# UC San Diego
## Independent Study Projects

**Title**

Addressing food insecurity in San Diego by providing food to low-income patients with diabetes,
educating health care providers, and increasing enrollment in CalFresh

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**Publication Date**

2017

**David Malinak – ISP Narrative Summary**
**Category: Community Service**
**ISP Committee: Sunny Smith M.D. (Chair); Cheryl Rock Ph.D., R.D.; Bilge Pakiz Ed.D.**
**August 2014 – March 2017**

**Title**
Addressing food insecurity in San Diego by providing food to low-income patients with diabetes, educating health care providers, and increasing enrollment in CalFresh

**Background**
Food insecurity is defined as an "economic and social condition of limited or uncertain access to adequate food" (1). 1 in 6 Americans – about 50 million people – qualify as being food insecure and live with the worry of not always knowing where their next meal is coming from (2). This insecurity leads to individuals developing poor dietary habits and choosing cheaper, less-healthy food options. In turn, this has been associated with the development of serious health problems for vulnerable populations, especially obesity, heart disease, and diabetes (3—7). Food insecurity is further associated with anemia, anxiety, depression, oral health problems, and birth defects (8).

Food insecure households often suffer from a range of factors that influence the development of chronic disease including: gravitation toward inexpensive fast food and processed food options that are highly filling; cycles of food deprivation and overeating; reduced variety of food; lack of access to healthy foods (eg, food deserts, no transportation, unsafe neighborhoods); greater exposure to advertising of obesity-promoting foods; and competing demands (eg, a need to purchase food instead of medicine) (4,9-12).

Numerous studies have demonstrated the relationship between food insecurity and higher HbA1c or deteriorating glycemic control in patients with diabetes (6,7,13—16). Those in food insecure households have a 50% higher chance of developing diabetes; and, after diagnosis, those who are food insecure are less likely to adequately control it, leading to more hospitalizations and costly complications (5,12). Low-income diabetic populations are especially susceptible to hypoglycemic episodes requiring hospitalization in the last week of the month, given that food budgets tend to run out at this time (17).

Additionally, the cost of healthcare for food insecure populations is particularly high, since they more often end up in acute care settings (more hospitalizations and emergency department utilization) (8,20). Therefore, designing a plan to improve nutrition to low-income groups could not only represent an impactful health measure – but also potentially a cost-effective strategy. To this end, there have been many calls for nutrition education efforts, changes in policy, and food assistance programs (4,6,9,12,14,17,22,23).

An effective program already in place is the Supplemental Nutrition Assistance Program (SNAP), which is the modern name of the Food Stamp Program. (And, in the context of Californian enthusiasm to rename programs, SNAP is also called CalFresh.) For hungry families, SNAP contributes an average of $146 per person every month for food (24). Yet California has the lowest enrollment rate (53%) of eligible persons compared to all the other states, and San Diego has the lowest enrollment rate (40%) of eligible persons compared to all other urban counties (25). San Diego consequently has an estimated $105 million in unclaimed benefits for SNAP (25). And, for every $1.00 of SNAP that is used, there is an estimated stimulus effect that generates $1.79 in the local economy (26).

Finally, healthcare providers can be better educated on screening patients for food insecurity. A study in Portland found that most providers did not ask their patients about food insecurity, though 89% said they would be willing to do so if given a standardized screening question. Over half of participants expressed a lack of knowledge of community interventions, 27% expressed discomfort in asking about food insecurity, and 22% were not sure how to inquire about the issue (28). In another study of 201 family practice physicians in Ohio, only 35% believed themselves to be knowledgeable about food insecurity (29).

Lastly, in a Maryland pediatrics clinic with 45 providers, only 11% screened for food insecurity, although 84% agreed that such screening was important (30). Accordingly the American Academy of Pediatrics has selected food insecurity as one of the five social domains to be asked about in a pediatrics visit (27). Therefore, healthcare providers may benefit from further education on screening tools available and exposure to local resources. Studies have demonstrated that quick 1- or 2-question screenings tools have both sensitivity and specificity in assessing food insecurity (31,32).

In summary, consistent access to high quality food likely represents an important facet in preventing and controlling chronic disease among vulnerable populations, and this may be especially relevant for patients with diabetes. Furthermore, CalFresh has untapped potential as an effective program, and screening tools are under-utilized by healthcare providers.

*References made available at the end of this document.*

### Objectives
- Coordinate a research study providing monthly boxes of healthy food and nutrition education to food-insecure patients with diabetes while following HbA1c, blood pressure, weight, LDL cholesterol, and other subjective measures for improvement
- Increase CalFresh (Food Stamp) enrollment for food-insecure families
- Increase awareness among physicians of how food insecurity disturbs health outcomes and promote the use of screening tools

### Narrative Summary
It was my first year of medical school that I started working at the UCSD Free Clinic. This was the year my white coat was still white, albeit crumpled, and the first time I tried doing doctor-like things. I learned to nod in a knowledgeable sort of way, fooled myself into thinking I could multitask, and enthusiastically urged consumption of fruits and vegetables. This last recommendation (universally met with an unconvincing nod) was what became a focus of mine for the next three years.

What if I ate a bag of chips as my breakfast, lunch, and dinner? What if I ate lettuce with some butter on it before school? What if I had two dollars each day for food? These were some of the scenarios that patients relayed to myself and other providers at the Free Clinic, which is where this project began. How could patients be expected to control their weight-associated diseases in this context?

My ISP quickly centered itself around the term 'food insecurity', which is defined as the condition of uncertain or limited access to adequate food. It is estimated to affect 50 million people in the United States, and often leads to poor dietary habits, such as the selection of calorie-dense food options that are less expensive. This in turn has been associated with the development of serious health problems for low-income populations, including hypertension, hyperlipidemia, obesity, and diabetes. Yet food insecurity is not routinely addressed in underserved clinical settings despite increasing recognition as an important social determinant of health. My initial concept was therefore to implement programs to measure and alleviate this need.

The first step of my project entailed screening the entire Free Clinic population of about 500, predominantly Latino, patients for food insecurity using a 6-item food insecurity survey tool from the USDA. By emailing local interest groups, I recruited and trained a team of 17 volunteers (mostly UCSD undergrads with Spanish competency) to help conduct this survey; we staffed clinics that ran 5 days of the week for more than six months. We found that nearly 75% of Free Clinic patients qualified as being food insecure, which to our knowledge is the highest prevalence of food insecurity ever recorded in a clinical population in the United States. (Please see 'Appendix B' for full manuscript.)

After survey administration, I trained the volunteers to refer patients to local food banks in their neighborhood (using online search tools and pre-made handouts) as well as evaluate patients for

potential CalFresh (Food Stamps) eligibility. This was done for all patients, regardless of food insecurity status. It should be noted that the CalFresh enrollment procedure was an already established entity by a prior medical student as a separate ISP; in this respect, my project only helped to identify those eligible and coordinate CalFresh enrollment referrals.

However, it was predicted that many patients would experience obstacles going to local food banks, such as transportation, lack of variety or quality food, and perceived stigma. Consequently, by teaming up with Feeding San Diego, a local food relief organization, I decided to conduct a clinical research study with the core concept of bringing healthy food directly to patients at the UCSD Free Clinic sites themselves. I was the lead supervisor in designing and conducting this multi-site, randomized controlled trial (RCT) that provided 200 diabetic patients with free monthly boxes of healthy food plus nutrition education classes for 6 months. Modifying unhealthy eating patterns to improve glycemic control (HbA1c) was the primary outcome. The 17 volunteers mentioned previously served as study coordinators for this project; I trained all volunteers to explain, consent, and conduct the RCT on a day-to-day basis. I frequently went to clinic to lead the organizational effort, troubleshoot and (hopefully) anticipate problems, replenish supplies, serve as back-up for volunteer absences, as well as monitor consistency among sites. My RCT featured a waitlist-control design such that, after 3 months, the waitlisted group rolled into the intervention group so that all enrolled patients received free food and nutrition education for a total of 6 months.

