



University student food insecurity and academic performance

Robert R. Weaver, Nicole A. Vaughn, Sean P. Hendricks, Penny E. McPherson-Myers, Qian Jia, Shari L. Willis & Kevin P. Rescigno

To cite this article: Robert R. Weaver, Nicole A. Vaughn, Sean P. Hendricks, Penny E. McPherson-Myers, Qian Jia, Shari L. Willis & Kevin P. Rescigno (2019): University student food insecurity and academic performance, *Journal of American College Health*, DOI: [10.1080/07448481.2019.1600522](https://doi.org/10.1080/07448481.2019.1600522)

To link to this article: <https://doi.org/10.1080/07448481.2019.1600522>



Published online: 07 May 2019.



Submit your article to this journal [↗](#)



View Crossmark data [↗](#)

MAJOR ARTICLE



University student food insecurity and academic performance

Robert R. Weaver, PhD^a, Nicole A. Vaughn, PhD^a, Sean P. Hendricks, EdD^b, Penny E. McPherson-Myers, EdD^c, Qian Jia, PhD, RD, LDN^d, Shari L. Willis, PhD^a, and Kevin P. Rescigno^a

^aDepartment of Health and Exercise Science, School of Health Professions, Rowan University, Glassboro, New Jersey, USA; ^bUniversity Advising, Rowan University, Glassboro, New Jersey, USA; ^cAVP Diversity & Organizational Effectiveness, Rowan University, Glassboro, New Jersey, USA; ^dHealth, Nutrition and Exercise Sciences, Immaculata University, Immaculata, Pennsylvania, USA

ABSTRACT

Objective: Characterize the prevalence and dimensions of student food insecurity and the associations with academic performance. **Participants:** An online survey was distributed (November 2017) to 13,897 undergraduates at a midsized, New Jersey Public University; 2,055 (15%) responded. **Methods:** Demographic, behavioral, and food security data from University IT services, and the survey were combined in a single dataset. The USDA food security index was adapted to assess food insecurity. **Results:** Forty-eight percent of students were food insecure. Odds were higher for: women, African Americans, Hispanics, students with partial or no meal plan, commuters, and students receiving financial assistance. Food insecurity increased the odds of being among the lower 10% GPA and reduced the odds of being among the upper 10% GPA. **Conclusions:** Food insecurity among university students is high and is associated with academic performance. Understanding the mechanisms underlying this relationship is essential to design programs to address this problem.

ARTICLE HISTORY

Received 29 August 2018
Revised 8 January 2019
Accepted 24 March 2019

KEYWORDS

Academic performance;
food insecurity; gender;
logistic regression;
university students;
ethnicity

Introduction

Previously, university education was viewed as a privilege afforded only to those with means. Today, most see it as necessary for social mobility, status, and success in an increasingly competitive, global, knowledge economy.¹⁻³ A college degree provides the main pathway for social mobility in the US, and few investments yield a higher return; over a lifetime it will generate well over twice the income as that of comparable investments in stocks, bonds, gold, or housing.⁴ Yet, this education is an expense many cannot afford – the net costs of higher education (including tuition, fees, room, and board) have increased in recent decades, while inflation-adjusted income levels for US families have remained mostly flat for all but the population's top quintile.^{5,6} The price of one year of college is the equivalent of 84% of the income for the lowest 25% of US families.⁵ More and more university students work part-time or full-time while attending university often accumulating substantial debt along the way.^{7,8} In 2012, almost 70% of students who graduate from public universities carry student debt averaging \$25,550, figures that continue to grow. In the worst case, where financial strains hinder the ability to progress through a program and earn a degree, students accumulate debt and have little to show for it.

Caught between work, debt, and rising expenses, many students struggle to afford basic necessities, finding themselves hungry and “food insecure” – unable to obtain “an

adequate amount of food and sufficient nutrition”.⁹ Unsurprisingly, then, recent research suggests that the prevalence of food insecurity among university students is substantially higher than the national average where roughly 12% of households report to be food insecure.¹⁰ An ambitious survey of over 3,000 students in 12 states, 8 community colleges, and 26 four-year colleges and universities estimates the prevalence of student food insecurity to be 48%.¹¹ Findings reported on the prevalence of food insecurity vary widely depending upon the study sample and type of university.¹²⁻¹⁹ For instance, at the lower end, a recent study found 15% of undergraduate students to be food insecure – still higher than the portion of insecure households but below that of several other studies.¹⁸ In contrast, research reported the prevalence of food insecurity to be almost 40% at a community college in New York City while a mid-Atlantic community college reported a rate of 56%.^{13,14} Prevalence rates of food insecurity at universities in Illinois, Appalachia, and Oregon reportedly reached 35%, 46%, and 59% respectively.^{9,16,19}

