




Advancing college food security: priority research gaps

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Abstract

Despite over a decade of both quantitative and qualitative studies, food insecurity among US college/university students remains a pervasive problem within higher education. The purpose of this perspective piece was to highlight research gaps in the area of college food insecurity and provide rationale for the research community to focus on these gaps going forward. A group of food insecurity researchers from a variety of higher education institutions across the United States identified five thematic areas of research gaps: screening and estimates of food insecurity; longitudinal changes in food insecurity; impact of food insecurity on broader health and academic outcomes; evaluation of impact, sustainability and cost effectiveness of existing programmes and initiatives; and state and federal policies and programmes. Within these thematic areas, nineteen specific research gaps were identified that have limited or no peer-reviewed, published research. These research gaps result in a limited understanding of the magnitude, severity and persistence of college food insecurity, the negative short- and long-term impacts of food insecurity on health, academic performance and overall college experience, and effective solutions and policies to prevent or meaningfully address food insecurity among college students. Research in these identified priority areas may help accelerate action and interdisciplinary collaboration to alleviate food insecurity among college students and play a critical role in informing the development or refinement of programmes and services that better support college student food security needs.

Key words: food insecurity: college students: campus programmes: higher education: nutrition policy

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Introduction

In 2009, Chaparro and colleagues⁽¹⁾ published the first manuscript of its kind showing that college and university students were an emerging at-risk population for food insecurity, the state of limited or uncertain availability of nutritionally adequate and safe foods, or limited or uncertain ability to acquire acceptable foods in socially acceptable ways⁽²⁾. Since this initial report, many researchers across the United States have chosen to focus on a similar question – ‘what is the prevalence of food insecurity among college students?’^(3–5). A search of the literature reveals numerous studies with some iteration of ‘food insecurity prevalence among college/university students attending a [insert university size] [insert geographical location] college/university’. Many studies rely on convenience samples, have small sample sizes or poor survey response rates, and often have a singular

institution focus⁽⁶⁾. Despite these known limitations, such prevalence research is undeniably important as it provides local stakeholders with an estimate/benchmark of food insecurity.

More recently, research has shifted to novel inquiries focusing on examining a wide range of solutions for addressing food insecurity⁽⁷⁾. There have also been increased calls for identification of successful initiatives, programmes and policies that universities and university administrators could implement to help alleviate hunger among students^(6,7). However, despite over a decade of both quantitative and qualitative studies being conducted and published on the topic, college students remain an at-risk population for food insecurity, and additional research is still needed. The purpose of this perspective piece was to highlight research gaps in the area of college food insecurity and provide rationale for why these research gaps should be a focus for the research community going forward.

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Table 1. Advancing college food security thematic areas and research gaps

Thematic area	Priority research gap
Screening and estimates of food insecurity	<ol style="list-style-type: none"> 1. Do the USDA (Food Security Survey Module) FSSM's traditional indicators of food insecurity accurately contextualise the experiences of college students and are the USDA FSSM screening questions appropriate for and well understood by college students? 2. Why does the prevalence of food insecurity differ across classification (freshmen, sophomore, junior, senior), between undergraduate versus graduate students (masters and PhD level) and between differing types of campuses (e.g. rural/urban, public versus private, 4-year versus 2-year institution (community college))? 3. How does the campus and local community food environment (e.g. transportation, cost of living in the local area, grocery store availability, local food pantries and emergency food providers) impact food security?
Longitudinal changes in food insecurity	<ol style="list-style-type: none"> 4. How does a student's food security change from semester to semester and year to year? 5. What are the best reference periods (30 days, semester/quarter/trimester, 12 months) and when during the academic year is the best time to measure food insecurity among college students? 6. What are the consequences of food insecurity before a student attends college, during summer and holiday breaks, and after a student graduates (or leaves the university)? 7. How do academic breaks impact college students' access to food? 8. How do campuses currently respond to students' needs for food security during/after natural disasters, and what efforts can be done to improve campus response?
Impact of food insecurity on broader outcomes	<ol style="list-style-type: none"> 9. What is the prevalence of students who experience basic needs insecurities (e.g. housing insecurity) in addition to food insecurity? 10. How does food insecurity impact retention and graduation rates? 11. What is the impact of food insecurity on physical and mental health?
Evaluation of impact, sustainability and cost effectiveness of existing programmes and initiatives	<ol style="list-style-type: none"> 12. What factors influence the availability, implementation or use of food insecurity programmes and initiatives on different types of campuses (e.g. private versus public; minority serving versus general; rural versus urban)? 13. Are student-led and administration-led programmes and initiatives equally effective? 14. How do food insecurity programmes or initiatives improve dietary intake, physical health and mental health outcomes of food-insecure students? 15. What is the cost-effectiveness of different types of food insecurity programmes and initiatives? 16. How do food insecurity programmes and initiatives on the same campus either coordinate or duplicate efforts? 17. How are food insecurity programmes and initiatives evaluated for programme sustainability?
State and federal policies and programmes	<ol style="list-style-type: none"> 18. What are the intra-student barriers to access and utilisation of federal nutrition assistance, and how do they differ on the basis of student sociodemographic characteristics? 19. What is the impact of state policies programming to support food-insecure college students?

