



## A systematic review of food insecurity among US students in higher education


Aydin Nazmi, Suzanna Martinez, Ajani Byrd, Derrick Robinson, Stephanie Bianco, Jennifer Maguire, Rashida M. Crutchfield, Kelly Condrón & Lorrene Ritchie

To cite this article: Aydin Nazmi, Suzanna Martinez, Ajani Byrd, Derrick Robinson, Stephanie Bianco, Jennifer Maguire, Rashida M. Crutchfield, Kelly Condrón & Lorrene Ritchie (2018): A systematic review of food insecurity among US students in higher education, Journal of Hunger & Environmental Nutrition, DOI: [10.1080/19320248.2018.1484316](https://doi.org/10.1080/19320248.2018.1484316)

To link to this article: <https://doi.org/10.1080/19320248.2018.1484316>

 View supplementary material [↗](#)


---

 Published online: 22 Jun 2018.

---

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

---

 Article views: 311


---

 View Crossmark data [↗](#)

---



## A systematic review of food insecurity among US students in higher education

Aydin Nazmi<sup>a</sup>, Suzanna Martinez <sup>b</sup>, Ajani Byrd<sup>c</sup>, Derrick Robinson<sup>d</sup>,  
Stephanie Bianco<sup>e</sup>, Jennifer Maguire<sup>f</sup>, Rashida M. Crutchfield<sup>g</sup>, Kelly Condran<sup>a</sup>,  
and Lorrene Ritchie<sup>h</sup>

<sup>a</sup>Food Science and Nutrition Department, California Polytechnic State University, San Luis Obispo, USA; <sup>b</sup>Nutrition Policy Institute, University of California, Oakland, USA; <sup>c</sup>Extended Opportunity Programs & Services, Mission College, Santa Clara, USA; <sup>d</sup>Division of Agriculture and Natural Resources, University of California, San Diego, USA; <sup>e</sup>California State University Chico, Department of Nutrition and Food Science, Center for Healthy Communities, Chico, USA; <sup>f</sup>Department of Social Work, Humboldt State University, Arcata, USA; <sup>g</sup>School of Social Work, California State University Long Beach, Long Beach, USA; <sup>h</sup>Nutrition Policy Institute, University of California, Berkeley, USA

### ABSTRACT

Accumulating evidence suggests that food insecurity in US colleges and universities is higher than in US households, making this a new public health priority. We conducted a systematic review of food insecurity among US students attending higher education institutions. A total of eight studies met inclusion criteria, representing data from 52,085 students. Unweighted mean food insecurity prevalence among this sample was 43.5% (SD = 12.4), significantly higher than the 13% reported for US national households in 2015. Higher education institutions must critically examine the problem of food insecurity and take creative policy and programmatic steps to mitigate its consequences. Short-term emergency solutions, such as food pantries, may be useful, but upstream solutions to address basic needs are imperative.

### KEYWORDS


Food insecurity; hunger;  
higher education; college

## Introduction

Food insecurity is defined as the inability to acquire sufficient or appropriate food in a socially acceptable manner. The United States Department of Agriculture (USDA) Economic Research Service (ERS) has been tracking food security status among US households annually since 1995. From 1997 to 2007, food insecurity fluctuated moderately between 10% and 12% and rapidly increased to 14–15% between 2008 and 2014 as a result of the Great Recession.<sup>1</sup> In 2015, the rate nearly returned to pre-recession levels; with 12.7% of US households, or 42.2 million people, experiencing food insecurity at some point during that year. Although food insecurity declined, it

**CONTACT** Aydin Nazmi  [nazmi@calpoly.edu](mailto:nazmi@calpoly.edu)  Food Science and Nutrition Department, 1 Grand Avenue, San Luis Obispo, CA 93401

Color versions of one or more of the figures in the article can be found online at [www.tandfonline.com/when](http://www.tandfonline.com/when).

 Supplemental data for this article can be accessed at the [publisher's website](#).

continues to disproportionately affect low-income households below 185% of the poverty threshold (33–38%), households headed by a single woman (30%) or man (22%), Black (22%) and Hispanic (19%) households, and households with children (17%).<sup>2</sup>

Food insecurity is associated with poor nutritional,<sup>3,4</sup> and physical<sup>5–8</sup> and psychosocial<sup>9–11</sup> well-being. Among children and adolescents who are in a period of learning and social development, cognitive and behavioral outcomes have also been investigated. In a nationally representative sample, Alaimo et al. found that after adjusting for a range of socioeconomic indicators, compared to school-aged children from households with food security, those from households that were food insecure had significantly lower math scores and were more likely to have repeated a grade. In addition, both school-aged children and adolescents from households with food insecurity had more externalizing behavior and conduct problems, such as not getting along with others and school suspension, than their peers from food secure households.<sup>12</sup> In a prospective study of school-aged children, Howard found significant impairments in self-control, interpersonal relations, and learning among children with food insecurity at home.<sup>13</sup> Jyoti et al. reported longitudinal deficits in developmental and social skills in addition to reading performance, among children living in households experiencing food insecurity.<sup>14</sup> Moreover, Winicki and Jemison (2003) found that children from households with even marginal food insecurity displayed diminished learning over the school year.<sup>15</sup>

Whereas the food security literature representing adults and children is relatively well established,<sup>4,8,10,12,14,16–19</sup> there is limited research on college students. More than 20 million US students, including 40% of all 18–24 year olds, are enrolled in higher education (National Center for Education Statistics) and emerging evidence suggests that this population is at elevated risk for food insecurity, despite the notion that this population is in a protected environment. Competing financial obligations, such as tuition and housing (which continue to rise), and educational expenses (e.g., textbooks, computers), which have disproportionately affected low- and middle-class families, have been implicated in the rise in hunger and homelessness among college students across the country,<sup>20,21</sup> and possibly more so after the Great Recession. It has been posited that students with unmet basic needs, such as food and/or housing, have difficulty learning and are less likely to achieve academic success.<sup>22</sup> Cook et al. have suggested that the impact of food insecurity on health in young adults is underestimated because “marginal” food security may be more akin to “low” versus “high” food security.<sup>17</sup> However, little is known about the negative behavioral and academic impacts that food insecurity may have on young adults.