My intervention provided monthly boxes of healthy foods as well as monthly nutrition classes. I conducted an interest group with Latino classmates to determine what would be culturally appropriate to include in the food boxes in addition to reviewing the items with a nutritionist and Dr. Rock. Participants would receive one food box, typically containing 25-30 lbs of canned, shelf-stable food, in addition to one large bag of vegetables and one large bag of fruits, all of which varied by week (please see 'David Malinak ISP Pictures'). Example items from the food box include canned meat (chicken, tuna), peanut butter, dried or canned beans, canned vegetables (low-sodium), 1% UHT milk, whole-wheat pasta, oatmeal, olive oil, and various spices. Example items from the bag of vegetables include carrots, tomatoes, onions, and broccoli while example items from the bag of fruits include apples, oranges, and avocados. I also wrote and obtained a grant to pay for wheeled carts, which most study participants opted to receive at no cost at the beginning of the study, to enable transport of the food. In sum we distributed more than 100,000 pounds of food worth over $200,000.

The nutrition classes covered a wide range of topics yet had a motif emphasizing healthy-eating on a budget. They were designed to be less didactic and more dialogue-oriented, with patients often breaking into small groups to share personal strategies with one another. Sometimes they included live cooking demonstrations.

Outcome measures were evaluated every 3 months. At 3 months (the end of the randomized control portion), the study found significant improvements in the immediate intervention group relative to the waitlisted (delayed intervention) group for fruit and vegetable intake, diabetes distress scores, and food insecurity scores. When the two groups were re-aligned into a single group as if it were a prospective trial, all participants with uncontrolled diabetes at baseline (defined as HbA1c of 7.5 or greater) had significant improvements in HbA1c (at 6 months), weight and BMI (at 6 months), depression (at 3 months), diabetes distress (at 3 and 6 months), fruit and vegetable intake (at 3 and 6 months), and food insecurity (at 3 and 6 months). HbA1c trended toward improvement at 3 months but did not reach statistical significance until 6 months (-0.4 [CI -0.7, -0.1], p=0.015). No changes were found in systolic or diastolic blood pressure, cholesterol, frequency of hypoglycemia, or medication compliance. Interestingly, only 10.7% of participants reported that they went to a local food bank during their 3 month waitlisted portion, alluding to the potential barriers in a purely referral-based approach. (Please see 'Appendix A' for full manuscript.)

At the study's conclusion, instead of taking away a service we had been providing, I designed and coordinated the project's expansion to routinely deliver food pantry services to all Free Clinic patients

(over 450). Patients became eligible to pick up "food prescriptions" consisting of two large bags of healthy food on a monthly basis (see attachment 'David Malinak ISP Pictures'). This food is being generously provided through a continued partnership with Feeding San Diego. There was a large turnover of volunteer support at this juncture, so I again recruited, trained, and continue to actively supervise over 20 volunteers to sustain this project, which is currently ongoing. I performed many food pick-ups from the food bank warehouse and still attend clinic often to help the volunteers with our distribution. The terminology of a "food prescription" is intended to reinforce how food is medicine, which is a concept so fundamental it is easily overlooked. A brief feedback survey conducted at 5 months since the Food Prescription Project's start on two different clinic days revealed that 25 of 25 participants ranked their overall satisfaction with our program at "5 out of 5" while 24 of 28 respondents agreed that the amount of food distributed was "adequate".

The project is being transitioned to three more junior medical students to ensure continuity and sustained analysis of outcomes (the heart of which is the longitudinal measurement of food insecurity scores every 6 months). Longer-term sustainability options are also currently under discussion, including mobile food truck pantries, which would largely diminish the volunteer burden of food preparation and coordinated distribution.

In a tangential project, I helped increase awareness among 85 medical students, residents, and faculty about how food insecurity adversely affects health outcomes through a series of lectures, promoting the use of screening tools and available interventions. Knowledge of food insecurity, food resources, importance, relevance, willingness to ask, all increased significantly ($p<0.0001$) in a pre and post survey analysis. This also resulted in systems-level changes at multiple residency programs, community health centers, and hospitals across San Diego, resulting in over a thousand patients being screened for food security and applying to CalFresh (Food Stamps). For example, one family medicine residency program subsequently modified their electronic health records at a low-income clinic to include a validated 2-item screening performed at intake by medical assistants; positive screens then generated automatic referrals to food resources and CalFresh application assistance. A second family medicine residency program began routinely reviewing a pre-existing screen in their intake process and discussing this with patients. A third family medicine residency program made food resource handouts available, coordinated CalFresh referrals, and aimed to start using a 2-item screen for their inpatients at discharge. (Please see 'Appendix C' for full manuscript.)

Yet beyond the study logistics and various outcomes measures, our patients impressed upon us their gratitude throughout the project, leaving myself and the volunteers with memories of kids hopping up and down as they received bags of apples and tubs of peanut butter, or a man yelling out from the back of an ambulance (which he was placed in due to the fact he was actively having a heart attack) fervently urging us to bring his food box inside the ambulance with him.

In reflection this project has certainly had its challenges. Not least among them was learning to navigate the mercurial balance of supply and demand (on occasion having left from clinic driving with a thousand onions in my back seat, blinking through tears). My commitment to the volunteers I recruited always weighed on my mind as well, since I felt responsible for creating a conducive learning environment and a volunteer-friendly experience for what ended up being a range of demanding positions. And for the patients too I felt very much accountable for making this project stay on its feet when it seemed determined to stumble and fall. Yet for me the Free Clinic became a place of innovation for a project that was pioneering, and something truly unique. It led to many heartwarming anecdotes and interesting experiences, including my first time speaking on live radio at a KPBS food insecurity fundraiser event.

I am bolstered that interest in food insecurity seems to be gaining momentum. The UCSD hospital system recently reached out with an interest to begin screening all inpatients for food insecurity, and I additionally received two more invitations to lecture on food insecurity for other healthcare systems in San Diego. Soon these efforts will hopefully reach a wider audience since three manuscripts detailing

these projects have been submitted for publication, and many poster sessions have led to us being contacted by other medical schools and underserved clinics across the country. This will hopefully continue to open doors for the medical students who plan to take over this project. Another medical student has already begun personally going with Free Clinic patients to neighborhood food banks in an effort to encourage and normalize the experience.

Suggested directions for future projects addressing food insecurity include: expanding the existing Food Prescription Project into a more robust research study (potentially also including an analysis of objective measures in addition to adding other subjective questions of interest); advocating for food insecurity screening in a pediatric setting; exploring the connection between food insecurity and mental health; as well as implementing food insecurity screening for inpatients in UCSD hospitals, coordinating with social workers to either have food available on-site or have an informational referral system in place.

My ISP truly became an integral part of my medical school experience for which I am profoundly grateful. Over the last three years I have recruited over 35 volunteers and led challenging projects aimed at alleviating food insecurity at the UCSD Free Clinics as well as across San Diego. The combined effect of my projects has resulted in thousands of patients being screened for food insecurity, well over 150,000 pounds of nutritious food being distributed, and over a thousand patients applying for CalFresh (Food Stamps) benefits. After embarking on this service-oriented research, my projects continued to evolve and expand across multiple healthcare systems in San Diego and hopefully beyond. This has ingrained an attention to social determinants of health as an important facet of my professional development.