Current status of knowledge and research gaps

A group of food insecurity researchers from a variety of types of higher education institutions across the United States identified five thematic areas of these gaps in the current literature: screening and estimates of food insecurity; longitudinal changes in food insecurity; impact of food insecurity on broader health and academic outcomes; evaluation of impact, sustainability and cost effectiveness of existing programmes and initiatives; and state and federal policies and programmes (Table 1). Within these thematic areas, nineteen specific research gaps were identified with limited or no peer-reviewed, published research. For each gap, the authors outline why and how research on this topic area would contribute to our understanding of and solutions to food insecurity among college students. When available, limited research is presented but is ultimately insufficient in scope to fully address the existing problems prompting focused research in these areas.

Theme 1: screening and estimates of food insecurity

GAP 1: Do the USDA Food Security Survey Module (FSSM's) traditional indicators of food insecurity accurately contextualise the experiences of college students, and are the USDA FSSM screening questions appropriate for and well understood by college students?

Researchers have used a variety of measurement tools to understand college student food security, including creating their own measures⁽⁸⁾. The most commonly used food security measurement tool, the United States Department of Agriculture's (USDA) Adult Food Security Survey Module (FSSM)⁽⁹⁾, has not been validated for use in college student populations⁽¹⁰⁾. Some have explored its appropriateness for measuring food insecurity among college students and found that students may interpret the survey questions differently than expected⁽¹¹⁾. In addition, there are multiple versions of the FSSM (two, six, ten and eighteen questions) which are used inconsistently in student populations and provide diverging estimates^(4,8). Finally, while students designated as marginally food secure on the FSSM are typically considered food secure⁽¹²⁾, research has found that these students are more similar to food-insecure students in terms of demographic characteristics⁽¹³⁾ and academic performance⁽¹⁴⁾. Taken together, these studies indicate that, should the FSSM continue to be used, researchers should explore validating the measure and determining the most appropriate version for this population, as well as distinguishing marginally food secure students from those experiencing high food security. The use of consistent measures that permit comparisons across institutions and over time are critical for fully understanding the problem as well as designing effective programmatic and policy solutions.

GAP 2: Why does the prevalence of food insecurity differ across classification (freshmen, sophomore, junior, senior),



between undergraduate versus graduate students (masters and PhD level) and between differing types of campuses (e.g. rural/urban, public versus private, 4-year versus 2-year institution (community college))?

Food insecurity has been identified among varying populations and institution types^(3–5). However, limited research describes how the prevalence of food insecurity differs across classification of students (e.g. freshmen versus seniors) or between undergraduate/graduate students. Some reports suggest that experiences of food insecurity increase beyond the first academic year^(15–17) but may decrease once in graduate or professional programmes^(18,19). Yet, these findings are contradicted by other studies⁽²⁰⁾. Thus, there is a need for research to understand if these differences in academic classification and degree type exist and, if so, why? In addition, researchers have reported experiences of food insecurity at public and private institutions, in rural and urban settings, and among students seeking degrees in various disciplines. Comparison between these groups is limited, so it is unclear why a difference in prevalence among these academic programmes and institutions might exist. There is a need for clearer indication if variation occurs in food insecurity rates between higher education institutions and among differing student populations. Identification of heightened risk at certain institution types or among specific student populations and investigation into this increased risk will help to develop targeted interventions and provide additional support for students and institutions in higher-risk settings. Campus- and population-specific interventions may be likely to succeed in providing a nutritionally secure environment.

GAP 3: How does the campus and local community food environment (e.g. transportation, cost of living in the local area, grocery store availability, local food pantries and emergency food providers) impact food security?

Similar to food insecurity in the community setting⁽²¹⁾, college students may face a higher burden of food insecurity if they do not have means of transportation since this prevents them from accessing more affordable food options off campus^(22,23). If a university campus does not have grocery stores in close proximity, this limits students' access to healthier options⁽²⁴⁾. Many students use financial aid to pay for their college experience⁽²⁵⁾, but if they do not participate in a meal plan, this can put them at higher risk of food insecurity⁽²⁶⁾, particularly if they do not have a car or reliable public transportation. Some students are able to take advantage of community-based transportation programmes, if they exist; however, uptake may be low due to the time required to take a bus from campus to the supermarket^(22,23,27). Other students may rely on rides from other students, car-pooling or delivery services^(28–30).

Ride share programmes have become increasingly popular in recent years as a means of transportation, particularly among college students (e.g. Lyft's Ride Smart Program⁽³¹⁾). These programmes vary from campus to campus, and they often allow students to share rides with others going in the same direction, which can reduce traffic congestion and lower transportation costs. While these programmes can be an effective way for students to save money on transportation costs, they may not necessarily expand food access⁽³²⁾. Additionally, ride share

programmes may not always be reliable, which could impact a student's ability to access food when needed.

Many students have access to campus and community programming for food security (local food pantries and emergency food providers); however, uptake of these programmes may be low on some campuses due to lack of awareness of programme existence^(33,34), and student concerns that others in the community may need the resources more than they do. Similar to the first research gap, this is another reason researchers should strive to conduct representative surveys with high response rates to identify target populations most in need of resources. Although the impact of cost of living on food security status has been studied among the general public, studies among college students have not specifically focused on this risk factor⁽³⁵⁾. Further research is needed to understand how aspects of the local community food environment and barriers to transportation or access to community services can impact food security among college students.

Theme 2: longitudinal changes in food insecurity among college students

GAP 4: How does a student's food security change from semester to semester and year to year?