Food insecurity among college students was first documented as public health issue almost 10 years ago, but did not appear in the literature until 2009 when Chapparo et al. published their 2006 data from the University

of Hawaii, Manoa.<sup>23</sup> The media, however, did not start spotlighting the problems of basic needs insecurity among college students until May 2010 (Google News search October 11, 2016 with media key words “college food security”),<sup>24</sup> which coincided with the economic turmoil of the Great Recession. Post-recession recovery coinciding with rising costs of tuition over the past decade and the increasing gap between financial aid packages and actual costs of higher education are likely reasons basic needs (food and housing) security has come to the forefront of the college student experience.<sup>22,25</sup>

Because studies on college food security have been published in a range of disciplines, including nutrition and dietetics, consumer studies, and higher education, it is difficult to gain a clear impression of the extent of the food insecurity issue in higher education, which makes this systematic review timely, as this information is necessary to inform policies and design effective programs to ensure basic needs, which includes food security, among all students. Therefore, the objectives of this systematic review were to: 1) document and describe the number of studies to date and the methodologies used to estimate food security and 2) synthesize available food security prevalence data from US higher education settings.

## Methods

Investigators (AN and SM) searched peer-reviewed and publicly available data sources for food insecurity prevalence in higher education in the US Google, Google scholar, Web of Science, and PubMed using the following keywords: food security, food insecurity, hunger, university, students, and college. Inclusion criteria included analyses that collected primary data on food security prevalence, utilized random or representative sampling strategies, and utilized any of the three standardized, validated USDA food security assessment tools. Data were required to be drawn from undergraduate or graduate students from 2- or 4-year US institutions of higher education; dates were not specified. Experts in the field were also contacted for in-progress or recently completed studies. Study authors were contacted to provide clarification on methods or results when necessary.

In supplemental analyses, we expanded inclusion criteria to studies utilizing any sampling strategies and any food security assessment tools for studies conducted in the US. Microsoft Excel was used to calculate unweighted and weighted mean (SD) food insecurity prevalence by taking into account study sample sizes and this approach was repeated for supplemental data.



**Table 1.** Description of the eight data sources meeting inclusion criteria examining prevalence of food insecurity at US higher education institutions, organized by food security assessment method and year of publication. (Abbreviations: AFSSM: Adult Food Security Survey Module, UG: Undergraduate students, G: Graduate students).

Year published	1st Author	Setting (data collection period)	Sample size, response rate	Design, sample details	Food security screening tool	Food insecurity prevalence reported	Other key findings	Source
<b>10-ITEM USDA ADULT FOOD SECURITY MODULE (AFSSM)</b>								
2009	Chaparro	University of Hawaii Manoa, flagship campus of UH system, urban public research university, approx. 20k students (Oct-Nov 2006)	410, 33%	Randomly selected UG/G non-freshman classes	AFSSM	21% in past 12 months	Significant differences in food insecurity among Native HI/Pacific Islander (38%), Filipino (33%), White (24%), Mixed (24%), and Japanese (8%); those living on campus (38%), off campus with roommates (31%), off campus with parents (11%); Increased odds of food insecurity among Hawaiian/Pacific Islander, Filipino, and students of mixed race/ethnicity	Peer-reviewed publication
2016	Morris	4 public universities in small-town rural settings; Northern, Eastern, Southern, and Western IL Universities, approx. 7-30k students/campus (Apr-May 2013)	1,882, 3.87%	Census of UG at 4 universities	AFSSM	35% in past 9 months	Higher prevalence among African-Americans, those with lower GPA, those living off campus independently, those on student aid, lower risk among those living with parents	Peer-reviewed publication
<b>6-ITEM SHORT FORM FOOD SECURITY MODULE</b>								
2014	Patton-Lopez	Western Oregon University, small town rural, approx. 6k students (May 2011)	354, 7%	Census of UG/G students	6-item Short Form of the Food Security Survey Module	58.8% in past 12 months	Higher prevalence among poor self-reported health, low GPA, employed students, low income	Peer-reviewed publication
2015	Goldrick-Rab	10 community colleges in 7 states (LA, PA, NY, CA, NJ, WI, WY), mostly small town, approx. 3-20k students/campus (Winter-Spring 2015)	4,312, 9%	Random sample, UG, at 9 institutions and census at 1 institution	6-item Short Form of the Food Security Survey Module	39% in past 12 months	Food insecurity among White (35%), Black (54%), Latino (45%), Southeast Asian (37%); among food insecure students: 73% housing insecurity, 38% used food-related public assistance; 91% depressed, 84% severe anxiety, 34% suicidal ideation	Report

(Continued)