Links between food insecurity and student success seem evident and include lower concentration, energy, test scores, and student retention.^{9,15,16} Some suggest there to be a relationship between food security and mental health (eg, depression, anxiety, disordered eating, suicide ideation),^{17,20,21} which likely influences performance as well. Finally, food insecurity often coincides with other factors that hamper student success (eg, difficulties with housing,

transportation, time management, employment, affording books, and supplies) and reflect other disparities in higher education.^{5,16,19}

The relationship between food insecurity and academic performance among university students remains less well understood, however. One study of two community colleges explored how food insecurity and academic performance relate, but several other key variables (e.g., nutritional deficiencies, behavioral and psycho-social issues) remained unaccounted for.¹⁵ Further, the prevalence among different segments of student populations within colleges and universities varies as well, and this also deserves careful examination.²⁰ How and to what extent these differences hold up when other factors are considered remains an open question. Inasmuch as food insecurity is pervasive in higher education and affects academic performance, the prospects of higher education offering an opportunity for upward mobility diminish. This research examines the prevalence of food insecurity among students attending a state-supported comprehensive university in the northeastern United States, along with how food insecurity relates to low or high academic success (GPA). It asks the following:

1. How prevalent is food insecurity among university students?
2. How do university students vary with respect to the prevalence of food insecurity?
3. How does food insecurity relate to academic performance?

Methods

Design and sample

The study was undertaken at a midsized, research-intensive public university in New Jersey. We distributed an online questionnaire to all undergraduate students 18 years old or older in the 2017 Fall term ($N=13,897$). We used the Qualtrics platform to distribute the survey. The sampling frame used information from the University's information technology office and included students' email addresses and demographic information – eg, gender, age, ethnicity, class standing, parents' education. Further, by retrieving GPAs we avoided reliance on self-reports of academic performance. This enabled us to compare attributes of survey respondents to non-respondents to assess the extent to which our results are generalizable to the larger student population. Identifying information (eg, names, ID numbers, addresses) was not provided, and email addresses were removed when the survey data were downloaded so researchers could not identify students and anonymity could be preserved. Incentives (eg, entry into a raffle for T-Shirts and \$50 gift cards) were provided to encourage participation. The survey was issued in five waves on different days and times during a three-week period. The study protocol received expedited approval from the University's Institutional Review Board.

Measures

The study used the demographic information that was collected by the University for all incoming students. The questionnaire used the United States Department of Agriculture (USDA) food security measure to assess food security.²² Over time, the measure has been modified and expanded and, most recently, includes a 10-item index. For instance, items inquire about whether respondents cut meal portions, skipped meals, or did not eat for an entire day because they lacked money. The USDA questions use either a 1-year or 30-day reference period.²³ Since students are a more transient population – eg, they typically return home for holidays and summers, or commute – we adopted the 30-day reference period. We omitted one item that pertained to weight loss due to money deficiency, since this would be difficult to gauge in the shortened timeframe. Affirmative responses to the food security questions were summed to yield a food security score. Based on food security scores, students were divided into four groups: (1) high food security (scored 0), (2) marginal food security (1–2), (3) low food security (scored 3–6), or (4) “very low” food security (scored 7–9). Low or very low food security students were classified as “food insecure,” while others were classified as food secure.¹⁷ Reliability score on our food security index was high (Cronbach $\alpha=.91$).

Several variables were downloaded a priori from the University student database. These included gender, ethnicity, parents' education, GPA, class level, and commuter status. Others derive from questionnaire responses: meal plan, employment status, and financial assistance. GPAs are based on grades received in courses that have been taken and are used to assess students' academic performance. GPAs range from .0 to 4.0, but since most incoming first-year students would have yet to complete any courses, cases where GPAs of .0 were removed in our analysis of academic performance. Finally, the questionnaire included three open-ended questions to capture students' views on the issue of food insecurity and attitudes toward using the campus food pantry when food is short. This paper only reports findings from the quantitative survey items.

