
<td>-0.989</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-1.43</td>
<td>0.815</td>
<td>-1.754</td>
</tr>
<tr>
<td>Receives Financial Aid That DOES NOT Require Repayment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>-0.071</td>
<td>0.251</td>
<td>-0.285</td>
<td>0.776</td>
</tr>
<tr>
<td>Receives Financial Aid That DOES Require Repayment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>1.083</td>
<td>0.255</td>
<td>4.244</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Current Job</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No job</td>
<td>-1.155</td>
<td>0.789</td>
<td>-1.464</td>
<td>0.144</td>
</tr>
<tr>
<td>Part-time over 20 hours a week</td>
<td>0.496</td>
<td>0.821</td>
<td>0.604</td>
<td>0.546</td>
</tr>
<tr>
<td>Part-time under 20 hours a week</td>
<td>-1.15</td>
<td>0.765</td>
<td>-1.503</td>
<td>0.134</td>
</tr>
<tr>
<td>Part-time work-study</td>
<td>-0.12</td>
<td>0.863</td>
<td>-0.139</td>
<td>0.889</td>
</tr>
</tbody>
</table>
### Appendix 1. Summary of published studies that describe the prevalence and drivers of food insecurity among college students

<table>
<thead>
<tr>
<th>Reference</th>
<th>University</th>
<th>Sample size</th>
<th>Student population surveyed</th>
<th>Prevalence of food insecurity</th>
<th>Measure of food insecurity</th>
<th>Factors associated with a greater likelihood of a student experiencing food insecurity</th>
</tr>
</thead>
<tbody>
<tr>
<td>This study</td>
<td>University of [name retracted for peer review]</td>
<td>339</td>
<td>Undergraduate and graduate students</td>
<td>54%</td>
<td>USDA Household Food Security Survey Module: 6-item short form</td>
<td>Being in receipt of financial aid</td>
</tr>
<tr>
<td>5</td>
<td>&quot;a mid-sized private university in the Midwestern USA&quot;</td>
<td>560</td>
<td>Undergraduate and graduate students</td>
<td>35.80%</td>
<td>USDA 6-question food insecurity screener</td>
<td>Prioritizing spending money on alcohol or tuition</td>
</tr>
<tr>
<td>6</td>
<td>University of Hawai‘i at Mānoa, USA</td>
<td>441</td>
<td>Non-freshman students</td>
<td>21%; an additional 24% at risk of food insecurity</td>
<td>USDA Household Food Security Survey Module</td>
<td>Living on-campus; Living off-campus with room-mates; Identifying as Hawaiians and Pacific Islanders, Filipinos, or mixed</td>
</tr>
<tr>
<td>7</td>
<td>City University of New York, USA</td>
<td>1,086</td>
<td>Undergraduate students</td>
<td>39.20%</td>
<td>Custom 4-question survey</td>
<td>Race (Black) and ethnicity (Latino); having an income of &lt;$20k; being financially self-supported; working &gt;20hrs per week; having health problems</td>
</tr>
<tr>
<td>8</td>
<td>10 community colleges in seven states</td>
<td>4,312</td>
<td>Undergraduate students</td>
<td>39% food insecure; plus 13% with marginal food security</td>
<td>USDA Household Food Security Survey Module: 6-item short form</td>
<td>Ethnicity (Hispanic and Latino); being a first generation college student; experiencing housing insecurity</td>
</tr>
<tr>
<td>9</td>
<td>70 higher education institutions</td>
<td>33,934</td>
<td>Students</td>
<td>67%</td>
<td>USDA 6-item Adult Food Security Survey Module</td>
<td>Pell-grant eligible students; being financially independent; being an undergraduate student with children; being a US citizen or permanent resident; having been in foster care</td>
</tr>
<tr>
<td>10</td>
<td>66 higher education institutions</td>
<td>43,000</td>
<td>Undergraduate students</td>
<td>42% (community colleges); 36% (4-year universities)</td>
<td>USDA 10-item Adult Food Security Survey Module</td>
<td>Pell-grant eligible students; being financially independent; having been in foster care; females and non-binary students; bisexual students; black students</td>
</tr>
<tr>
<td>11</td>
<td>&quot;a Queensland-based University&quot;, Australia</td>
<td>399</td>
<td>Undergraduate and graduate students</td>
<td>12.7% (by a single measure); 46.5% &quot;food insecure without hunger&quot;; 25.3% &quot;food insecure with hunger&quot;</td>
<td>Custom 39-question survey, derived from USDA Community Food Security Assessment Toolkit</td>
<td>Renting accommodation; having a low income; receiving government assistance</td>
</tr>
<tr>
<td>12</td>
<td>&quot;a large, Midwestern, public university&quot;</td>
<td>514</td>
<td>Undergraduate, graduate, and non-degree-seeking students</td>
<td>16.4% very low, 25.1% low, and 12.2% marginal food security</td>
<td>USDA 6-item Short Form of the Food Security Survey Module</td>
<td>Among students in housing without food provision: underrepresented minorities; being without car access; being an undergraduate student</td>
</tr>
<tr>
<td>13</td>
<td>&quot;a midsize rural university in western Oregon&quot;, USA</td>
<td>354</td>
<td>Undergraduate and graduate students</td>
<td>58.80%</td>
<td>USDA Household Food Security Survey Module: 6-item short form</td>
<td>Having fair/poor health; being employed; having an income &lt;$15k</td>
</tr>
<tr>
<td>14</td>
<td>&quot;a large mid-Atlantic publicly funded university&quot;</td>
<td>237</td>
<td>Undergraduate students</td>
<td>15%; an additional 16% at risk of food insecurity</td>
<td>USDA 18-item Household Food Security Survey Module</td>
<td>African American or other race/ethnicity; receiving multiple forms of financial aid; experiencing housing problems</td>
</tr>
<tr>
<td>15</td>
<td>&quot;a university in southwestern Ohio&quot;</td>
<td>~150</td>
<td>Undergraduate students</td>
<td>48%</td>
<td>Custom survey</td>
<td>Food pantry users were more likely to be: women; African American; living in poverty; unemployed; living off campus</td>
</tr>
</tbody>
</table>
Appendix 2. Survey used to collect data from University of [name retracted for peer review] students on the prevalence and determinants of food insecurity