**Table 1.** (Continued).

Year published	1st Author	Setting (data collection period)	Sample size, response rate	Design, sample details	Food security screening tool	Food insecurity prevalence reported	Other key findings	Source
2016	Bedore	California State University Chico, suburban setting, approx. 18k students (May-June 2016)	707, 13%	Random sample of all UG/G	6-item Short Form of the Food Security Survey Module	43.1% in past 12 months	46.4% of students eligible for CalFresh 28.6% of students identified as both food insecure and CalFresh eligible USDA guidelines for food insecurity status do not accurately reflect CalFresh eligibility	Master's thesis
2016	Maguire	California State University Humboldt, small town rural, approx. 9k students (Nov 2015)	1,554, 19%	Census of UG/G students	6-item Short Form of the Food Security Survey Module	53% in past 30 days	19% utilized CalFresh, 27% used campus pantry, freshmen least food insecure	Report
2016	Martinez	University of California system, diverse settings, approx. 5-45k students per campus (Spring 2015)	8,932, 14%	Random sample of UG/G students at 10 campuses	6-item Short Form of the Food Security Survey Module	42% in past 12 months	57% new to food insecurity. Higher prevalence among African-American and Latino students, students with child history of food insecurity, longer time as an undergraduate, receiving financial aid, and other living situation including homeless or living temporarily with friend	Report
2017	Goldrick-Rab	70 community colleges in 24 states, diverse settings, approx. 75k students total (Fall 2016)	33,934, 4.5%	Census of student body at all institutions	6-item Short Form of the Food Security Survey Module	56% in past 12 months	Food insecurity among Pell Grant recipients (65%), students who had been in foster care (75%), US citizens/permanent residents (56% vs. non-citizen/resident 51%), student parents (63%) 29% of food insecure students utilized SNAP	Report

## Results

A total of 28 studies were identified. Of these, eight studies met the inclusion criteria (Table 1), representing data collected between 2006 and 2016 from 52,085 students in 27 states at more than 100 US institutions. Three sources were from peer-reviewed journals<sup>23,26,27</sup>, four were reports<sup>28-31</sup>, and one was a Master's thesis.<sup>32</sup> Of these eight studies, sample sizes ranged from 354<sup>27</sup> to 33,934<sup>29</sup> and five of these studies included both undergraduate and graduate students.<sup>23,27,30-32</sup> Two studies presented data solely from community colleges.<sup>28,29</sup> Response rates ranged from <4% at Illinois public universities<sup>26</sup> to 33% at University of Hawaii,<sup>23</sup> with an average of 8.3%.

## Sampling

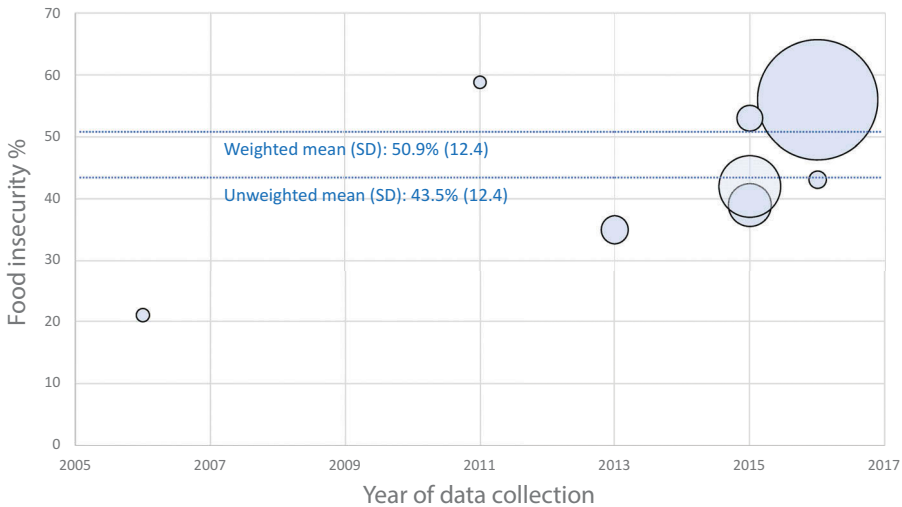
Four studies collected data from a single campus, representing studies from Hawaii, Oregon, and California (two separate studies).<sup>23,27,30,32</sup> The other four studies collected data from two or more campuses; one study in Illinois collected at four campuses, another collected data at the 10 campuses of the University of California system, and two studies focused on community college campuses (10 and 70, respectively) in several states (seven and 24, respectively).<sup>26,28,29,31</sup>

Studies differed on sampling techniques. Four studies employed random sampling<sup>23,28,31,32</sup> and four<sup>26,27,29,30</sup> employed census sampling. Most studies used individual students as sampling units,<sup>26-32</sup> but one used classes as aggregate-level (classroom clusters) sampling units<sup>23</sup> that involved inviting all students in those classes to take part in data collection.

Three studies<sup>26,28,29</sup> examined food insecurity among undergraduates only (including community college students), whereas five studies<sup>23,27,30-32</sup> included data on graduate students as well. Studies examining solely undergraduate samples ranged from  $N = 1,882$ – $33,394$ . The graduate student samples were relatively small, with the proportion of graduate students ranging from 8–37% ( $n = 58$ – $147$ , respectively), but Martinez et al. studied the greatest total number of graduate students ( $n = 2412$ ).