Analysis

We examined odds ratios (ORs) for several of the attributes associated with food insecurity to ascertain who might be most vulnerable to food insecurity and performed logistic regressions to adjust these ratios by controlling for several other variables – gender, ethnicity, parents' education, class level, meal plan, commuter status, employment status, financial assistance. We performed a similar analysis to assess the odds of students with various attributes falling into the lowest or highest 10 percent GPA, including food security as a variable in the model. Further, the analysis of GPA did not include first-year students as just a small portion actually carried a GPA and the GPAs of those who did varied widely. All analyses were conducted using the SPSS (Version 24) statistical package.

Results

Sample and population

Our sample included 2,055 students, yielding a response rate of roughly 15%. Table 1 compares sample statistics with known parameters of the population from which the sample was drawn.

Differences between sample statistics and population parameters are comparatively small, and adjustments made to accommodate differences produced negligible changes in food security prevalence – ticking overall food insecurity prevalence just slightly upward or downward depending on the variable. One exception was gender – women were much more likely to respond than men – 56.5% to 43.5% – but also were more likely to be food insecure – 51.6% compared with 43.0%. Still, when correcting for these differences overall food security prevalence dropped just about one percent from 48% to 46.9%. Of course, we were unable to detect all potential differences between the sample and the population that would skew our results. Nonetheless, of the evidence available, none suggests the existence of substantial demographic differences between respondents and non-respondents with respect to food security.

The prevalence of food insecurity on campus

Table 2 shows the distribution of students' food security based on responses to nine food security questions. Almost half (48%) the students experience food insecurity, and over 3 in 10 score "very low" on the food security measure, often missing meals, cutting portions, and sometimes not eating for an entire day. Students who are very food insecure face

disrupted eating patterns and reduced intake due to money shortages.

These figures correspond with other data we collected on student food insecurity. Half of the respondents indicate that they know other students who struggle to afford basic food needs; 14% acquired food from the café for a friend "specifically because they could not afford to have a meal". Half the students report that they often or sometimes must borrow from family members to help satisfy basic needs. Over 1 in 4 reports having to borrow money for food from friends, despite potential embarrassment, status deprivation, or loss of social capital associated with borrowing money. About 1 in 10 students reported that they "did not eat for a whole day" because money was short, some several times over the last 30 days.

Differences in food insecurity among students

Table 3 shows crude and adjusted ORs of food insecurity for students with various attributes. Crude rates for all but Native Americans were shown to be statistically significant, and, except for men, all showed higher odds of being food insecure. When adjusting for other variables in the model, African Americans and Hispanics (compared to non-Hispanic whites), students who maintained a limited meal plan (compared to those with a robust plan), commuters (compared to non-commuters), and students who received some financial assistance (compared to those who do not) showed greater odds of being food insecure. Certain key variables – eg, gender, employment status, and parents' education – do not show significantly higher odds than their corresponding reference groups when other variables are taken into account.

Table 1. Demographic attributes of the sample and population.

Variable	Sample	Population
Age	<i>n</i> = 2055	<i>N</i> = 13897
Mean (SD)	20.9 (4.34)	21.6 (4.80)
GPA	<i>n</i> = 1480	<i>N</i> = 10469 ^a
Mean (SD)	3.22 (0.60)	3.08 (0.61)
Gender	<i>n</i> = 2055	<i>N</i> = 13876
Male	43.5%	54.1
Female	56.5%	45.9
Ethnicity	<i>n</i> = 1978	<i>N</i> = 13194
African American	10.9%	11.6%
American Indian	1.4%	1.1%
Native Hawaiian	0.2%	0.2%
Asian	7.1%	5.9%
Hispanic	10.7%	10.6%
White, non-Hispanic	68.8%	69.9%
International Student*	0.9%	0.8%
Class	<i>n</i> = 2055	<i>N</i> = 13897
Freshman	21.5%	14.9%
Sophomore	22.9%	22.0%
Junior	28.2%	30.7
Senior	27.4%	32.3%
Father's Highest Grade	<i>n</i> = 1824	<i>N</i> = 12003
Middle School	4.1%	3.4%
High School	38.8%	41.8%
College or beyond	57.1%	54.8%
Mother's Highest Grade	<i>n</i> = 1689	<i>N</i> = 11042
Middle School	4.9%	4.2%
High School	41.6%	45.9%
College or beyond	53.5%	49.9%

^aNote: GPAs of .0 were treated as missing.