Quantitative data about college student food insecurity are most commonly collected in cross-sectional surveys^(3,36). When these are repeated over time (panel surveys), they can describe population-level changes in food insecurity rates but cannot identify intra-individual changes, either by semester, by year or across students' college enrolment. Fluctuations in food insecurity prevalence at a college or university from one year to the next may be due to intra-individual changes, shifts in the makeup of the student body, or sampling bias, but it is not possible to identify the cause(s) of observed changes in prevalence using study designs that use consecutive cross-sectional surveys among different samples of students.

Observational longitudinal quantitative studies are needed to understand the transient nature of food insecurity. One qualitative study of a convenience sample of students found that changes in students' circumstances, specifically employment, financial resources, networks of support, and expenses, were linked to changes in food security over a 9-month period of time⁽³⁷⁾. Researchers have used a large United States-based national panel survey to study fluctuations in food insecurity from college to post-graduation^(38,39), but only one to date examines intra-student changes in food insecurity during college enrolment⁽⁴⁰⁾.

GAP 5: What are the best reference periods (30 days, semester/quarter/trimester, 12 months) and when during the academic year is the best time to measure food insecurity among college students?

The USDA FSSM is validated to measure food security in the past 12 months and 30 days; however, there is no recommendation or guideline on which reference period best reflects campus food insecurity⁽⁹⁾. College students are a unique population regarding living situation and time of year – for example, a student may live on campus during the academic

year and then live off-campus at home or in another location during the summer. Students also may spend academic breaks in different locations than when school is in session. Additionally, a student may have access to federal food assistance programmes for a limited amount of time. Therefore, student responses to the FSSM could differ on the basis of the reference time used in survey questions and when the data are collected. Researchers should compare the food security status of college students using various timeframes to better understand which reference period is most appropriate as well as when during the academic year is the best time to measure food security status.

In a review, 64% of studies reporting a reference period asked college students about their experiences in the last 12 months⁽⁵⁾. Studies with reference periods shorter than 12 months had higher rates of food insecurity than those longer than 12 months⁽⁵⁾. Some studies use the last 30 days as a reference period, but the specific timing of the 30 days and data collection within the academic year or semester is rarely provided. This is necessary information because students who rely on campus dining meal plans may have fewer meals to utilise as the semester progresses. Furthermore, if an academic break occurred within the 30 days prior to research participation, the food security status reflected could differ during that time from the student's experience while school is in session. Researchers should consistently report the data collection periods in reference to time during the academic year to better understand the time-sensitive contexts that may differ between college campuses. Institutions would also benefit from a better understanding of how food access may or may not fluctuate throughout the academic year.

GAP 6: What are the consequences of food insecurity before a student attends college and after a student graduates or leaves the university?

Adverse experiences during childhood and adolescence, such as food insecurity, can have a wide range of short- and long-term impacts. However, younger children are more likely to be protected from the consequences of food insecurity by adults or adolescents⁽⁴¹⁾. Furthermore, the US National School Lunch Program and School Breakfast Program provide federally subsidised meals to low-income children, decreasing food insecurity risk^(42,43). As children age into adolescence, food insecurity risk may increase⁽⁴⁴⁾. Adolescents have similar risk factors for food insecurity as college students, often due to resource scarcity. Adolescents experiencing food insecurity are more likely to have poor academic performance and not graduate from high school⁽⁴⁵⁾, similar to evidence in college students^(15,46). Adolescents experiencing food insecurity have less access to preventive health and dental care than food secure peers⁽⁴⁷⁾, which may be related to the association between college students self-reporting poor or fair health and food insecurity^(15,46,48). Similar to college students, there is also a strong relationship between experiencing food insecurity and increases in mental health diagnoses and psychosocial factors among adolescents in households with food insecurity⁽⁴⁸⁻⁵¹⁾.

Although there is similar evidence linking food insecurity to poor health and academic outcomes prior to and during college, few studies have examined how food insecurity experiences before college can impact food insecurity risk and coping

mechanisms in the college-aged population. One study found a significant increase in the prevalence of food insecurity between the summer prior to enrolment and during the first year of college⁽⁵²⁾. Students who were once shielded from food insecurity by household member sacrifices or assistance programmes may not have these once they begin college. There is also minimal information regarding experiencing food insecurity during college and health and behavioural outcomes post-graduation. One longitudinal study found that college students experiencing food insecurity were more likely to be food insecure in adulthood after graduation, especially for students that were economically independent of their parents during college⁽³⁹⁾. Longitudinal cohort study designs are needed to provide a clearer picture on the long-term impact of food insecurity before, during and after college.

GAP 7: How do academic breaks impact college students' access to food?

There is no specific research on how academic breaks (i.e. holiday breaks, spring break) impact college student access to food. Many studies investigate why students seek resources, such as a campus food pantry or supplemental assistance, but do not include the timing of using these resources. Institutions may currently provide food or financial resources over academic breaks, but there is no focus on this in the literature. In school-age students, food insecurity has been found to increase in severity over weekends, summer and holiday breaks, when meals are not served through schools⁽⁵³⁻⁵⁵⁾. On college campuses, supplemental food and meals can alleviate this burden, but offerings may be limited. College student experiences and living situations during academic and summer breaks vary greatly and are worth exploring. These data could be highlighted using both quantitative and qualitative approaches to better understand how academic breaks impact student food access and if there is variation between university programme and policies, as well as campus geographic location, type of institution, living situation or financial status.