## Food security assessment tools

Per inclusion criteria, all studies used USDA food security assessment instruments, including two studies that used the 10-item US Adult Food Security Survey Module (AFSSM)<sup>23,26</sup> and six studies that used the 6-item Short Form of the Food Security Survey Module<sup>27-32</sup> (short version of the AFSSM). Unweighted and weighted mean (SD) food insecurity prevalence in the studies that used the 10-item AFSSM and 6-item Short Form was 28% (9.9) and 32.5% (17.7) and 48.7% (8.3) and 51.8% (14.7), respectively.



**Figure 1.** Prevalence of food insecurity at US institutions of higher education among eight studies meeting inclusion criteria. Unweighted mean (SD): 43.5% (12.4); weighted mean (SD): 50.9% (12.4). Size of circle indicates study size ( $N = 354$ – $33,934$ ).

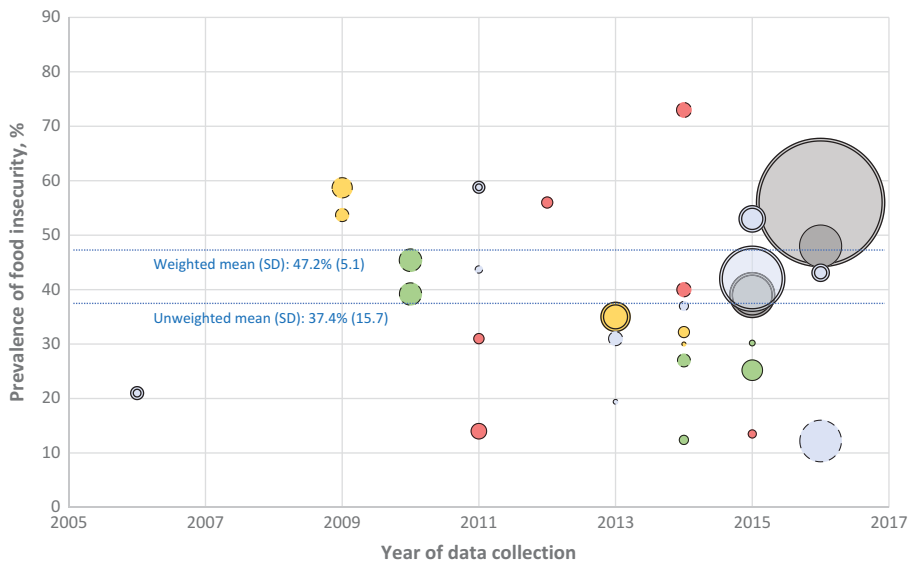
### **Food insecurity prevalence among studies meeting inclusion criteria**

Figure 1 shows the sample prevalence of food insecurity from all eight data sources in relation to year of data collection and sample size. Unweighted mean (SD) food insecurity prevalence across all eight studies was 43.5% (12.4); range: 21 to 58.8%;  $N = 52,085$ . Weighted mean (SD) was higher, at 50.9% (12.4).

The lowest prevalence of food insecurity was 21% at the University of Hawaii in 2006 among undergraduates and graduates in a study with relatively high (33%) response rate ( $N = 410$ ).<sup>23</sup> The highest food insecurity prevalence was at Western Oregon University in 2011 (58.8%, 7% response rate,  $N = 354$ ).<sup>27</sup> The two community college studies (total  $N = 38,246$ ) showed higher food insecurity prevalence than the 4-year colleges (total  $N = 13,839$ ). Unweighted and weighted mean (SD) prevalence rates were 47.5% (12.0) and 54.1% (32.0) for community colleges, whereas corresponding values for 4-year colleges were 42.2% (15.0) and 42.2% (10.0).

In supplemental analysis, we broadened the inclusion criteria to include studies that utilized any sampling strategies and any food security assessment tool. This added 20 data sources<sup>33–52</sup> to the original eight (Figure 2) and increased the total sample size to 68,125. Unweighted and weighted mean (SD) food insecurity prevalence rates among all studies were lower than the original estimates; 37.4% (15.7) and 47.2% (5.1), respectively. Table 2, available as an online supplement, describes the characteristics of the 20 additional data sources that did not meet inclusion criteria.





**Figure 2.** Prevalence of food insecurity at US institutions of higher education among all 28 studies (eight primary and 20 supplemental), unweighted mean (SD): 37.4% (15.7); weighted mean (SD): 47.2% (5.1). Size of circle indicates study size ( $N = 53\text{--}33,934$ ). Color indicates region of study (blue: West, yellow: Mid, red: South, green: East, grey: multiple regions). Double outline indicates studies from primary analysis ( $N = 8$ , random/representative sampling plus use of USDA food security assessment instrument). Dashed outline indicates studies using non-USDA food security assessment instrument, including “adapted” methods ( $N = 11$ ). Single outline indicates studies using USDA instrument but not random/representative sampling ( $N = 9$ ). Note: Broton et al. (data collected in 2009) is shown as two data points representing its results from 2- and 4-year institutions. Freudenberg et al. (data collected in 2010) is also represented as two data points representing its results from all CUNY campuses and a targeted sample.

## Discussion

This systematic review included eight studies in its primary analysis and showed that food insecurity among students at US higher education institutions was at least three times higher than observed in nationally representative households. We found that food insecurity was 43.5% when unweighted and 50.9% when weighted, suggesting that food insecurity may impact one in two students. To our knowledge, this is the first systematic review of food insecurity in US higher education. One other review examined peer-reviewed publications and the “grey literature” in the global context but did not utilize inclusion criteria to distinguish higher quality studies.<sup>53</sup> Their findings showed that the average rate of food insecurity in nine peer-reviewed US studies was 33%, lower than our estimate. By comparing our primary and secondary analyses, we suggest that lower quality studies may underestimate food insecurity prevalence, which could explain Bruening et al’s findings.