Food security and academic performance

The study's third aim was to assess the impact of food insecurity on academic performance, measured in terms of GPA. Specifically, we wanted to identify differences between the lowest and highest achievers. Because the survey was distributed in the Fall term and the vast majority (80%) of first-year students had not yet earned a GPA, freshman students were removed from the analysis. The lowest 10% includes students with GPA scores that range from .08 to 2.37 (a third of whom were under academic probation, while the rest remain on the margin). The upper 10% includes students with GPA scores higher than 3.92 (a GPA of 4.0 represents the upper limit).

Table 2. Food insecurity among university students (*n* = 1529)^a.

Food Security	Percent	Frequency
High	34.8	532
Marginal	17.2	263
Low	17.1	262
Very low	30.9	472
Total	100.0	1529

^aNote: The 526 missing values resulted from non-responses to one or more of the items used to construct the FS score.

Table 3. Crude and adjusted odds ratios associated with being food insecure.

Variable – value ^a	Crude odds of being food insecure (CI 95%)	Adjusted Odds of being food insecure (CI 95%)
Gender – Male	0.71 (0.58–0.87) [†]	0.86 (0.67–1.09)
Ethnicity – African American	3.41 (2.39–4.88) [†]	3.44 (2.17–5.46) [†]
Ethnicity – Native Americans	1.59 (0.72–3.52)	1.10 (0.61–1.99)
Ethnicity – Asian	1.72 (1.14–2.60)**	2.19 (0.83–5.81)
Ethnicity – Hispanic	3.85 (2.62–5.64) [†]	2.07 (1.10–3.86)*
Parents' education – First Generation Students	1.57 (1.23–2.00) [†]	1.27 (0.96–1.67)
Class level – 3rd-4th year	1.62 (1.32–1.98) [†]	1.29 (0.974–1.715)
Limited meal plan – robust plan	2.42 (1.91–3.06) [†]	2.65 (1.86–3.77) [†]
Commuter status – Commuter	1.30 (1.06–1.59)**	1.57 (1.15–2.14)**
Employment status – Employed	1.56 (1.27–1.92) [†]	1.26 (0.98–1.62)
Receives financial assistance	1.93 (1.39–2.67) [†]	1.62 (1.08–2.41)*

^aNote: All ethnicity variables were dummied against non-Hispanic whites. Reference groups for other variables were gender (female); parents' education (not-first-generation); meal plan (robust meal plan); class level (second year); commuter status (non-commuter); employment status (unemployed), receives financial assistance (does not receive assistance).

* $p \leq .05$, ** $p \leq .01$, [†] $p \leq .001$; Cox & Snell R-square=.113, Nagelkerke R-square=.150.

Table 4. Odds ratio – predictors of lower or upper 10% GPA (combined second-, third-, and fourth-year students).

Variable – Value ^a	Crude odds of being in lower 10% GPA (CI 95%)	Odds of being in the lower 10% GPA (CI 95%)	Crude odds of being in upper 10% GPA (CI 95%)	Odds of being in the upper 10% GPA (CI 95%)
Food Security – food insecure	2.28 (1.45–3.57) [†]	2.11 (1.23–3.63)**	0.33 (0.21–0.52) [†]	0.34 (0.20–0.58) [†]
Gender – Male	1.53 (1.08–2.19)*	2.57 (1.54–4.29) [†]	0.72 (0.48–1.06)	0.63 (0.37–1.07)
Ethnicity – African American	2.97 (1.84–4.79) [†]	1.35 (0.60–3.07)	0.35 (0.14–0.87)*	0.80 (0.25–1.31)
Ethnicity – Native American	3.48 (1.12–10.86)	2.82 (1.12–7.13)*	0.56 (0.07–4.30)	0.39 (0.10–1.49)
Ethnicity – Asian	1.43 (0.71–2.88)	1.42 (0.24–8.35)	0.88 (0.41–1.88)	0.46 (0.05–4.38)
Ethnicity – Hispanic	1.85 (1.08–3.18)*	1.23 (0.40–3.76)	0.64 (0.32–1.30)	0.39 (0.09–1.70)
Parents' education – First Generation Students	1.31 (0.87–1.97)	1.60 (0.95–2.69)	0.54 (0.31–0.92)*	0.61 (0.32–1.15)
Limited meal plan – robust plan	1.78 (0.94–3.37)	1.47 (0.62–3.52)	1.11 (0.62–1.98)	0.96 (0.45–2.05)
Class level – third or fourth year	0.50 (0.35–0.73) [†]	0.40 (0.23–0.70)**	1.14 (0.74–1.74)	0.86 (0.46–1.59)
Commuter status – Commuter	1.45 (1.00–2.11)*	2.07 (1.12–3.80)*	0.96 (0.65–1.40)	0.99 (0.55–1.80)
Employment status – Employed	0.91 (0.62–1.35)	1.28 (0.77–2.12)	1.14 (0.75–1.73)	1.78 (1.03–3.07)*
Receives financial assistance	2.44 (1.52–3.94) [†]	2.40 (1.28–4.50)**	0.79 (0.39–1.59)	0.90 (0.39–2.01)