## Manuscripts

Smith, S.*, *Malinak, D. *,* Chang, J.*, Perez, S., Perez, M., Rock, C., Florin, F., Jacinto., S. Impact of clinic-based food pantries on health outcomes of patients with diabetes: A Randomized Controlled Trial. 2017: Pub Status: Submitted. (*co-first authors). See Appendix A.

Smith, S., *Malinak, D.,* Chang, J., Settlecowski, E., Rodriggs, T., Perez, S., Perez, M., Hsu, M., Abrew, A., & Aedo, S. Implementation of a food insecurity screening and referral program in student-run free clinics in San Diego, California. Prev Med Rep. 2016 Dec 8;5:134-139. eCollection 2017. DOI: 10.1016/j.pmedr.2016.12.007. See Appendix B.

Smith, S., *Malinak, D.,* Chang, J., Schultz, A., & Brownell, K. Educating Family Medicine Residents and Medical Students About Food Insecurity Modified Individual Clinical Practices and Systems-Level Changes. Academic Medicine. 2016, Jul; Pub Status: Accepted. See Appendix C.

## Oral Presentations

*Malinak, D.,* Chang, J., Perez, S., Perez, M., Brownell, K., & Smith, S. Food insecurity, its impact on health, and methods to address this modifiable social determinant of health in primary care. Oral Presentation presented at: Society of Teachers of Family Medicine: May 2017 Annual Spring Conference; San Diego, CA, USA. Status: Pending.

Live radio interview on KPBS NPR. On food insecurity awareness and a Feeding San Diego fundraiser. Oct 19, 2016. San Diego, CA. See attachment 'David Malinak ISP Pictures'.

## Posters

*Malinak D,* Settlecowski E, Niemiec S, Smith S. Universal food insecurity screening and referrals within Student-run Free Clinics. University of California San Diego Public Health Research Day. La Jolla, CA. Apr 2015.

Chang J, Egnatios J, *Malinak D,* Smith S. Student-Run Free Clinic Universal Food Insecurity Screening and Referral Project. Building Healthy Communities Summit. Los Angeles, CA. Sept 2015. (Won first prize in poster competition)

Chang J, Egnatios J, *Malinak D,* Smith S. Student-Run Free Clinic Universal Food Insecurity Screening and Referral Project. American Association of Family Physicians National Conference of Medical Students and Residents. Kansas City, MO. Aug 2015.

Perez S, Perez M, Liao K, Haimovich A, Panusis D, Mathew D, Alkafaji R, Richter M, Cui C, Chang J, *Malinak D,* Smith S. The Food Prescription Project: Assessment and Intervention for Food Insecurity. Society of Student Run Free Clinics Annual Conference. Anaheim, CA. Feb 2017.

## Recognition

Award for Outstanding Leadership and Dedication to Social Justice, UCSD Student-Run Free Clinic Project (2016).

Recipient of $4,000 grant from the UCSD PACE Program to support underserved communities (2015).

UCSD Student-run Free Clinic Project Newsletter: "Student Spotlight". Pending publication.

## Acknowledgments

This project was made possible thanks to the guidance of my ISP committee, especially the remarkable support and mentorship from my ISP Chair, Dr Sunny Smith. The volunteers and fellow students who came on board for this project were exceptional, not only continuing to sustain roles requiring exhausting manual labor but also helping to push and evolve this ISP in new directions; an enormous portion of this project's success is in thanks to their time, effort, and initiative. Many thanks to the patience, acommodation, and grace of our Free Clinic site hosts. Finally, I was incredibly fortunate to have the generous partnership of Feeding San Diego in pursuing a shared vision.


# Appendix A

Manuscript: **Smith, S.\*, Malinak, D.\*, Chang, J.\*, Perez, S., Perez, M., Rock, C., Florin, F., Jacinto., S. Impact of clinic-based food pantries on health outcomes of patients with diabetes: A Randomized Controlled Trial. 2017: Pub Status: Submitted. (\*co-first authors)**.

## Abstract

Objective: To examine the impact of clinic-based food pantries on diabetes related health outcomes.

Research Design and Methods: This RCT enrolled 201 patients with diabetes from three sites of the UCSD Student-Run Free Clinic Project. The intervention group was given immediate access to food pantry services on-site once a month for 6 months. The wait-list control group was referred to off-site food pantries for the first 3-months then received access to clinic-based food pantry services for 6 months. Outcomes measured at 3, 6, and (for wait-list subjects) 9 months included diabetes distress, depression, fruit and vegetable intake, household food insecurity, hypoglycemia, medication adherence, HbA1c, weight, BMI, and blood pressure.

Results: After three months, participants who had access to clinic-based food pantry services, including food and education (n=104), had less diabetes distress (2.1 ± 1.1 vs. 2.6 ± 1.4, p=0.04) and had increased fruit and vegetable intake (2.7 ± 1.5 vs. 2.0 ± 1.2, p=0.02) compared to wait-listed participants (n=97). When combining the groups in a pre-determined cross-over analysis, access to clinic-based food pantry services decreased diabetes distress, depression, and household food insecurity, while fruit and vegetable intake increased. In patients with HbA1c ≥ 7.5% (58mmol/mol), mean HbA1c decreased from 9.6% ± 1.8 (81mmol/mol ±19.7) at baseline to 9.2% ± 2.0 (77mmol/mol ± 21.9) at 3 months and 9.1% ± 1.8 (76mmol/mol ± 19.7) at 6 months (p=0.046 and p=0.015 respectively).

Conclusions: Partnering with food banks to bring healthy food and nutrition education into low-income clinics improved diabetes related health outcomes.

## Introduction

Food insecurity is defined as an "economic and social condition of limited or uncertain access to adequate food"[1] affecting over 42 million people in the U.S.[2] People in food insecure households have a 50% higher chance of developing diabetes.[3] Even among low income adults, those who are food insecure are more than twice as likely to have diabetes than those who report being food secure.[4] Food insecurity has been demonstrated to be an independent risk factor for poor glycemic control.[5] Nearly half of patients with diabetes seeking care in safety-net clinics are food insecure.[5-7] However, food insecurity is an issue that is not commonly addressed in health care.[8]

Food insecurity is correlated with worse glycemic control in patients with diabetes, while also correlated with significant hypoglylemic episodes.[4-7,9-10] Low-income individuals living with diabetes are hospitalized more frequently for hypoglycemic episodes during the last week of the month.[11] This cyclic monthly correlation with admissions for hypoglycemia, seen only in low-income patients, is believed to be associated with government assistance that is traditionally distributed at the beginning of each month, leaving low-income patients with diabetes without sufficient resources for adequate food at the end of the month.[11] Healthcare utilization and costs are higher in food insecure patients, even when controlling for other known social determinants of health.[12]

There is an increasing body of evidence of the impact of food insecurity on people living with diabetes and a concurrent increased awareness of the need to consider food insecurity when making treatment plans.[13] The American Diabetes Association (ADA) Standards of Medical Care in Diabetes 2016 described that patients with limited access to food are at risk for hyperglycemia as well as hypoglycemia and recommended that providers seek local resources to help patients obtain nutritious foods.[14]

A recent pilot study conducted in food banks demonstrated that providing nutritionally appropriate food to clients with diabetes along with counseling and referrals to medical clinics resulted in improved glycemic control, fruit and vegetable intake, self-efficacy, and medication adherence in a pre/post intervention analysis.[15] We sought to bring food pantry services to patients in their pre-established medical homes to further isolate the effect of providing food pantry services to low-income patients with diabetes already receiving medical care.