This is a relatively new field of research, evidenced by the fact that six of the eight studies represented in the main analysis represented data collected since 2013.

The sample prevalence of food insecurity among these eight studies was higher than when estimated by all 28 studies in supplemental analyses. This may suggest that studies which do not utilize standardized, validated assessment tools to assess food insecurity may be underestimating the prevalence of food insecurity. However, the factors associated with food insecurity among college students may be distinct from those affecting community-based populations, warranting a careful examination of methodological issues, as discussed in the following paragraphs.

This review demonstrated that college students are not protected from food insecurity, to the contrary, they may be at significantly elevated risk compared to community-dwelling populations. As such, future research should be directed at developing commonly accepted standards for assessing food insecurity in collegiate samples, including identifying and implementing standardized and valid methodological approaches. The validity of USDA instruments within college student populations has not been tested but has been validated for use in US households, and therefore, food insecurity estimations based on the USDA food security survey questions may be differentially interpreted according to general household demographic factors.<sup>54</sup> It may be important to include a supplemental measure to assess timing of food insecurity such as whether students experienced food insecurity during the academic year or during winter/spring/summer breaks. In addition, it would be important to know whether students experience food insecurity toward the end of a term when financial aid funds have been exhausted. This type of information could show that students experience food insecurity heterogeneously over a typical year, which may aid in designing creative solutions toward student's basic needs' security. For instance, national household data have been used to inform public safety net mechanisms such as Supplemental Nutrition Assistance Program (SNAP), The Special Supplemental Nutrition Program for Women Infants and Children (WIC), the National School Lunch Program, and food banks. Although college students may participate in SNAP and WIC, to date, no federal mechanisms are specifically targeted to combat food insecurity among college students.

On college campuses, efforts are nascent in addressing food insecurity, starting with emergency relief. Campus food pantries have been the quickest way to respond to college food insecurity. What originally started as a handful of programs on several campuses has evolved into the College and University Food Bank Alliance, and as of March 2017, comprised 400 higher-education institutions ([cufba.org](http://cufba.org)). This alliance is a response to the crisis that has gone largely unaddressed. Other emergency assistance programs on campuses provide support for acute situations, with more novel approaches focusing on food recovery programs that share food that would otherwise be

wasted, dining plan sharing programs, cooking classes, and campus community gardens or farms.<sup>39,55</sup>

Upstream solutions are fundamental to reduce and eliminate food insecurity in higher education. Efforts such as CalFresh Outreach, which aims to increase participation in California's SNAP, has recently been directed at college students. In 2016–18, 11 of the California State University's 23 campuses will be participating in a CalFresh Outreach project in a significant new undertaking to address the dual burden of student food insecurity and under-utilization of CalFresh (Bianco, S, personal communication). By 2017–2018 academic year, the University of California anticipates incorporating CalFresh outreach throughout the UC system and by 2020 implementing a comprehensive model that encompasses justice and basic needs for all UC students, efforts that have been funded by the UC President (Canedo, R, personal communication). Recently, the University of California, California State University, and California Community College systems, which collectively represent more than 3 million students, formalized a partnership with the aim of collaboratively increasing student food and housing security as a means to improve student success across the state (Canedo, R, personal communication). These examples, taken from California higher education, could serve as a model for others aiming to strategize efforts on food insecurity at a statewide level, and potentially organize at a national level.

To increase food security among college students, trials on the effects of food assistance or similar programs on student outcomes are imperative, as are natural experiments following implementation of campus or system-wide policies. Due to relatively fixed and controllable environments, in addition to “captive audiences,” it might be anticipated that implementation of sound policies at the campus or system levels may yield quicker and more dramatic results in improving food security compared to policies at the state or federal levels. Additionally, longitudinal studies could help to elucidate mechanisms by which increasing food security status may improve learning, educational outcomes, and retention rates, and could also be used to examine post-graduation professional or economic trajectories. In terms of economic analyses, the cost of college attendance has been examined,<sup>25,56</sup> but more precise estimates, such as actual cost of living, may help determine more suitable or sustainable financial aid mechanisms for students in need. Furthermore, it would be important to examine these relationships by level of higher education such as community college, undergraduate, and graduate given that food insecurity may impact these populations differently.

Although national efforts will take time to develop, empirical evidence from future studies may support federal policies that create greater potential for college students to access social safety net programs, which many low-income college students would otherwise qualify for by income if they were not enrolled in college. For example, the USDA, the California Department of Social Services, and the county welfare offices, who jointly administer SNAP in California (CalFresh), should investigate ways to make it easier for

students to enroll in this supplemental assistance program. Collaborations are necessary to explore how to improve the infrastructure and process that is available for students to apply for SNAP. Indeed, a number of policy approaches have been proposed by, among others, the Wisconsin Hope Lab.<sup>22,25,28,39,56</sup> Approaches, both short- and long-term, center on making the college experience more equitable for students through expansion of college food pantries, SNAP outreach, and making campus meals universally free or subsidized and included as part of the tuition as one option, which could be modeled after the National School Lunch and School Breakfast Programs for primary and secondary education. Addressing upstream determinants of student basic needs could include college affordability and tuition, financial aid reformulations and restructuring student loans, increasing availability of work-study programs, raising the minimum wage for student employees working fewer than 20 h per week, promoting research into basic needs of college students. Finally, programmatically, the post-secondary education environment provides a largely untapped opportunity to teach students financial, basic needs, and health literacy. Links between college staff, researchers, and community organizations to support and enhance student services may also be fruitful.