^aNote: All ethnicity variables were dummied against non-Hispanic whites. Reference groups for other variables were food security (food secure); gender (female); parents' education (not-first-generation); meal plan (robust meal plan); class level (second year); commuter status (non-commuter); employment status (unemployed), receives financial – (does not receive assistance).

Chi-square tests: * $p \leq .05$, ** $p \leq .01$, [†] $p \leq .001$; for the lower 10%, Cox & Snell R-square=.068, Nagelkerke R-square=.141; for the upper 10%, Cox & Snell R-square=.038, Nagelkerke R-square = 0.085.

As the table shows, our variables more readily predict underachievement than over-achievement as measured by GPA. Odds of underachieving are significant for the food insecure, males, Native Americans, second-year students, commuters, and financial aid recipients. Notably, whereas the odds of being food insecure for African Americans and Hispanics remain significant when other variables are taken into account, this is not the case for GPA – African Americans and Hispanics do not show significantly greater odds of carrying a low GPA. We were less able to identify attributes that contribute to the highest levels of academic achievement. When other variables are controlled for, food insecurity is inversely associated with falling within the upper 10 percent GPA; stated differently, food secure students have about three times the odds of being among the top group. Finally, being employed improves the odds of being among the top 10% for GPA.

Discussion

Almost half (48%) of undergraduate students in this study were food insecure. These numbers are considerably higher than the population as a whole, identical to those found in a broad survey of colleges and universities,¹¹ but somewhat higher than the average rate (32.9%) reported in

Bruening's¹³ systematic review. By any reckoning, however, the figures are alarming. Adjusted odds of being food insecure are higher in some groups rather than in others – African Americans, Hispanics, commuters, students with partial or no meal plan, and student recipients of financial assistance. Prevalence and dimensions of the problem are largely consistent with data from other universities.^{9,15,16}

According to our data, the association between food insecurity and academic performance is clear and persistent. After adjusting for other variables, the odds of the food insecure falling in the lowest 10 percent of GPA are two times those of food secure counterparts. Even while just two variables significantly associate with high GPAs, food security is one of them – food insecure students are about three times less likely to be among the highest 10% GPA compared to their food secure counterparts. These patterns largely consistent to other studies that examine the relationship between food security and academic performance.^{15,16,18,19}

As others have argued, various mechanisms might combine to put food insecure students at an academic disadvantage. For instance, inadequate diet generates various health effects that diminish academic performance – eg, fatigue and difficulties concentrating, reduced psychological well-being, impaired cognitive function.^{9,15,16,24,25} At the

behavioral level, time spent securing food may hinder academic success as food insecure students often must make special efforts to obtain food or money to purchase it – eg, selling textbooks, other possessions or services, joining groups that provide free meals, attending events where food was served, visiting family for weekend meals.^{19,26} Further, food insecure students tend to lower expectations regarding their academic performance, rate their overall progress lower, and be more inclined to take fewer courses or drop out due to financial difficulties; these factors may in part contribute to underperformance.^{19,27}

It is likely that no single mechanism operates to shape the relationship between food insecurity and academic performance but, rather, multiple mechanisms conspire to affect the outcome. Irrespective of what connects the two variables, the relationship persists and, as discussed, certain groups face a higher risk of being food insecure than others. African Americans, for instance, are neither more nor less likely than non-Hispanic whites to be among the lower or upper 10% in academic performance, but they are over three times more likely to be food insecure. Hence, their unadjusted odds of being in the lower 10% GPA are almost three times greater than whites, and the odds of being in the upper 10% GPA are almost three times lower.