Student-Run Free Clinics are present at over 75% of medical schools in the U.S. and provide care to the underserved.[16] The most common diagnoses treated at Student-Run Clinics are diabetes and hypertension.[16] The UCSD Student-Run Free Clinic Project (SRFCP) was established in 1997 and provides continuity primary and specialty care for patients without access to care.[17-20] We serve an uninsured, low-income, and largely monolingual Spanish-speaking Latino population.[18-20]

The purpose of this study was to determine if providing access to food pantry resources, including healthy foods along with nutrition education on how to eat healthier on a budget, on-site at free clinics would improve diabetes related health outcomes.

## Research Design and Methods

**Study recruitment, enrollment, and randomization**

This was a wait-list cross-over open-label randomized controlled trial.  Recruitment for this study occurred from January through August 2015 and the intervention continued through study completion in April 2016.  Study participants were recruited and enrolled at three sites of the UCSD SRFCP.  All patients with a medical appointment at these sites were screened for food insecurity as part of a universal food insecurity screening program using the United States Department of Agriculture (USDA) 6-item food security questionnaire and given information on local food resources.  At the bottom of the food security screening forms, patients were asked to indicate if they had diabetes.  Those who marked "yes" or "not sure" were then assessed for eligibility for participation in this study.  Eligibility criteria included age over 18 years, receiving medical care at the UCSD SRFCP, and a diagnosis of type 2 diabetes recorded in the electronic health record (EHR).  The diagnosis of diabetes had been routinely entered in the EHR if a patient has had a HbA1c of 6.5% (48 mmol/mol) or greater in accordance with the American Diabetes Association diagnostic criteria for diabetes.[14] Potential study participants were excluded only if they stated they were not willing or able to participate in monthly food distributions on site.

All surveys, forms, and consents for this study were provided on paper and made available in English and Spanish. Bilingual English and Spanish-speaking study coordinators provided assistance to all patients who could not read or write, had difficulty with vision, or asked for help for any reason.  When asked for assistance, study coordinators read all materials aloud to patients and marked their responses on paper.  Patients were informed that participation was completely voluntary and that refusal to participate would in no way affect their ability to continue receiving medical care or obtain assistance with referrals to other local food resources.

Once written informed consent was obtained, the form was handed to a study coordinator who then used an electronic spreadsheet provided by a study statistician to randomize patients to the immediate intervention group or to the delayed intervention (wait-list) group.

Participants who were assigned to the delayed intervention group had a waiting period of 3 months before crossing-over into the intervention phase. All participants were given information on local food resources including food pantries based on their home address and referrals to apply for Supplemental Nutrition Assistance Program (SNAP, known as CalFresh in California, formerly known as food stamps) if it appeared their household may be eligible based on basic screening information including immigration status, number of household members, and household income. The intervention phase lasted 6 months for both the immediate and wait-list control groups. At any given time, the patient had the right to withdraw from the trial. Appendix 1 follows the Consolidated Standards of Reporting Trials (CONSORT) flowsheet to document the study design, randomization, number of participants proceeding through study allocation, follow-up, and analysis.

**Intervention**

The study intervention was access to nutritious diabetes-appropriate foods on-site at one of two clinic sites along with concurrent educational information provided by Feeding San Diego food bank staff about how to make healthy food choices on a limited budget. Participants were invited to participate in food distributions once a month for 6 months. Patients received monthly telephone call reminders one to four days before the distribution of food. The UCSD SRFCP patients receive primary care at one clinic site and specialty care at any of three clinic sites depending on where specialty services are available. Referrals into the diabetes food pantry project followed a similar model of referral for specialty care as food distributions could be at the patient's home clinic if the patient received primary care at the Downtown San Diego or South East San Diego site, but those receiving primary care at our Pacific Beach site were referred to the Downtown San Diego site.

Participants received one food box, typically containing approximately 20-25 pounds of diabetes appropriate healthy shelf-stable food, in addition to one ten-pound bag of vegetables and one ten-pound bag of fresh fruit (Appendix 2). We provided wheeled grocery carts to enable transport of the food since most participants took public transportation. If extra food was available due to scheduled participants not attending, it was distributed equally among participants who were present. All fresh food and shelf-stable food was provided by Feeding San Diego, a large local food bank, and distributed the same day. There was no food storage on-site as part of this project.

Feeding San Diego food bank staff provided educational information along with food distributions. The food was intended as a supplement and to provide examples of what types of food are healthier choices for patients with diabetes yet affordable when on a very limited budget. Participants were encouraged to share personal strategies to eat healthy on a budget with other participants in small and large groups. Educational topics addressed by food bank staff and volunteers included increasing low-cost high-protein foods (e.g., dried beans), decreasing food sources of refined carbohydrates (e.g., flour tortillas, white rice, sugary drinks), and portion control. Feeding San Diego provided nutritious recipes utilizing items from the food boxes at each intervention and at times conducted live cooking demonstrations and distributed samples.

Patients continued to receive usual medical care at the SRFCP throughout the study. The UCSD SRFCP provides primary care, specialty care, laboratory testing, medications, and diabetes supplies including syringes, lancets, test strips, and glucometers to patients free of charge. Usual care included routine clinical visits for diabetes and any other health problems, with a frequency determined by the primary care physician and the patient. Medication is typically dispensed for 90 days at a time and follow-up visits are typically scheduled every 3 months or more often if needed. Weight and height were obtained during food distributions when possible and body mass index was calculated as weight (kg)/height (m$^2$). We queried the EHR for systolic blood pressure (SBP) and diastolic blood pressure (DBP) as well as weight, height, and BMI in case weight and height information were not available from on-site food distributions. A query of online laboratory records (Quest Diagnostics, Madison, NJ) was used to obtain HbA1c values.

**Outcomes**

The primary outcome measure was change in glycemic control as indicated by HbA1c at 3 and 6 months. Mean HbA1c of the immediate intervention group was compared with the wait-list group at 3 months. In addition, it was pre-determined that groups would be combined based on number of months in the intervention to increase statistical power to detect change in HbA1c over time. Consistent with previous studies, uncontrolled diabetes, defined as HbA1c of 7.5% (58 mmol/mol) or greater, was a pre-determined threshold of uncontrolled diabetes that would be analyzed separately to examine for potential improvement.[15]

Secondary outcomes included change in the following survey items: food insecurity, as measured by USDA 6-item food security survey,[21-22] diabetes distress (as measured by the 5-item emotional burden subset of the Diabetes Distress Scale)[5,23] fruit and vegetable intake (as measured by the 7-item Food Frequency Questionnaire),[24] depression (as measured by the Patient Health Questionnaire 2-item survey (PHQ-2),[25] frequency of hypoglycemia (1-item),[15] and medication adherence (1-item).[15] Secondary clinical outcomes measurements included change in SBP, DBP, weight (in pounds), and BMI (kg/m$^2$). Hypoglycemia and medication adherence were categorical variables. Any hypoglycemic event within the last 4 weeks was considered a positive response. Subjects were considered adherent to medication adherence if they had not missed any doses of medications in the last seven days.

All outcomes measures were collected at baseline, 3 months, and 6 months for both groups, and at 9 months for the wait-list group so that each group had a total of 6 months of intervention data. Clinical data were obtained as part of usual care and extracted from the EHR and online laboratory services. To allow for usual variation in clinical visits and variable attendance at interventions, values within 45 days of a study time frame (baseline, 3, 6, or 9 months) were assigned to the closest time point and included in the study. If two values were available near one study time frame the value from the closest date was chosen. Participants completed surveys at baseline, then again at 3 months, 6 months, and (for wait list participants) 9 months during food distributions. After 6 months of time had passed since the first intervention, no further outcomes measures were collected although participants we encouraged to continue receiving monthly distributions of food on-site. No interim analyses were conducted.