### **Limitations**

Research of food insecurity among college populations is nascent, resulting in only eight studies for this review. Colleges may have collected food security data for internal purposes under the designation of evaluation of educational practice and may not have shared their findings publicly, which would have precluded inclusion in this analysis. We included supplementary analyses with studies that did not meet our inclusion criteria, which stipulated random or representative sampling and USDA assessment tools, but did not distinguish between varying response rates, which may have disproportionately represented certain groups. Weighted analyses increased mean estimates by 7.4 and 9.8 percentage points, respectively, for the original eight studies and all 28 studies due to the higher mean estimates in the largest studies (e.g., Goldrick-Rab et al.,  $N = 33,934$  and  $4,312$ ; Martinez et al.,  $N = 8,932$ ; and Wood,  $N = 3,647$ ). With these expanded criteria, the six studies that analyzed community college data (total  $N = 43,465$ ) showed higher food insecurity prevalence than the 4-year colleges (total  $N = 24,660$ ). Unweighted and weighted mean (SD) sample prevalence rates were 44.5% (17.0) and 50.5% (17.3) for community colleges whereas corresponding values for 4-year colleges were 36.1% (15.1) and 41.3% (3.1), suggesting higher prevalence of food insecurity at the community-college level, but this warrants further research. Even with this multi-pronged analytical strategy, this review study may have under- or over-

estimated food security among college populations if sampling was not representative on each campus.

Comparisons between college student populations and household population data should be made with caution. The USDA ERS reports nationally representative data based on standardized validated versions AFSSM (for adults) or HFSSM (for households with children), but only two studies meeting inclusion criteria utilized the 10-item AFSSM,<sup>23,26</sup> whereas six used the standardized, validated 6-Item Short Form and an additional two utilized four-item adapted versions. Using the 10-item AFSSM instead of the 6-item short survey module among college students has been recommended to detect food insecurity at the most severe levels (Rabbitt, M, personal communication). Recent use of nationally representative Current Population Survey (CPS) data to estimate food security prevalence among households<sup>57</sup> likely underestimates the problem of food insecurity, as these data are measured at the household-level, not the student-level, where risk for food insecurity is higher.<sup>58</sup>

Higher education institutions must assess and, if present, acknowledge the problem of food insecurity among college students and take creative policy and programmatic steps to mitigate its consequences. Recently, the Government Accountability Office committed to the request of Senators Warren, Markey, Murray and Stabenow to conduct a food insecurity study among US colleges and universities. This work is instrumental in addressing student basic needs and this review will help to inform research practices around this effort. As such, it is recommended that rigorous methods be employed, including random sampling of representative samples and utilizing validated measures of food insecurity, such as the AFSSM, among college students. Moreover, new and better methods of assessing food security in the college student's context are urgently needed. Lastly, although short-term emergency relief solutions may be immediately useful, strategizing upstream solutions starting at the local and statewide levels are imperative.

Higher education is seen as one of the most important determinants of social capital, mobility, and health.<sup>59–62</sup> Basic needs, including food and housing, clearly must be met for students to pursue, much less achieve, academic success.<sup>63</sup> Food security and poverty are closely linked, and limited access to food is cyclically associated with poverty over generations.<sup>64</sup> According to Cook and Frank, food insecurity is “readily measured and rapidly remediable” even at the national level, but the commitment to alleviate hunger on college campuses remains to be seen.<sup>65</sup> It is hard to imagine a more sensible investment than to make procedural changes and relatively small investments to ensure that college students are adequately nourished and ready to learn, which in turn will position them to lead more productive lives.