GAP 8: How do campuses currently respond to students' needs for food security during/after natural disasters, and what efforts can be done to improve campus response?

The risk of food insecurity is known to increase following natural disasters (e.g. hurricanes, tornadoes, wildfires, winter storms) due to the destruction of infrastructure and interruptions in the food supply chain⁽⁵⁶⁾. A limited number of research studies focus on the impact natural disasters have on college students' food access, and there is even more limited research on how campuses respond to students' food security needs during or immediately after a natural disaster. Research studies focusing on the impact of a natural disaster on food access are imperative because college students, especially those financially independent from family, likely do not have the resources to recover quickly.

Assessing the direct impact of natural disasters on college students is challenging because of their unpredictable nature as well as the limited capacity of a university to collect data on food security at the time of a disaster. Even if a university does have capacity for data collection during a natural disaster, most institutions do not have reliable data regarding food insecurity prior to the disaster event for comparison. One study in Kansas

assessed food security status in students using a reference period of the past 12 months⁽⁵⁷⁾. During that time, a tornado had touched down in the campus area. The authors found that those experiencing exogenous shock had increased risk for food insecurity, but no specific information about the source of shock in relation to the tornado was provided⁽⁵⁷⁾.

Future research in this area can examine how universities can better respond to students' food security needs during and after a natural disaster. This includes quantifying the extent to which institutions have comprehensive emergency preparedness plans in place. Plans should include provisions for stocking and distributing food, water and other essential supplies that are needed to ensure the basic needs of students. Institutions can establish protocols as part of their emergency preparedness plan to increase the programmatic capacity and number of students supported by ongoing campus programmes and initiatives. Universities can also partner with local community organisations during the aftermath of a disaster to provide essential services and resources.

One avenue to begin this research is to examine how universities responded to the coronavirus disease 2019 (COVID-19) pandemic. Although not a natural disaster, during the COVID-19 pandemic, universities were faced with the challenge of ensuring the food security of a growing number of their students that faced financial difficulties, loss of wages, and navigated campus facility closures^(58–60). While many institutions were caught off guard by the sudden unprecedented need, some universities implemented various measures to support their students. These measures included creation of emergency funds to provide financial support to students for groceries and other essential needs, establishment of partnerships with local food banks to distribute food directly to students, or providing meal delivery or pick-up services to students who were unable to access on-campus dining facilities. Research into the best practices of university responses during the pandemic may provide insights into efforts that universities can take to improve campus response for future disaster events or unexpected events resulting in heightened food insecurity.

Theme 3: impact of food insecurity on broader outcomes

GAP 9: What is the prevalence of students who experience basic needs insecurities (e.g. housing insecurity) in addition to food insecurity?

Food insecurity is just one basic need insecurity college students may experience. There has been a recent focus on understanding and addressing additional basic needs such as housing and mental health insecurities since the prevalence of these issues can vary from campus to campus^(29,61,62). It is important to recognise the high cost of living in metropolitan, urban areas where housing insecurity may be a more prevalent issue⁽⁶³⁾. The 2021 #RealCollege survey, an annual assessment of US students' basic needs conducted by the Temple University's Hope Center for College, Community, and Justice⁽⁶⁴⁾, reported that, of the 195 000 students surveyed across universities in different states, 48% were affected by housing insecurity while 14% suffered from homelessness⁽⁶⁵⁾. Additional studies provided

estimates of undergraduate housing insecurity between 45% and 52%^(66,67). However, as these studies did not use representative sampling, it is unknown if the prevalence of housing security is over- or underestimated. A qualitative study using a trauma-informed lens indicated community college students faced housing insecurity and homelessness and called for integrated services to support housing security⁽⁶⁸⁾. However, more research is needed to investigate differences in assessing housing insecurity and its impacts on students at community colleges in comparison with 4-year colleges and universities. Furthermore, previous research has documented changing mental health needs of the students and challenges they impose on universities⁽⁶⁹⁾. However, limited research exists that looks at the effect of the combination of these additional challenges of housing insecurity, mental health needs and food insecurity on student success.

These factors call for development, implementation and evaluation of comprehensive, multifaceted measurement tools, interventions and policies that holistically account for academic and personal wellbeing of the student. Additionally, there is a need to assess effectiveness of current campaigns and marketing tools to raise awareness of existing programmes around food and housing security, and mental health, and encouraging utilisation of available resources.

GAP 10: How does food insecurity impact retention and graduation rates?

Students who are hungry or worried about getting enough food to eat may struggle to excel in academic coursework. Researchers have highlighted that food-insecure college students display lower grade point averages (GPA) and are more likely to report low academic performance, including lack of comprehension of course material or inability to focus during class^(15,70,71). This may lead food-insecure students to be more likely to fail or withdraw from college courses⁽⁷²⁾. Even more detrimental, it is suggested that food-insecure college students are at higher odds of disenrolling from higher education altogether⁽⁷³⁾. The mechanism responsible for the impacts of food insecurity on academic performance is debated and may include the role of diet on cognition, stress of efforts to secure food, and/or lack of social and economic support among high-risk students^(22,74). It is likely that the factors that influence lower academic success among food-insecure students are multifaceted, and more research on these mechanisms is needed. Understanding the pathways in which food insecurity disrupts college student academic performance can allow higher education administrators and stakeholders to provide campus resources specific to identified mechanisms (e.g. counselling sessions) to increase retention and graduation rates.