Unreliable access to nutritious food is troubling in itself, but its implications for academic success further raise the stakes with regard to student retention, progress in their programs, and timely graduation. Success in post-secondary education provides the condition for economic success after graduation. Students who do very well likely benefit from “Matthew Effects” where the gains of early career success accrue over a lifetime.^{28,29} In contrast, those who underperform or do not graduate seem more likely to face precarious employment and financial instability. While the data we present are cross-sectional, it may portend upward or downward academic and financial trajectories that prospective investigations would do well to track.

Study limitations

Limitations of this investigation suggest opportunities for future ones. First, this study used a cross-sectional design so the results only suggest what causal factors might be at play. Prospective cohort investigations would enable us to more confidently show how the mechanisms operate over time. For instance, we did not examine how food security relates to mental illness or other health problems; how they might underlie or interact with food security to influence academic performance remains a critical open question.^{24,25,30} Moreover, the cross-sectional design did not permit the assessment of delayed academic progress or withdrawal due to food insecurity and, instead, relied solely on GPA as a performance metric. Second, although GPA was downloaded from official records, data on other key variables are self-reported and subject to misrepresentation, intentional or not. Third, our online survey yielded a large sample, but a response rate of 15%. The survey might suffer from unknown biases from over-representation of students who

are food insecure and eager to relate their experiences. To assess the similarity in the distribution of respondents and non-respondents, the means and distributions of sample statistics and the population parameters across several demographic variables are compared.³¹ The comparison (Table 1) provide no evidence of a demographic difference between respondents and non-respondents. Nonetheless, the results should be understood in their context. While typical of comprehensive state-supported universities of its size that cater mainly to a lower- to middle-class demographic of traditional students, important differences would likely be found for smaller, private colleges in different regions of the US and for those that serve mainly nontraditional and commuting students. Finally, the models presented offer, at best, a modest fit with the data, leaving considerable variation in academic success unaccounted for. Many food insecure students excel at the university, while many food secure students flounder. What mechanisms account for this difference? A qualitative examination of food insecure high achievers would enable us to ascertain what other mechanisms (eg, social support, role models, peer influence) offset the negative influence of food security on academic performance.

Implications

Arguably the issue of food insecurity across colleges and universities is a system-wide problem – eg, due to growing economic inequality and diminished higher education funding – that calls for a system-wide solution. Absent larger structural changes, there are more immediate changes that universities should make to reduce the problem of student food insecurity. For instance, a growing number of universities make available food pantries for students, and those that do not should consider doing so – if nothing else, food pantries serve as a stop-gap measure for students when funds run painfully short.³² Of course, the number of services they offer can expand further, furnishing school supplies, feminine products, toiletries, and other items to students in need. Local businesses and grocers often show a willingness to donate foods and supplies as a community service gesture. Food pantry services should be accompanied by stigma reduction programs, as students often express reluctance to use them, fearing shame and status deprivation some associate with dependence on others.^{19,26} Minority students, who face food insecurity at higher rates, may feel particularly vulnerable to the slights of others who carry negative perceptions of them as multiple stigmatized statuses often disrupt multiple life domains.^{33,34}

Many students, new to the college environment, must develop skills in time management, budgeting, along with planning for and preparing meals. Robust meal plans usually fade as students advance beyond their first year, and this skill deficit may be particularly debilitating for food insecure students. Food pantries and other campus resources would offer a service for students by assisting them in the development of basic skills in planning and preparing nutritious meals.^{19,35}

Instructors often underestimate the extent of food insecurity on campus³⁶ and remain unaware of many students in their classrooms who can barely afford to eat. Serious consideration may be given to providing alternatives to high-cost textbooks where possible without compromising course integrity. Selling textbooks or postponing their purchase altogether is one strategy students sometimes use to cope with food insecurity.^{19,26} Online resources are abundant and accessible to all students. Where textbooks are required, one or more copies should be placed on library reserve. Costs of textbooks tend to be frontloaded in the semester and student loans may have yet to arrive. Reserve copies will offer temporary relief until the dust settles by the semester's third or fourth week. Additional studies would need to be undertaken to assess the impact of these and other programs designed to address the issue of food insecurity.