To determine sample size for adequate statistical power, we examined 3-month data from a clinical trial conducted by one of the study authors (CR) in subjects with type 2 diabetes.[26] Assuming mean ± SD HbA1c% reduction from baseline of 0.68 ± 1.02% in immediate

intervention, and 0.0 ± 0.88% in the wait list control group, there is 97% power with a dropout/nonadherence rate of up to 40% to see a group difference at 3 months with 100 patients assigned to immediate intervention and 100 to a wait-list control, for a total of 200 patients under study.

**Statistical Methods**

Demographic and clinical characteristics collected at baseline included age, gender, race/ethnicity, primary language, HbA1c, weight, BMI, and type of diabetes medication used (metformin, sulfonylurea, insulin, dipeptidyl peptidase-4). Means and standard deviations were recorded for continuous variables. Number and percent were calculated for categorical variables. The data showed normal distributions; therefore, parametric tests were used in all analyses. We performed one-way ANOVA, Fisher's exact, independent sample t-tests, or paired t-tests, dependent on variables. All tests were performed with SPSS (version 24.0). $P < 0.05$ was considered significant. The UCSD IRB approved this study.

# Results

**Demographics and baseline characteristics**

201 patients were included in the study, with 104 in the immediate intervention group and 97 in the delayed intervention group. The mean age was 53.9 ± 10.7 years, 73.6% (148) were female, nearly all were Latino (99.0%; 199), and Spanish-speaking (97.0%; 195). The mean BMI was 32.4 ± 7.2 kg/m² 34.3% (69) were on insulin (Table 1). The majority were food insecure (85.6%; 172), including 47.3% (95) with low food security (USDA 6-item food security survey score of 2-4) and 38.3% (77) with very low food security (USDA 6-item food security survey score of 5-6). Participant demographics, clinical characteristics, and baseline survey characteristics did not vary between randomized groups.

**Number of interventions attended**

The mean number of times study participants attended the food pantry and received food was 3.55 ± 1.76 out of 6 possible times in 6 sequential months. Nearly all patients referred to on-site monthly food distributions came to pick up food at least once (190/201; 94.5%); 139 (69.2%) received 3 or more boxes, 109 (54.2%) received 4 or more, 73 (36.3%) received 5 or more, and 30 (14.9%) received food in all 6 of 6 sequential monthly food distributions. Attrition did not vary by study group. All pertinent clinical data available in the EHR or online laboratory system for patients enrolled in the study was used in this analysis regardless of whether they attended food distributions. Survey responses were available only for participants who attended a food distribution during the appropriate time window and all available survey responses were analyzed.

Primary outcome data of HbA1c were recorded in the EHR for 62.7% (126/201) of participants at 3 months, 62.7% (126/201) at 6 months, and 60.8% (59/97) at 9 months. There was no difference in the proportion of patients without follow up HbA1cs between study arms.

Participants in the immediate intervention group who received food on-site reported less diabetes distress (2.1 ± 1.1 versus 2.6 ± 1.4, p=0.04) and higher fruit and vegetable intake (2.7 ± 1.5 vs.

2.0 ± 1.2, p=0.02) at 3 months when compared with those in the delayed intervention group (Table 2).  Differences between groups were not observed at 3 months in any other measures including clinical measures or survey items. Only 10.7% (11/65 respondents) of the wait-listed participants stated that they had gone to an off-site food pantry to which they were referred by the end of the 3 month waiting period.  No significant changes were noted in any clinical or survey measures in the wait-list group who received referrals to off-site food resources after 3 months compared with baseline.  Data from the wait-listed group at 3 months was then used as the new baseline for this group to assess the impact of the intervention as they crossed-over into the active phase of the intervention.  If data were missing for the wait list group at 3 months, the enrollment baseline was used since there were no significant differences between the two time points for this group.  The cross-over time frame allowed us to examine the impact of the intervention over 6 months in all study participants. As described in Table 3, access to on-site food pantry services resulted in decreased diabetes distress, decreased depressive symptoms, increased fruit and vegetable intake, and increased household food security scores.  We did not detect any changes in SBP or DBP (Table 3).  There was no improvement in medication adherence (112/197; 56.9% at baseline, 52/109; 47.7% at 3months, 60/118; 50.8% at 6 months, p=0.271) or presence of hypoglycemic episodes (94/196; 48.0% at baseline, 53/110; 48.2% at 3 months, 62/118; 52.5% at 6 months, p=0.708).

When examining the effect of the intervention on all participants with uncontrolled diabetes at baseline, defined as a HbA1c of 7.5% (58mmol/mol) or greater, significant improvements were seen in HbA1c, diabetes distress, depression, fruit and vegetable intake, household food insecurity, weight, and BMI (Table 4).  There were no differences noted in this subgroup in medication adherence (61/113; 54.0% at baseline, 30/63; 47.6% at 3 months, 39/73; 53.4% at 6 months, p=0.699) or hypoglycemic events (59/113; 52.2% at baseline, 32/65; 49.2% at 3 months, 40/73; 54.8% at 6 months, p=0.808).

## Discussion

Providing food pantry services on-site in a free clinic resulted in decreased diabetes distress, depressive symptoms, and household food insecurity, as well as improvements in fruit and vegetable intake, weight, and glycemic control.  To our knowledge, this is the first study to examine the impact of food pantry services in free clinics on health outcomes of patients with diabetes.  Bringing traditional food pantry resources, including the provision of healthy food along with nutrition education on how to eat healthy with a limited budget, into a low-income clinic resulted in improved outcomes when compared to referrals to traditional off-site food pantries.

In this study, 95% percent of patients referred to an on-site food pantry received food.  This near universal follow-through on the food resources distributed at the clinic is in sharp contrast to the very small percentage (11%) of respondents from the wait-list who reported that they had received food from off-site food pantry referrals by the end of the 3-month wait-list time frame.  There are many barriers for patients to accessing traditional food pantries including stigma, shame, lack of familiarity, limited hours, long wait times, identification requirements, or fear that food banks provide unhealthy foods.[27-29] Most food insecure households will implement a multitude of coping mechanisms before resorting to using food banks.[28-29] These coping mechanisms include eating less expensive and less healthy food, restricting food choices,

deferring other bills, recycling, using coupons, borrowing money, and skipping meals or eating less.[28-29] Food pantry services based within medical clinics may decrease some of those barriers and increase acceptability.

Several innovative programs encourage physicians to provide food prescriptions to their patients to address food insecurity.[30-32] These food prescriptions can include off-site referrals for government sponsored food programs, grocery stores, or farmers markets.[35] Referrals to food assistance programs on-site, co-located within medical facilities, including applications for SNAP and Women Infants and Children (WIC) programs can help increase the likelihood that patients will follow-up on food resource referrals.[33] Some health care settings dispense food at the site of clinical care, and we encourage expansion and further study of these models.[31]

Participants in this study have a remarkably high level of food insecurity (86%). Prior studies conducted in diabetic patients in low income clinics documented food insecurity rates of 46%.[5-7] Despite such high rates of food insecurity in the UCSD SRFCP and a holistic multi-disciplinary approach to patient care, food insecurity was not previously routinely assessed or addressed in this clinic population. Food insecurity may be underdiagnosed and undertreated in many patients with diabetes, particularly in settings that have a significant portion of low-income patients. This study further supports the need to screen for food insecurity and make appropriate referrals. A validated simple two-item food insecurity screening tool is most often used in health care settings.[34] A positive response to either item is considered a positive screening. Food insecurity can then be recorded in the EHR with an ICD-10 code of Z59.4. Health care providers as well as ancillary staff can make referrals and follow up on the status of referrals. Food insecurity referral outcomes can be tracked on an individual basis or a food insecurity registry can be used for a population of patients.