The impact of food insecurity on academic performance may persist throughout enrolment, as a recent study found that the GPAs of students who were food insecure at any point in their enrolment were lower than those who were food secure⁽⁴⁰⁾. A separate longitudinal study by Wolfson *et al.* utilised a cohort of students who attended college from 1999 to 2003 and found that food insecurity during college was a barrier to graduation and higher-degree attainment⁽³⁸⁾. A limitation of this cohort study is historical bias, as it likely represents a much different population than today's college student, especially considering rising inflation following the COVID-19 pandemic⁽³⁸⁾. Together



these two longitudinal studies suggest that food insecurity has a negative impact on academic performance among college students; however, there is a need to further investigate the impact in a US nationally representative sample of college students using a more current cohort.

GAP 11: What is the impact of food insecurity on physical and mental health?

Food insecurity is associated with poor nutrition and health outcomes among the general, non-collegiate population⁽⁷⁵⁻⁷⁷⁾. Within college students, poor dietary outcomes have been associated with food insecurity, although limitations in this data include the heterogeneity of student sampling and data collection methods⁽⁷⁸⁾. Beyond diet-related outcomes, research on how food insecurity impacts the short-term, and especially long-term, health outcomes of college students is relatively limited^(4,79). Existing studies on the impact of food insecurity on physical and mental health have limitations, including self-reported rather than objective measures of health-related data, singular institutional focus, cross-sectional study designs and small sample sizes or convenience sampling⁽²⁰⁾. One of the largest and most comprehensive studies to date was conducted by Laska and colleagues which included analyses of pooled annual data from a state-based surveillance of twenty-seven higher education institutions ($n = 13\ 720$ students)⁽²⁰⁾. Findings highlighted that food insecurity was significantly associated with nearly every adverse health factor examined.

Further investigation into the extent to which college food insecurity impacts physical and mental health, beyond dietary outcomes is important for understanding the extent to which food insecurity during the college years impacts an individual's long-term overall health and wellbeing. Longitudinal data collected from a US nationally representative sample of students in various higher education settings would be most valuable to address this research gap⁽⁸⁰⁾.

Theme 4: evaluation of impact, sustainability and cost effectiveness of existing programmes and initiatives

GAP 12: What factors influence the availability, implementation and use of food insecurity programmes and initiatives on different types of campuses (e.g. private versus public; minority serving versus general; rural versus urban)?

When creating programmes to address food insecurity, it is vital to understand the campus context and surrounding environment⁽⁸¹⁾. While many studies have demonstrated the need for collaborative efforts and centralised food security programming, the gap remains in understanding the unique contexts of type of institutions. Further studies and efforts need to be conducted to understand the facilitators and barriers to food security programming on different campus settings such as urban, rural, residential and commuter universities contexts. Additionally, geographical contexts such as high cost of living and food desert classification should be accounted for when examining the factors that influence the availability, implementation and use of food insecurity programmes and initiatives on different types of campuses. For example, local economic, political and tax-related issues can affect the costs and

availability of foods differently by region (e.g. South, Midwest), state and/or metropolitan area. Research has consistently found that the university food environment can influence students' behaviours, preferences and opinions about food availability⁽⁸²⁻⁸⁴⁾. Therefore, it is crucial to account for these contextual factors when designing and implementing effective food insecurity programmes and initiatives that cater to the diverse needs of students in various regions. Furthermore, a university's private or public standing may influence the types of resources they can offer to their students. An online cross-sectional survey of faculty, staff, administrators and student leaders at higher educational institutions in 28 US states by Hagedorn-Hatfield and colleagues reported that barriers and facilitators to implementing and sustaining campus food insecurity initiatives differed between public and private institutions⁽⁸⁵⁾.

Colleges with higher proportions of students from marginalised communities may need more resources allocated⁽⁶⁾. A racial equity lens should be applied to hunger-relief efforts to increase the understanding of the detrimental effects of structural racism and design targeted approaches that focus on the needs of marginalised groups⁽⁸⁶⁾. In this regard, researchers should systematically evaluate and report on the equity impact of programmes and initiatives⁽⁸⁷⁾. However, the authors are not aware of any research assessing the factors impacting implementation and usage of food programmes in these unique contexts.

Even when programmes or initiatives addressing food insecurity are present on campus, stigma is a commonly reported barrier that can prevent students from utilising these resources^(34,85,88). Stigma surrounding the use of programmes is not unique to higher education institutions⁽⁸⁹⁾. Institutions can work towards reducing stigma by providing educational opportunities that expose students to the realities and complexities of food insecurity and address negative perceptions and stigmas around basic need insecurities⁽⁸⁵⁾. University and community culture can reduce the stigma by rejecting cultural narratives that individual weakness or faults are the cause of food insecurity⁽⁹⁰⁾. How stigma manifests among students may be different across institutions and even within groups student populations on a singular campus. Researchers should consider how unique student emotional experiences interface with the structural inequalities when examining the availability, implementation and use of campus-based programmes and initiatives.

GAP 13: Are student-led and administration-led programmes and initiatives equally effective?