**ORCID**

Suzanna Martinez  <http://orcid.org/0000-0001-7864-1391>

**References**

1. USDA ERS. Food security: key statistics and graphs. <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/key-statistics-graphics/>. Published 2016. Accessed October 10, 2016.
2. USDA ERS. Food security: frequency of food insecurity. <https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-us/frequency-of-food-insecurity/>. Published 2016. Accessed October 10, 2016.
3. Rose D. Economic determinants and dietary consequences of food insecurity in the United States. *J Nutr.* 1999;129(2):517. doi:10.1093/jn/129.2.517S.
4. Bhattacharya J, Currie J, Haider S. Poverty, food insecurity, and nutritional outcomes in children and adults. *J Health Econ.* 2004;23(4):839–862. doi:10.1016/j.jhealeco.2003.12.008.
5. Pan L, Sherry B, Njai R, Blanck HM. Food insecurity is associated with obesity among US adults in 12 states. *J Acad Nutr Diet.* 2012;112(9):1403–1409. doi:10.1016/j.jand.2012.06.011.
6. Olson CM. Nutrition and health outcomes associated with food insecurity and hunger. *J Nutr.* 1999;129(2):521. doi:10.1093/jn/129.2.521S.
7. Mangini LD, Hayward MD, Dong YQ, Forman MR. Household food insecurity is associated with childhood asthma. *J Nutr.* 2015;145(12):2756–2764. doi:10.3945/jn.115.215939.
8. To QG, Frongillo EA, Gallegos D, Moore JB. Household food insecurity is associated with less physical activity among children and adults in the U.S. population. *J Nutr.* 2014;144(11):1797–1802. doi:10.3945/jn.114.198184.
9. Leung CW, Epel ES, Willett WC, Rimm EB, Laraia BA. Household food insecurity is positively associated with depression among low-income supplemental nutrition assistance program participants and income-eligible nonparticipants. *J Nutr.* 2015;145(3):622–627. doi:10.3945/jn.114.199414.
10. Whitaker RC, Phillips SM, Orzol SM. Food insecurity and the risks of depression and anxiety in mothers and behavior problems in their preschool-aged children. *Pediatrics.* 2006;118(3):e859–e868. doi:10.1542/peds.2006-0239.
11. Slopen N, Fitzmaurice G, Williams DR, Gilman SE. Poverty, food insecurity, and the behavior for childhood internalizing and externalizing disorders. *J Am Acad Child Adolesc Psychiatry.* 2010;49:444–452.
12. Alaimo K, Olson CM, Frongillo EA. Food insufficiency and American School-Aged Children's cognitive, academic, and psychosocial development. *Pediatrics.* 2001;108:44–53.
13. Howard LL. Does food insecurity at home affect non-cognitive performance at school? A longitudinal analysis of elementary student classroom behavior. *Econ Educ Rev.* 2011;30(1):157–176. doi:10.1016/j.econedurev.2010.08.003.
14. Jyoti DF, Frongillo EA, Jones SJ. Food Insecurity Affects School Children's academic performance, weight gain, and social skills. *J Nutr.* 2005;135(12):2831–2839. doi:10.1093/jn/135.12.2831.
15. Winicki J, Jemison K. Food insecurity and hunger in the kindergarten classroom: its effect on learning and growth. *Contemp Econ Policy.* 2003;21:145–157. doi:10.1093/cep/byg001.
16. Bertram DC, Coleman-Jensen A, McFall W, Nord M, Richardson J. *Food Insecurity in U.S. Households with Children: Trends and Analysis*. New York: Nova Science; 2013.

17. Cook JT, Black M, Chilton M, et al. Are food insecurity's health impacts underestimated in the U.S. population? Marginal food security also predicts adverse health outcomes in young U.S. children and mothers. *Adv Nutr.* 2013;4(1):51–61. doi:10.3945/an.112.003228.
18. Frongillo EA, Jyoti DF, Jones SJ. Food stamp program participation is associated with better academic learning among school children. *J Nutr.* 2006;136(4):1077–1080. doi:10.1093/jn/136.4.1077.
19. Kleinman RE, Murphy JM, Little M, et al. Hunger in children in the United States: potential behavioral and emotional correlates. *Pediatrics.* 1998;101(1):e3–e3. doi:10.1542/peds.101.1.e3.
20. Goldrick-Rab S, Kendall N. *The Real Price of College.* Washington, DC: The Century Foundation; 2016.
21. Kolowich S How many college students are going hungry? *The Chronicle of Higher Education.* 2015;Students.
22. Broton K, Goldrick-Rab S. *Public Testimony on Hunger in Higher Education Submitted to the National Commission on Hunger.* Madison, WI: Wisconsin Hope Lab; 2015.
23. Chaparro MP, Zaghoul SS, Holck P, Dobbs J. Food insecurity prevalence among college students at the University of Hawai'i at Manoa. *Public Health Nutr.* 2009;12(11):2097–2103. doi:10.1017/S1368980009990735.
24. Robbins K Among dorms and dining halls, hidden hunger. *The Atlantic.* May 4, 2010.
25. Ma J, Baum S, Pender M. *Trends in College Pricing 2015.* New York: The College Board; 2015.
26. Morris LM, Smith S, Davis J, Null DB. The prevalence of food security and insecurity among Illinois University Students. *J Nutr Educ Behav.* 2016;48(6):376–382. e371. doi:10.1016/j.jneb.2016.03.013.
27. Patton-Lopez MM, Lopez-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.
28. Goldrick-Rab S, Broton K, Eisenberg D. *Hungry to Learn: Addressing Food & Housing Insecurity among Undergraduates.* Madison: Wisconsin Hope Lab; 2015.
29. Goldrick-Rab S, Richardson J, Hernandez A. *Hungry and Homeless in College: Results from a National Study of Basic Needs Insecurity in Higher Education.* Madison: Wisconsin Hope Lab; 2017.
30. Maguire J, O'Neill M, Aberson C. *California State University Food and Housing Security Survey: Emerging Patterns from the Humboldt State University Data.* Humboldt, California: California State University, Humboldt; 2016.
31. Martinez SM, Maynard K, Ritchie LD. *Student Food Access and Security Study.* University of California Global Food Initiative, Oakland; 2016.
32. Bedore A. *Food Insecurity among Students and Identifying Constraints for SNAP/ CalFresh Participation.* Chico, CA: Nutrition and Food Science, California State University at Chico; 2016.
33. Biediger-Friedman L, Sanchez B, He M, Guan J, Yin Z. Food purchasing behaviors and food insecurity among college students at The University of Texas at San Antonio. *J Food Secur.* 2016;4:52–57.
34. Broton K, Frank V, Goldrick-Rab S. *Safety, Security, and College Attainment: An Investigation of Undergraduates' Basic Needs and Institutional Response.* Madison: Wisconsin Hope Lab; 2014.
35. Bruening M, Brennhofner S, Van Woerden I, Todd M, Laska M. 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.