This study demonstrated that providing healthy and nutritious food to low-income patients with diabetes in a clinical setting can decrease depressive symptoms as reported on a routinely used depression screening questionnaire.[25] Depressive symptoms are associated with poor diabetes management, complications, and mortality, even when symptoms are below the range of clinical depression.[35,36] A prospective study of Medicare claims data of patients with diabetes demonstrated that depression was associated with a 50% increase in costs and that surprisingly, depressive symptoms were better predictors of future health care costs than glycemic control.[37] We found that the provision of food to low-income patients also decreased diabetes distress, the emotional burden specifically related to diabetes.

HbA1c improved in patients who were not well controlled at baseline. Improved glycemic control is associated with improved health outcomes and decreased health expenditures.[37,38] The change in HbA1c noted with on-site food pantries is comparable to that seen with many medications and in studies that provided pre-packaged foods for every meal as part of structured weight loss programs.[26,39] Since food pantry distributions were available only once per month, an even larger change may be possible if food insecure patients with diabetes could return to a clinic food pantry more often to obtain items that could not possibly last a full month including fresh fruits and vegetables.

Linking food pantries with low-income clinics could be a more cost effective and desirable way to improve glycemic control than intensifying medication management. Food is one of the most

basic human needs. Providing referrals for provisions of nutritious food in a healthcare setting is not only humanistic, but may serve to reinforce the concept that food is medicine.

Distribution of healthy and nutritious foods improved not only the fruit and vegetable intake of study participants, but contributed to an overall improvement in household-level food insecurity. The impact of diabetes interventions on household-level outcomes are typically not measured, but could have significant public health impacts given that members of food insecure households are at increased risk for diabetes.[4,15]

## Limitations

This study was conducted at Student-Run Free Clinics affiliated with one institution in San Diego, California with a largely monolingual Spanish speaking population. However, patients received care at three different clinic sites and food distribution along with education was conducted in multiple locations. The sample size was limited by the number of patients with diabetes receiving care at the UCSD Student-Run Free Clinic Project. The intervention was variable as not all patients obtained food each month. However, more than half of study participants came to four or more food distributions. Outcome measures were not available for all patients at all time points as clinical measures were obtained during routine clinical care and survey measures were completed only when patients came to a food distribution within the appropriate time frame. However, we believe that obtaining clinical measures from the EHR best reflects the true impact of adding food pantry services to routine medical care. Lastly, self-reported measures are susceptible to inaccuracies, but self-report is widely utilized to assess health related outcomes.

## Future Directions

Future studies are needed to replicate these findings in diverse low-income patient populations throughout the U.S., including Federally Qualified Health Centers and hospitals. Additional studies are also needed to assess the impact of food distribution on-site at low-income clinics on health outcomes in patients who do not have diabetes, particularly in patients who are food insecure. Implementation and evaluation of universal food insecurity screening and referral programs with multiple food resources available on-site are needed. The ubiquity of food banks in the U.S., the desire of hunger relief organizations to collaborate with health care partners, and the recent addition of assessment of nutritional needs as an allowable component of required periodic non-profit hospital Community Health Needs Assessments makes partnerships between food pantries and health care systems a meaningful area for growth.[40]

In conclusion, health care providers can partner with food pantries to offer nutritious food and education at the site of clinical care to improve outcomes in patients with diabetes. Food pantries placed within health care settings that serve low-income patients may be one part of a broader strategy to improve household food insecurity and health outcomes for food insecure patients.

## Funding

## Tables

Table 1. Baseline clinical and survey characteristics of study participants.

| | All | Site | | | P-value | Group | | P-value |
| | | Down-town | South East San Diego | Pacific Beach | | Inter-vention | Control | |
|---|---|---|---|---|---|---|---|---|
| Demographics, N=201 | | | | | | | | |
| Age, mean (SD) | 53.9 (10.7) | 54.3 (9.7) | 53.4 (12.4) | 53.9 (9.0) | 0.87 | 54.0 (10.1) | 53.7 (11.4) | 0.85 |
| Gender, n (%) | | | | | 0.12 | | | 0.61 |
| Female | 148 (73.6) | 60 (72.3) | 67 (79.8) | 21 (61.8) | | 75(72.1) | 73 (75.3) | |
| Male | 53 (26.4) | 23 (27.7) | 17 (20.2) | 13 (38.2) | | 29 (27.9) | 24 (24.7) | |
| Race/Ethnicity, n (%) | | | | | 0.17 | | | 0.39 |
| Latino | 199 (99.0) | 82 (98.8) | 84 (100.0) | 33 (97.1) | | 102 (98.1) | 97 (100.0) | |
| Caucasian | 1 (0.5) | 1 (1.2) | 0 (0.0) | 0 (0.0) | | 1 (1.0) | 0(0) | |
| Asian | 1 (0.5) | 0 (0.0) | 0 (0.0) | 1 (1.2) | | 1 (1.0) | 0 (0) | |
| Language, n(%) | | | | | 0.04 | | | 0.46 |
| Spanish | 195 (97.0) | 80 (96.4) | 84 (100.0) | 31 (91.2) | | 100 (96.2) | 95 (48.7) | |
| English | 6 (3.0) | 3 (3.6) | 0 (0.0) | 3 (8.8) | | 4 (3.8) | 2 (2.1) | |
| Clinical measures, mean (SD) | | | | | | | | |
| HbA1c, % mmol/mol | 8.4 (2.0) 68 (21.9) | 8.4 (2.0) 68 (21.9) | 8.4 (2.1) 68 (23.0) | 8.2 (2.1) 66 (23.0) | 0.87 | 8.5 (2.2) 69 (24.0) | 8.2 (1.9) 66 (20.8) | 0.36 |
| Systolic blood pressure | 131.3 (16.9) | 133.0 (19.2) | 128.5 (15.2) | 133.7 (13.8) | 0.16 | 130.7 (17.3) | 131.9 (16.4) | 0.63 |
| Diastolic blood pressure | 78.1 (10.7) | 79.5 (11.6) | 76.0 (9.9) | 79.4 (9.6) | 0.09 | 77.1 (10.2) | 79.1 (11.2) | 0.19 |
| Body mass index (kg/m$^2$) | 32.4 (7.2) | 33.0 (8.1) | 31.4 (6.1) | 33.3 (7.2) | 0.24 | 32.5 (7.1) | 32.3 (7.3) | 0.82 |
| Weight (lbs) | 180.8(42.7) | 183.8(45.4) | 173.4(39.2) | 190.1 (43.0) | 0.11 | 181.7(42.9) | 179.8(42.7) | 0.76 |
| Diabetes Medication, n (%) | | | | | | | | |
| Metformin | 131(65.2) | 54 (65.1) | 54 (64.2) | 23 (67.6) | 0.94 | 63 (60.6) | 68 (70) | 0.16 |
| Sulfonylurea | 45 (22.4) | 21 (25.3) | 18 (21.4) | 6 (17.6) | 0.64 | 25 (23) | 20 (20.1) | 0.56 |
| Insulin | 69 (34.3) | 31 (37.3) | 29 (34.5) | 9 (26.5) | 0.53 | 34 (32.7) | 35 (36.1) | 0.61 |
| DPP-4 inhibitor | 19 (9.5) | 9 (10.8) | 9 (10.7) | 1 (2.9) | 0.37 | 9 (8.7) | 10 (10.3) | 0.69 |
| Survey measures N=197 | | | | | | | | |
| Household food security status, n (%) | | | | | <0.001 | | | 0.73 |
| Food secure | 29 (14.4) | 4 (4.8) | 15 (17.9) | 10 (29.4) | | 13 (12.5) | 16 (16.5) | |
| Low food security | 95 (47.3) | 35 (42.2) | 44 (52.4) | 16 (47.1) | | 51 (49) | 44 (45.4) | |