While some college food insecurity efforts follow a hierarchical approach where administration controls the power, direction and voice of food insecurity programmes impacting college students, some address college food insecurity with peer-based or student-led efforts to emphasise student voices and empower students as change makers. There are also programmes that are led by faculty, staff and students while being supported by administration. For example, a case study at an urban, Hispanic-serving institution emphasised the importance of leadership buy-in, financial support and collaborative efforts between administration, faculty, staff, students and community partners in creating, maintaining and assessing a

campus garden and food pantry that are led by faculty, staff and students⁽⁹¹⁾. Ultimately, the leadership and funding of these programmes vary and research highlights the need for a collaborative approach on campus with student engagement and administrative support⁽⁹²⁾.

Despite the existence of numerous college food insecurity initiatives led by many different entities across the United States, there is a gap in the research literature regarding effectiveness, sustainability and/or student utilisation of student-powered college food insecurity programmes compared with those directed by strictly administrative levels. Regardless of whether programming and initiatives are student or administration led, there is a need to conduct consistent, systematic research on the effectiveness of various leadership structures for interventions to minimise food insecurity among college students⁽⁹³⁾. Additionally, to the best of the authors' knowledge, some programmes do not utilise systematic process evaluation methods, consistent record-keeping or data-driven assessments, which often makes it challenging to assess the impact and effectiveness. This may be due to the lack of infrastructure, financial and researchers' support in evaluating various programmes led by different leadership structures.

More process-based research is needed to understand how to effectively train the programme leadership on effective management and recordkeeping. Efforts should also be made to use established methods across campuses, where applicable, to allow for inter-university/college comparison. Researchers should ensure that evaluation methodologies and tools are validated and reliable. More research is needed to understand how to effectively train the programme leadership team on systematic process evaluation approaches that provide adequate data, but not too comprehensive or time-consuming to negatively affect student utilisation of such programmes.

GAP 14: How do food insecurity programmes or initiatives improve dietary intake, physical health and mental health outcomes of food-insecure students?

Colleges and universities across the country are implementing a wide range of food insecurity programmes and initiatives, yet limited research has been conducted to determine the short- and long-term impacts that participation in these programmes have on dietary intake, physical health and mental health. Campus food pantries are rising in prevalence and popularity and can provide critical emergency food assistance⁽⁹⁴⁾. To date, two studies have investigated health outcomes of campus food pantry patrons, one of which was focused on fruit and vegetable intake⁽⁹⁵⁾ and another on measures of sleep, physical health and mental health⁽⁹⁶⁾. Research that highlights the use of other food insecurity programmes or initiatives (e.g. gleaning programmes, sharing meal swipes, food scholarships) on outcomes of dietary intake, physical health or mental health outcomes are warranted. Identifying the impact campus food security programmes have on the overall health of students is essential as faculty, staff, students and administrators advocate for additional funding and resources. Additional studies, especially those longitudinal in nature, are needed to determine the relationship between participation and health outcomes.

GAP 15: What is the cost-effectiveness of different types of food insecurity programmes and initiatives?

There exists a multitude of food insecurity programmes and initiatives for the general population at the US federal/national, regional and local levels, yet an opportunity to systematically evaluate and monitor such programmes remains. The United States' largest food insecurity programme, the Supplemental Nutrition Assistance Program (SNAP), supported by federal, state and local government to provide approximately \$70 billion US dollars per year for supplemental food purchases of 42 million low-income participants, was found to be cost-effective longitudinally due to its significant health improvements and healthcare cost savings at the US federal level⁽⁹⁷⁾. However, about 2.3 million college students were enrolled in SNAP, based on data from the 2016 US National Postsecondary Student Aid Study, resulting in a participation rate of 31% compared with 85% for the general US population⁽⁹⁸⁾. Due to limited research on SNAP utilisation among college students, research findings about SNAP cost effectiveness among general population have limited generalisability when applied to college students. Moreover, many food insecurity initiatives specifically for college students have been implemented at the university levels, but there is limited evaluation research conducted on those college food insecurity efforts. Funding of these campus-based programmes varies but often includes internal mechanisms and community sources⁽⁵⁵⁾. Allocated budgets for food insecurity programmes are limited, and many campuses must rely on more than one funding mechanism to sustain campus programming⁽⁵⁵⁾. Metrics to evaluate cost-effectiveness of campus-based programming is lacking in the literature. Therefore, a research gap remains regarding the cost effectiveness of SNAP and other university-level food insecurity programmes for the college student population.

GAP 16: How do food insecurity programmes and initiatives on the same campus either coordinate or duplicate efforts?

Currently, food insecurity programmes and initiatives on the same campuses may duplicate efforts to address student food insecurity, likely because of lack of awareness or collaboration. One campus may sponsor multiple food pantries as an effort to increase food access. While multiple food pantries that can accommodate specific student populations are useful, resources could be more appropriately distributed to implement a diverse range of initiatives that address the varying facets of food insecurity. As leadership across various food insecurity programmes may differ, uncertainty may be present regarding efforts across campus⁽⁹²⁾. Therefore, using a coordinated, systems science, interdisciplinary approach to support multiple campus food security programmes has potential to decrease student food insecurity⁽⁹⁹⁾. For example, in coordination with a campus food pantry, a nutrition education programme, meal-swipe programme and campus/state/federal policies that distribute financial food assistance can symbiotically work together to decrease student food insecurity.

GAP 17: How are food insecurity programmes and initiatives evaluated for programme sustainability?