There are compelling reasons why serious efforts should be made to better address campus food insecurity. If not motivated by compassionate concern – ie, where food is abundant, food insecurity is hard to justify – there are utilitarian reasons that our study suggests. Data show that food insecurity negatively relates to academic performance and likely lowers students' chances of persistence and timely graduation. In contrast, meaningful effort to address food insecurity (1) demonstrates genuine concern and support for students' well-being, and (2) might serve to elevate academic performance, retention, and graduation rates. Both serve to retain current and attract new students to the university. Prospective studies on food insecurity and academic performance should identify more directly the mechanisms that underlie the association between the two, as well as their implications for performance and retention.

Conflict of interest disclosure

The authors have no conflicts of interest to report. The authors confirm that the research presented in this article met the ethical guidelines, including adherence to the legal requirements, of USA and received approval from the Institutional Review Board of Rowan University.

References

- Bui KVT. First generation college students as a four-year university: Background characteristics, reasons for pursuing higher education, and first-year experiences. *Coll Stud J*. 2002;36(1):3–11.
- Stephens NM, Hamedani MG, Destin M. Closing the social-class achievement gap. *Psychol Sci*. 2014;25(4):943–953. doi:10.1177/0956797613518349.
- Georgetown University Center on Education and the Workforce. *Good Jobs That Pay without a BA: A State-by-State Analysis*. Washington, DC: Georgetown University, Center on Education and the Workforce; 2017.
- Greenstone M, Looney A, Patashnik J, Yu M. Thirteen economic facts about social mobility and the role of education. In: *The Hamilton Project*. Washington, DC: Brookings Institute; 2013.
- Goldrick-Rab S. *Paying the Price: College Costs, Financial Aid, and the Betrayal of the American Dream*. Chicago, IL: University of Chicago Press; 2016.
- Ma J, et al. Trends in College Pricing 2018, in Trends in Higher Education. New York; 2018.
- DeRuy E. At universities, more students are working full-time, in The Atlantic. 2015.
- Friedman Z. Student loan debt statistics in 2018: A \$1.5 trillion crisis. Forbes. Available at: https://www.paisboa.org/assets/aggie-blog/2018/09.21.18/StudentLoanDebt_%241.5TrillionCrisis.pdf. Published 2018. Accessed June 13, 2018.
- Morris L, Smith SS, Davis J, Null DB. The prevalence of food security and insecurity among Illinois University students. *J Nutr Educ Behav*. 2016; 48(6):376–382.
- Coleman-Jensen A, Rabbitt MP, Gregory CA, Singh A. Household Food Security in the United States in 2016, ERR-237. U.S. Department of Agriculture, Economic Research Service; 2017.
- Dubick J, Mathews B, Cady L. Hunger on campus: The challenge of food insecurity for college students. College and University Food Bank Alliance. Available at: http://studentsagainsthunger.org/wp-content/uploads/2016/10/Hunger_On_Campus.pdf. Published 2016.
- Cady CL. Food insecurity as a student issue. *J Coll Charact*. 2014;15(4):265–272.
- Bruening M, Argo K, Payne-Sturges D, Laska MN. The struggle is real: A systematic review of food insecurity on postsecondary education campuses. *J Acad Nutr Diet*. 2017; 117(11):1767–1791. doi:10.1016/j.jand.2017.05.022.
- Freudenberg N, et al. Food insecurity at CUNY: Results from a survey of CUNY undergraduate students. April 2011: City University of New York. Available at: <http://web.gc.cuny.edu/che/cunyfoodinsecurity.pdf>
- Maroto ME, Snelling A, Linck H. Food insecurity among community college students: Prevalence and association with grade point average. *Community Coll J Res Pract*. 2015;39(6):515–526. doi:10.1080/10668926.2013.850758.
- Patton-López MM, López-Cevallos DF, Cancel-Tirado DI, Vazquez L. Prevalence and correlates of food insecurity among students attending a Midsize Rural University in Oregon. *J Nutr Educ Behav*. 2014;46(3):209–214. doi:10.1016/j.jneb.2013.10.007.
- Bruening M, Brennhofers S, van Woerden I, et al. Factors related to the high rates of food insecurity among diverse, urban college freshmen. *J Acad Nutr Diet*. 2016;116(9):1450–1457. doi:10.1016/j.jand.2016.04.004.
- Payne-Sturges DC, Tjaden A, Caldeira KM, et al. Student hunger on campus: Food insecurity among college students and implications for academic institutions. *Am J Health Promot*. 2018;32(2):349–354. doi:10.1177/08901171171719620.
- McArthur LH, Ball L, Danek AC, Holbert D. A high prevalence of food insecurity among university students in Appalachia reflects a need for educational interventions and policy advocacy. *J Nutr Educ Behav*. 2018; 50(6):564–572. doi:10.1016/j.jneb.2017.10.011.
- Farahbakhsh J, Ball GDC, Farmer AP, et al. How do student clients of a university-based food bank cope with food insecurity? *Can J Diet Pract Res*. 2015;76(4):200–203. doi:10.3148/cjdrp-2015-020.
- Goldrick-Rab S, Broton KM, Hernandez DC. Addressing Basic Needs Security in Higher Education: An Introduction to Three Evaluations of Supports for Food and Housing at Community Colleges. W.H. LAB, Editor, University of Wisconsin-Madison. Available at: <https://hope4college.com/wp-content/uploads/2018/09/Addressing-Basic-Needs-Security-in-Higher-Education.pdf>; 2018. Accessed July 25, 2018.
- Economic Research Service Measurement. United States Department of Agriculture. 2017. Available at: <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/measurement/>.
- USDA 2012, U.S. Household Food Security Survey Module: Six-Item Short Form, 2012. Economic Research Service.
- Gao X, Scott T, Falcon LM, et al. Food insecurity and cognitive function in Puerto Rican adults. *Am J Clin Nutr*. 2009;89(4):1197–1203. doi:10.3945/ajcn.2008.26941.