| Variable | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Very low food security | 77 (38.3) | 44 (53) | 25 (29.8) | 8 (23.5) | | 40 (38.5) | 37 (38.1) | |
| FI score, mean (SD) | 3.5 (2) | 4.2 (1.8) | 3.1 (1.9) | 2.8 (2) | <0.001 | 3.5 (1.9) | 3.5 (2) | 0.93 |
| FFQ, mean (SD) | 2.1 (1.4) | 1.8 (1.4) | 2.4 (1.5) | 2.2 (1.5) | 0.032 | 2.2 (1.4) | 2.1 (1.5) | 0.74 |
| DDS, mean (SD) | 2.5 (1.3) | 2.8 (1.3) | 2.3 (1.3) | 2.7(1.2) | 0.064 | 2.6 (1.3) | 2.4 (1.3) | 0.23 |
| PHQ2, mean (SD) | 1.4 (1.7) | 1.6 (1.7) | 1.2 (1.7) | 1.4 (1.9) | 0.40 | 1.4 (1.7) | 1.4 (1.8) | 0.94 |
| Hypoglycemia, n (%) | 94 (48.0) | 40 (49.4) | 39 (48.1) | 15 (44.1) | 0.88 | 51 (50.0) | 42 (45.8) | 0.55 |
| Med adherence, n (%) | 112(56.9) | 46 (56.8) | 42 (51.2) | 24 (70.6) | 0.16 | 57 (55.9) | 55 (57.9) | 0.78 |

FI: Food Insecurity Score: Measured with United States Department of Agriculture 6-item food security survey
FFQ: Food Frequency Questionnaire. Measures fruit and vegetable intake
DDS: Diabetes Distress Score
PHQ-2: Patient Health Questionnaire-2. Two item screening for depression
DPP-4: dipeptidyl peptidase 4
Hypoglycemia: any hypoglycemic episode within the last four weeks
Med adherence: Medication adherence, defined as not missing any medication doses for 7 days

Table 2: Comparing health outcomes of immediate intervention group with wait list control at 3 months.

| Variable | Intervention Mean (SD) | Control Mean (SD) | Difference Intervention – Control (95% CI) | P-value |
|---|---|---|---|---|
| Survey measures | | | | |
| FI (N=103)* | 2.7 (1.7) | 3.2 (1.7) | -0.6 (-1.3, 0.1) | 0.087 |
| FFQ (N=104)* | 2.7 (1.5) | 2.0 (1.2) | 0.7 (0.1, 1.2) | 0.018 |
| DDS (N=101)* | 2.1 (1.1) | 2.6 (1.4) | -0.5 (-1.0, -0.02) | 0.041 |
| PHQ-2 (N=100)* | 1.0 (1.4) | 1.3 (1.6) | -0.3 (-0.9,0.2) | 0.26 |
| Clinical measures | | | | |
| HbA1c, % mmol/mol (N=126)* | 8.8 (2.1) 73 (23) | 8.5 (2.0) 69 (21.9) | 0.3 (-0.5, 1.0) | 0.50 |
| Weight (lbs) (N= 164)* | 182.5 (41.3) | 180.1 (42.8) | 2.3 (-10.6, 15.3) | 0.72 |
| BMI (kg/m$^{2}$) (N= 164)* | 32.9 (7.1) | 32.3 (7.3) | 0.6 (-1.6, 2.8) | 0.62 |
| Systolic BP (N=161)* | 131.9 (17.4) | 128.3 (15.9) | 3.6 (-1.5, 8.8) | 0.17 |
| Diastolic BP (N=161)* | 76.6 (9.9) | 76.2 (11.0) | 0.5 (-2.8, 3.7) | 0.78 |

FI: Food Insecurity Score, measured with United States Department of Agriculture 6-item food security survey
FFQ: Food Frequency Questionnaire. Measures fruit and vegetable intake
DDS: Diabetes Distress Score
PHQ-2: Patient Health Questionnaire-2. Two item screening for depression
BP: Blood Pressure

*N varies by cell as clinical measures were extracted from the Electronic Health Record as they were obtained as part of routine medical care and survey measures were completed when participants came to the food pantry within the appropriate study time frame.

Table 3. Changes in survey measures and clinical indicators for all study participants at 3 and 6 months of distribution of diabetes appropriate foods on-site at the Free Clinics

| | Baseline | | 3 months | | 6 months | | Difference at 3 months of food distribution* | | Difference at 6 months of food distribution † | |
|---|---|---|---|---|---|---|---|---|---|---|
| Variable | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | Mean (95% CI) | P-value | Mean (95% CI) | P-value |
| **Survey Measures** | | | | | | | | | | |
| FI | 199 | 3.5 (1.8) | 111 | 2.6 (1.8) | 117 | 2.4 (1.7) | -1.0 (-1.4, -0.6) | <0.001 | -1.4 (-1.7 -1.0) | <0.001 |
| FFQ | 198 | 2.1 (1.4) | 112 | 2.8 (1.7) | 118 | 3.0 (1.8) | 0.6 (0.3, 1.0) | 0.001 | 0.7 (0.3, 1.0) | 0.001 |
| DDS | 198 | 2.6 (1.3) | 111 | 2.1 (1.1) | 118 | 2.2 (1.1) | -0.4 (-0.7, -0.2) | <0.001 | -0.5 (-0.7, 0.3) | <0.001 |
| PHQ-2 | 197 | 1.4 (1.7) | 105 | 1.0 (1.3) | 113 | 1.4(1.8) | -0.4 (-0.7, -0.1) | 0.005 | -0.2 (-0.6,0.8) | 0.14 |
| **Clinical Measures** | | | | | | | | | | |
| HbA1c, % mmol/mol | 199 | 8.4(2.1) 68(23.0) | 127 | 8.5(2.0) 69(21.9) | 125 | 8.2(1.9) 66(20.8) | -0.1 (-0.4, 0.1) | 0.24 | -0.1 (-0.3, 0.1) | 0.401 |
| Weight (lbs) | 200 | 181.2 (42.2) | 163 | 181.3 (42.3) | 154 | 179.2 (41.3) | -0.5 (-1.4, 0.5) | 0.37 | -1.1 (-2.4, 0.1) | 0.069 |
| Body Mass Index (kg/m$^2$) | 200 | 32.5 (7.0) | 163 | 32.6 (7.3) | 154 | 32.2 (6.9) | -0.1 (-0.2, 0.1) | 0.37 | -0.2 (-0.4, 0.2) | 0.074 |
| Systolic BP | 194 | 129.9 (16.5) | 151 | 130.0 (15.5) | 138 | 127.7 (14.4) | 0.7 (-1.8, 3.1) | 0.58 | -2.0 (-4.8, 0.8) | 0.15 |
| Diastolic BP | 194 | 77.(10.6) | 152 | 76.3 (10.7) | 138 | 74.9 (9.1) | 0.2 (-1.5, 1.9) | 0.79 | -1.1 (-3.0, 0.9) | 0.29 |

FI: Food Insecurity score measured with United States Department of Agriculture 6-item food security survey

FFQ: Food Frequency Questionnaire. Measures fruit and vegetable intake.

DDS: Diabetes Distress Score

PHQ-2: Patient Health Questionnaire-2. Two item screening for depression

BP: Blood Pressure

* Based on 3-month minus baseline values for the immediate intervention group and 6-month minus 3-month values in the wait list group.

† Based on 6-month minus baseline values for the immediate intervention group and 9-month minus 3-month values in the wait list group.