A wide range of programmes to address student food insecurity exist at institutions around the United States. Regularly evaluating and making appropriate modifications can increase the effectiveness and sustainability (i.e. maintaining consistent programming over time) of these programmes. Evaluating the



process and outcomes of a programme and modifying aspects of the programme that are or are not effective are two aspects that could lead to programme sustainability⁽¹⁰⁰⁾. As such, programmes that are no longer feasible, effective or preferred by students should be de-implemented so that new, innovative programmes can be implemented. For example, campus food pantries are a common method for combating food insecurity⁽⁹⁴⁾; however, to students, they might not be the most acceptable or preferred method^(88,101). Students asked to identify solutions to address food insecurity rarely proposed campus food pantries as an effective solution. Instead, students proposed on-campus food assistance programmes (e.g. discounted meals at dining halls) and education programmes (e.g. basic life skills classes) as preferred solutions⁽¹⁰¹⁾. While there is currently limited literature on evaluating campus food security programmes, there is no literature about evaluating and modifying existing programmes for sustainability. Programmes should be systematically evaluated and adapted to address shifts in food insecurity trends so that effective programmes can be sustained and that resources are appropriately utilised.

Theme 5: state and federal policies and programmes

GAP 18: What are the intra-student barriers to access and utilisation of federal nutrition assistance (i.e. SNAP) and has temporary relaxation of eligibility requirements impacted enrolment and participation in SNAP?

Beyond campus resources, students may be eligible for food assistance programmes such as SNAP, the largest component of the social safety net against food insecurity in the United States⁽¹⁰²⁾. However, there have been long-standing SNAP restrictions for full-time college students, known as the college SNAP rule, that were created under the assumption that most students enter college directly after high school and are supported by their parents⁽¹⁰³⁾. Due to these outdated eligibility restrictions, many college students are ineligible to receive assistance. Even when students are eligible to receive SNAP benefits, nearly 60% do not participate in the programme⁽⁹⁸⁾. The most cited barriers to applying include navigating the daunting and confusing application process and confusion about eligibility⁽¹⁰⁴⁾. Additionally, some eligible students may feel shame or stigma from receiving assistance⁽¹⁰⁵⁾. Future research could examine which campus-based programmes are most effective in helping overcome intra-student barriers to access and utilisation of federal nutrition assistance programmes.

Permanent expansion of college student eligibility for SNAP has long been recommended as a necessary step to alleviate food insecurity on college campuses^(6,7,104,106). In response to the COVID-19 pandemic, the Consolidated Appropriations Act of 2021 (Pub. L. 116-260) was passed and temporarily expanded college students' eligibility for SNAP. It is estimated to have made an additional 3 million students eligible for SNAP⁽¹⁰⁷⁾. This temporary change in federal regulations offers a unique opportunity for researchers to examine how changes in federal policy impact programme enrolment in SNAP as well as how participation impacts prevalence of food insecurity.

This research could be instrumental in advocating for the permanent expansion of college student eligibility for SNAP.

GAP 19: What is the impact of state policies programming to support food-insecure college students?

The need to provide nutrition assistance and support to food-insecure students has been acknowledged by policymakers at both the federal and state levels^(106,108). In fact, some states have successfully passed and implemented legislation to support higher education institutions in creating a more nutritionally secure environment and providing increased access to nutrition assistance for food-insecure students. A review by Laska and colleagues identified six states that have legislation enacted to address college student food insecurity and hunger in some way⁽¹⁰⁸⁾. Legislation to support food-insecure students is to be applauded, but there is a need to evaluate the impact these policies are having on reducing student food insecurity and improving the experiences of food-insecure students. The ability to quantify the impact of these state-level policies will help advocates champion evidence-based legislation in states that lack current statutes. This work has the potential to result in federal-level policies to support all students pursuing higher education. Additionally, the pieces of enacted legislation vary in reach and direct support to students. For example, California provides funding to campuses that meet 'hunger-free campus' designation by meeting requirements to increase student access to support through an on-campus food pantry, meal share programme and SNAP outreach on campus⁽¹⁰⁸⁾. Differently, Connecticut enacted legislation requiring the study of student food insecurity (including programmes being offered for food-insecure students) but not the implementation of specific programming to support students⁽¹⁰⁸⁾.

Research to distinguish the impact of the type of policy implemented can help advocates promote policies that provide the most robust improvements in college student food insecurity. As described above, as there is substantial variability in campus environments, policies may need to be flexible in their requirements of specific evidence-based programming to support food-insecure college students.

Conclusion

As researchers, we seek to better understand the prevalence of food insecurity among diverse groups of college students; how food insecurity impacts a student's health, academic performance and overall college experience; and what are the most sustainable and effective programmes, interdisciplinary initiatives and policies to help students experiencing food insecurity. Food insecurity researchers can play a pivotal role by helping to answer the most critical gaps in our knowledge around college food insecurity. Figure 1 displays a cyclical pathway researchers can use to begin exploring themes and research gaps described in this commentary. Actionable steps provided in the figure are meant to be used as starting points in addressing the gaps by first identifying the current stage their university or college campus is at in addressing food insecurity among its students.