25. Bruening M, Dinour LM, Chavez JBR. Food insecurity and emotional health in the USA: A systematic narrative review of longitudinal research. *Public Health Nutr.* 2017;20(17):3200–3208. doi: [10.1017/S1368980017002221](https://doi.org/10.1017/S1368980017002221).
26. Weaver R, Willis S, Vaughn N, et al. Food Insecurity among Rowan University Undergraduate Students; 2018.
27. Phillips E, McDaniel A, Croft A. Food insecurity and academic disruption among college students. *J Stud Affairs Res Pract* 2018; 55(4):1–20.
28. Merton R. The Matthew effect in science. *Science* 1968; 159(3810):56–63. doi:[10.1126/science.159.3810.56](https://doi.org/10.1126/science.159.3810.56).
29. Rigney D. *The Matthew Effect: How Advantage Begets Further Advantage*. New York: Columbia University Press; 2010.
30. Gundersen C, Ziliak JP. Food insecurity and health outcomes. *Health Aff (Millwood)*. 2015; 34(11):1830–1839. doi:[10.1377/hlthaff.2015.0645](https://doi.org/10.1377/hlthaff.2015.0645).
31. Sivo S, Saunders C, Chang Q, et al. How low should you go? Low response rates and the validity of inference in IS questionnaire research. *J Assoc Inf Syst.* 2006;7(6):351–414. doi: [10.17705/1jais.00093](https://doi.org/10.17705/1jais.00093).
32. El Zein A, Mathews A, House L, et al. Why are hungry college students not seeking help? Predictors of and barriers to using an on-campus food pantry. *Nutrients* 2018; 10(9):1163.
33. Hatzenbuehler ML, Phelan JC, Link BG. Stigma as a fundamental cause of population health inequalities. *Am J Public Health.* 2013; 103(5):813–821. doi:[10.2105/AJPH.2012.301069](https://doi.org/10.2105/AJPH.2012.301069).
34. Link BG, JC, Phelan ML, Hatzenbuehler Stigma as a fundamental cause of health inequality. In: Major B, Dovidio J.F., Link B.G, eds. *The Oxford Handbook of Stigma, Discrimination, and Health*. New York, NY: Oxford University Press; 2018: p. 53–67.
35. Gaines A, Robb CA, Knol LL, et al. Examining the role of financial factors, resources and skills in predicting food security status among college students. *Int J Consum Stud.* 2014;38(4):374–384. doi:[10.1111/ijcs.12110](https://doi.org/10.1111/ijcs.12110).
36. Crutchfield R. *Serving displaced and food insecure students in the CSU*. California State University, Long Beach; 2016.