36. Buch K, Langley S, Johnson T, Coleman N. A University-Community Partnership to Combat Food Insecurity among College Students. *Partnerships: J Serv-Learn Civic Engagement*. 2016;7(1):16–26.
37. Davidson A. Assessing hunger issues among University of New Hampshire Students. University of New Hampshire Undergraduate Research Conference, Durham, New Hampshire, USA; 2016.
38. Davidson A, Morrell J. Food insecurity among undergraduate students. *FASEB J*. 2015;29:LB404.
39. Dubick J, Mathews B, Cady CL. *Hunger on Campus: The Challenge of Food Insecurity for College Students*. College and University Food Bank Alliance, National Student Campaign Against Hunger and Homelessness, Student Government Resource Center, Student Public Interest Research Groups; 2016.
40. Freudenberg N, Manzo L, Jones H, Kwan A, Tsui E, Gagnon M. *Food Insecurity at CUNY: Results from a Survey of CUNY Undergraduate Students*. The City University of New York, New York, NY, USA; 2011.
41. Gaines A, Robb CA, Knol LL, Sickler S. 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.2014.38.issue-4.
42. Gorman A. *Food Insecurity Prevalence among College Students at Kent State University*. Kent, OH: College of Education, Health, and Human Services, Kent State University; 2014.
43. Green and Caplan in Johnson D. *In College and Food Insecure: An Invisible Population*. Corvallis, OR: Anthropology, Oregon State University; 2011.
44. Hanna LA. Evaluation of food insecurity among college students. *Am Int J Contemp Res*. 2014;4:46–49.
45. Koller K. *Extent of BGSU Student Food Insecurity and Community Resource Use*. Bowling Green, OH: Food Science and Nutrition, Bowling Green State University; 2014.
46. MacDonald A. *Food Insecurity and Educational Attainment at the University of Arkansas*. Fayetteville, AR: School of Social Work, University of Arkansas, Fayetteville; 2016.
47. Maroto ME, Snelling A, Linck H. Food insecurity among community college students: Prevalence and Association with grade point average. *Community Coll J Res Pract*. 2014;39(6):515–526. doi:10.1080/10668926.2013.850758.
48. Monahan LC, Gilboy MB. Prevalence and Factors Associated with Food Insecurity of College Students at a MidAtlantic Suburban University. Scarborough Fare: Global Foodways and Local Foods in a Transnational City Association for the Study of Food and Society, Toronto, Canada; 2016.
49. Riggsbee K, Colby S. Prevalence of food insecurity among college students and potential effects on fruit and vegetable consumption, stress, and weight. Tennessee Academy of Nutrition and Dietetics Annual Meeting, Chattanooga, TN, USA; 2016.
50. Wintz R, Christ N. *Food Insecurity within the University Student Population A Survey at the University of Alaska Anchorage*. Anchorage, AK: University of Alaska at Anchorage; 2013.
51. Wood J, Harris F, III, Delgado N. *Struggling to Survive- Striving to Succeed: Food and Housing Insecurities in the Community College*. San Diego, CA: Community College Equity Assessment Lab; 2016.
52. Silva MR, Kleinert WL, Sheppard AV, et al. The relationship between food security, housing stability, and school performance among college students in an Urban University. *Journal of College Student Retention: Research, Theory & Practice*. 2015;19(3): 284–299. doi:10.1177/1521025115621918.



53. Bruening M, Argo K, Payne-Sturges D, Laska MN. The struggle is real: a systematic review of food insecurity on postsecondary education campuses. *Journal of the Academy of Nutrition and Dietetics*. 2017;117(11):1767–1791.
54. Opsomer JD, Jensen HH, Pan S. An evaluation of the U.S. Department of agriculture food security measure with generalized linear mixed models. *J Nutr*. 2003;133(2):421–427. doi:10.1093/jn/133.2.421.
55. Cruthfield R. *Serving Displace and Food Insecure Students in the CSU*. Long Beach: California State University; 2015.
56. Goldrick-Rab S, Kendall N. *F2CO. Redefining College Affordability: Securing America's Future with a Free Two-Year College Option*. Indianapolis, IN, USA: The EduOptimists; 2014.
57. Blagg K, Gundersen C, Schanzenbach DW, Ziliak JP. *Assessing Food Insecurity on Campus*; 2017.
58. Goldrick-Rab S, Broton K On Estimating Food Insecurity Among Undergraduates. <https://medium.com/@saragoldrickrab/on-estimating-food-insecurity-among-undergraduates-a7db0cf79632>. Published 2017. Accessed October 1, 2017.
59. Winkleby MA, Jatulis DE, Frank E, Fortmann SP. Socioeconomic status and health: how education, income, and occupation contribute to risk factors for cardiovascular disease. *Am J Public Health*. 1992;82(6):816–820. doi:10.2105/AJPH.82.6.816.
60. Adler NE, Newman K. Socioeconomic disparities in health: Pathways and policies. *Health Aff*. 2002;21(2):60–76. doi:10.1377/hlthaff.21.2.60.
61. Centers for Disease Control and Prevention. Health disparities experienced by Hispanics–United States. *MMWR*. 2004;53(40):935–937.
62. Centers for Disease Control and Prevention. Health disparities experienced by black or African Americans–United States. *MMWR*. 2005;54(1):1–3.
63. Maslow AH. A theory of human motivation. *Psychol Rev*. 1943;50(4):370. doi:10.1037/h0054346.
64. Wagmiller RL, Adelman RM. *Childhood and Intergenerational Poverty: The Long-Term Consequences of Growing up Poor*. New York, NY, USA: National Center for Children in Poverty; 2009.
65. Cook JT, Frank DA. Food security, poverty, and human development in the United States. *Ann N Y Acad Sci*. 2008;1136:193–209. doi:10.1196/annals.1425.001.