To advance college food security, a nuanced, integrated and collaborative approach leveraging researchers, campus and

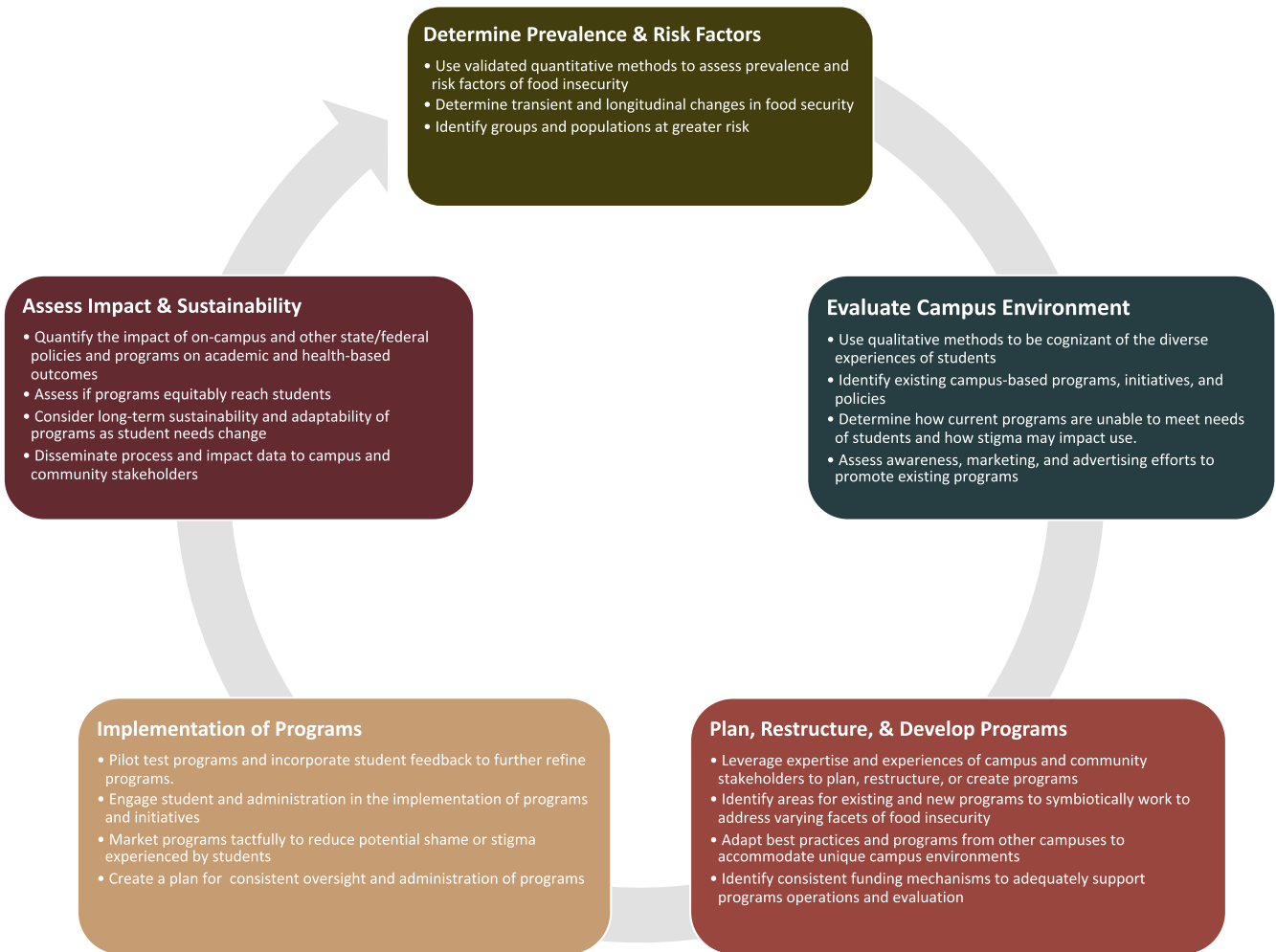


Fig. 1. Moving food security forward. Actionable steps provided in the figure are suggested starting points in addressing research gaps by first identifying the current stage a university or college campus is at in addressing food insecurity among its students.

community stakeholders will be required, and novel evidence-based, community informed research can help inform appropriate action. Successful approaches must involve students in development, implementation and evaluation. In addition to funding programming, which can be very rewarding because there is a tangible and visible evidence of investment, there also needs to be more research funding. Federal, state, institutional and private funders can also look to these priority research gaps as potential topic areas for future funding opportunities.

Research alone will not fully address food insecurity. Dissemination of research findings related to the effectiveness of college food insecurity initiatives will not only add to the limited literature, but also allow other researchers to further evaluate and contribute to the implementation of evidence-based college food insecurity programming whether it is student led, administration led or co-led by varying levels⁽⁹³⁾. It is recommended that a database of college food insecurity evidence-based programmes and initiatives be developed and maintained stakeholders so that effective programmes can be adopted by other campuses. Researchers should use existing communication networks to share best practices and cutting-edge findings among established and emerging research

professionals in this area. It is important to ensure that research findings are disseminated beyond traditional academic settings (e.g. peer-reviewed journals, scientific conference presentations) concurrently through community presentations, social media, white papers, reports and policy documents among others. It is encouraged that researchers establish collaborations across campus and community stakeholders, especially those with diverse disciplinary perspectives, to maximise impact and disseminate findings from research.

We acknowledge the tremendous amount of research and action that has been done in this space over the course of the last decade. But we also concede that much more is needed to be done to truly move the needle and lower the prevalence of food insecurity on college campuses. The authors acknowledge that this is not an exhaustive list but instead represents suggested priority areas that researchers can use as a road map when considering future research efforts. Research in these identified priority areas may help accelerate action to alleviate food insecurity among college students and play a critical role in informing the development or refinement of programmes and services that better support college student food security needs.



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