Thank you for your participation!

This research will help us improve our understanding of student food security at the University of [name retracted for peer review]. It will give us insight to whether food insecurity is an issue for University of [name retracted for peer review] students, and how we can take action to improve the quality of life and education for University of [name retracted for peer review] students.

It is entirely your choice whether or not to participate in this survey.

If you agree to take part in this survey, you will be asked a series of questions, related to demographics and food security. The survey will likely take 3-5 minutes to answer. The researcher will have access to your responses, however, the responses will not be traceable to your email or any other form of your identity.

If you participate in this study fully, you will have the option of being entered into a prize draw to win one of two $50 gift certificate.

Risks associated with this study are minimal, but include the chance of emotional discomfort due to the subject content of some of questions.

You have the right to skip questions during the survey if you choose. You can end your participation at any time with no negative consequences.

Your identity will in no way be connected to the information received in the survey, or information used in the research project in its entirety.

If you should have questions or concerns before, during, or after your participation, please contact [name retracted for peer review] at [email address retracted for peer review] or [name retracted for peer review] at [email address retracted for peer review].

If you have questions regarding your rights as a participant, any concerns regarding this project or any dissatisfaction with any aspect of this study, you may report them -- confidentially, if you wish -- to the Institutional Review Board, [address retracted for peer review].

agree (1)
disagree (2)

Q1 What gender do you identify as?

Male (1)
Female (2)
Other (3) ____________________

Q2 Ethnicity origin (or Race): Please specify your ethnicity
White (1)
Black or African American (2)
American Indian or Alaska Native (3)
Asian (4)
Native Hawaiian or Pacific Islander (5)
Hispanic or Latino (6)
Other (7) ____________________
Prefer not to respond (8)

Q3 Do you have children?
yes (1)
no (2)

Q4 What is your current living arrangement?
on-campus (1)
off-campus alone (2)
off-campus with roommates (3)
off-campus with parents (4)
off-campus with spouse and/or children (5)
no current arrangement (6)
other (7) ____________________

Q5 What academic level are you?
1st year (1)
2nd year (2)
3rd year (3)
4th year (4)
5th year (5)
grgraduate student (6)

Q6 What is your GPA?
0.00-1.99 (1)
2.00-2.75 (2)
2.76-3.49 (3)
3.5-4.00 (4)

Q7 Do you receive financial support through student loans or any other funding that DOES NOT require repayment?
Yes (1)
No (2)

Q8 If yes, how much in the past 12 months?
(USD) (1) ____________________
Not applicable (2)

Q9 Do you receive financial support through student loans or any other funding that DOES require repayment?
Yes (1)
No (2)

Q10 If yes, how much in the past 12 months?
(USD) (1) ____________________
Not applicable (2)

Q11 Besides being a student, do you currently hold a part-time or full-time job?
part-time under 20 hours a week (1)
part-time over 20 hours a week (2)
part-time work-study (3)
full-time (4)
no job (5)

Q12 Based on the statement “The food that (I) bought just didn’t last, and (I) didn’t have money to get more.” In the last 12 months was this
  often true (1)
  sometimes true (2)
  never true (3)

Q13 Based on the statement “(I) couldn’t afford to eat balanced meals.” In the past 12 months was this
  often true (1)
  sometimes true (2)
  never true (3)

Q14 In the last 12 months, 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?
  yes (1)
  no (2)

Q15 If yes to the above question, how often did this happen?
  almost every month (1)
  some months, but not every month (2)
  only 1 or 2 months (3)
  not applicable (4)

Q16 In the last 12 months, did you ever eat less than you felt you should because there wasn’t enough money for food?
  yes (1)
Q17 In the last 12 months, were you ever hungry but didn’t eat because there wasn’t enough money for food?
yes (1)
no (2)

Q18 If provided with on-campus food assistance in the form of free groceries, would you use this?
yes (1)
maybe (2)
no (3)

Q19 If provided with on-campus food assistance in the form of free cooked meals, would you use this?
yes (1)
Maybe (2)
No (3)

Q20 What other food assistance programs would you find useful for the University of [name retracted for peer review] to offer to students?

Q21 Are you familiar with the SNAP program, formerly known as food stamps?
yes (1)
maybe (2)
no (3)

Q22 If you knew that you were qualified for food assistance through SNAP, would you use this?
yes (1)
Maybe (2)
No (3)
Q32 Would you like to enter your email address in order to be in the drawing to win a $50 giftcard?

yes (1) ____________________

no (2)