Table 4. Changes in survey measures and clinical indicators at 3 and 6 months of distribution of diabetes appropriate foods on-site at the Free Clinics for study participants with uncontrolled diabetes (HbA1c ≥ 7.5% (58 mmol/mol)) at baseline.

| Variable | Baseline | | 3 months | | 6 months | | Difference at 3 months of food distribution* | | Difference at 6 months of food distribution † | |
|---|---|---|---|---|---|---|---|---|---|---|
| | N | Mean (SD) | N | Mean (SD) | N | Mean (SD) | Mean (95% CI) | P-value | Mean (95% CI) | P-value |
| **Survey Measures** | | | | | | | | | | |
| FI | 115 | 3.6 (1.9) | 65 | 2.9 (1.8) | 72 | 2.5 (1.8) | -0.9 (-1.4, -0.4) | 0.001 | -1.3 (-1.7, -0.9) | <0.001 |
| FFQ | 114 | 2.0 (1.3) | 66 | 2.8 (1.8) | 73 | 2.8 (1.6) | 0.8 (0.3, 1.3) | 0.002 | 0.8 (0.3, 1.3) | 0.001 |
| DDS | 114 | 2.7 (1.3) | 65 | 2.3 (1.2) | 73 | 2.2 (1.2) | -0.3 (-0.7, 0.0) | 0.053 | -0.5 (-0.8, -0.2) | 0.001 |
| PHQ-2 | 113 | 1.6 (1.7) | 62 | 1.2 (1.4) | 69 | 1.5 (1.9) | -0.5 (-0.8, -0.1) | 0.016 | -0.2 (-0.7, 0.2) | 0.29 |
| **Clinical Measures** | | | | | | | | | | |
| HbA1c, % mmol/mol | 117 | 9.6(1.8) 81(19.7) | 85 | 9.2(2.0) 77(21.9) | 74 | 9.1(1.8) 76(19.7) | -0.3 (-0.7, -0.01) | 0.046 | -0.4 (-0.7, -0.1) | 0.015 |
| Weight (lbs) | 117 | 181.1 (41.6) | 99 | 180.3 (43.4) | 96 | 178.6 (41.0) | -0.7 (-1.9, 0.5) | 0.24 | -1.6 (-3.1, -0.01) | 0.048 |
| Body Mass Index (kg/m$^2$) | 117 | 32.4 (6.8) | 99 | 32.3 (7.2) | 96 | 31.9 (6.5) | -0.1 (-0.3, 0.1) | 0.18 | -0.3, -0.6, -0.03) | 0.027 |
| Systolic BP | 115 | 130.6 (17.5) | 88 | 131.0 (16.5) | 79 | 129.2 (14.3) | 0.1, (-3.2, 3.3) | 0.96 | -1.2 (-5.3, 2.9) | 0.57 |
| Diastolic BP | 115 | 77.1 (11.2) | 89 | 76.4 (10.9) | 79 | 75.1 (8.8) | -0.1, (-2.3, 2.2) | 0.97 | -0.4 (-3.1, 2.3) | 0.75 |

FI: Food Insecurity score measured with United States Department of Agriculture 6-item food security survey

FFQ: Food Frequency Questionnaire.  Measures fruit and vegetable intake.

DDS: Diabetes Distress Score

PHQ-2: Patient Health Questionnaire-2.  Two item screening for depression

BP: Blood Pressure

* Based on 3-month minus baseline values for the immediate intervention group and 6-month minus 3-month values in the wait list group.

† Based on 6-month minus baseline values for the immediate intervention group and 9-month minus 3-month values in the wait list group.

Table 5. Example Food Box Contents

| Food | Feeding San Diego Product Item | Diabetic Product Guidelines | Size | Quantity per box |
|---|---|---|---|---|
| **Whole Grains** | | | | |
| Brown Rice | Brown rice, whole grain rice, whole grain pasta, quinoa | Unrefined, whole | 16 oz. | 2 |
| Quick oats | Oats and oatmeal (traditional or quick). | No sugar added | 42 oz. | 1 |

| **Vegetables and Fruits** | | | | |
|---|---|---|---|---|
| Canned vegetables | Tomatoes, carrots, green beans, corn, peas | No salt | 15 oz. | 7 |
| Canned fruit | Canned peaches, pears, pineapples in juice or water | No added sugar, in juice or water (water preferred) | 15 oz. | 2 |
| Soup (dry mix or prepared) | Bean (vegetarian), tomato, vegetable, chicken noodle, chicken rice | Low-sodium (sodium content should be less than 500 mg sodium per serving) | 20 oz. | 1 |
| Fresh Vegetables | Carrots, onions, broccoli, squash, string beans, tomatoes, avocados | Fresh | 10 pounds | 1 bag |
| Fresh Fruits | Apples, pears, stone fruit, oranges, cherries, grapes, bananas | Fresh | 10 pounds | 1 bag |
| **Meat/Protein** | | | | |
| Vegetarian beans, low-sodium | Black beans, pinto beans, lentils dried or canned. | If canned, should be less than 300 mg sodium per serving | 15 oz. | 3 |
| Peanut Butter | Peanut butter, peanuts | No sugar added, Unsalted nuts | 18 oz. | 1 |
| Tuna | Canned tuna, light, in water | Light, packed in water | 5 oz. | 2 |
| Pink salmon | Salmon | Light, packed in water | 14.5 oz. | 1 |
| Chicken | Canned chicken, light in water | Light, packed in water | 5 oz. | 2 |
| **Dairy/Dairy Substitutes** | | | | |
| UHT Milk | Nonfat or 1% fat milk | Nonfat or 1% fat milk | 1 qt. | 2 |

*References made available at the end of this document.*

# Appendix B

Manuscript: **Smith, S., *Malinak, D.*, Chang, J., Settlecowski, E., Rodriggs, T., Perez, S., Perez, M., Hsu, M., Abrew, A., & Aedo, S. Implementation of a food insecurity screening and referral**

## Abstract

Food insecurity is associated with many poor health outcomes yet is not routinely addressed in clinical settings. The purpose of this study was to implement a food insecurity screening and referral program in Student-run Free Clinics (SRFC) and to document the prevalence of food insecurity screening in this low-income patient population. All patients seen in three SRFC sites affiliated with one institution in San Diego, California were screened for food insecurity using the 6-item United States Department of Agriculture (USDA) Food Security Survey between January and July 2015 and referred to appropriate resources. The percentage of patients who were food insecure was calculated. The screening rate was 92.5% (430/463 patients), 74.0% (318/430) were food insecure, including 30.7% (132/430) with very low food security. A food insecurity registry and referral tracking system revealed that by January 2016, 201 participants were receiving monthly boxes of food onsite, 66 used an off-site food pantry, and 64 were enrolled in the Supplemental Nutrition Assistance Program (SNAP). It is possible to implement a food insecurity screening and referral program into SRFCs. The prevalence of food insecurity in this population was remarkably high yet remained largely unknown until this program was implemented. Other health care settings, particularly those with underserved patient populations, should consider implementing food insecurity screening and referral programs.

**Abbreviations:** AAP, American Academy of Pediatrics; ADA, American Diabetes Association; SNAP, Supplemental Nutrition Assistance Program; SRFC, Student-Run Free Clinic; SRFCP, Student-Run Free Clinic Project; UCSD, University of California San Diego; USDA, United States Department of Agriculture

## 1.   Introduction

Food insecurity is an "economic and social condition of limited or uncertain access to adequate food" (United States Department of Agriculture: Economic Research Service, 2016). The United States Department of Agriculture (USDA) further describes food insecurity as "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways" (Life Sciences Research Office & Anderson, 1990). There are various length survey instruments used by the USDA to measure food insecurity, which include a 10-item tool and an expanded 18-item tool utilized for households with children (United States Department of Agriculture Economic Research Se, Bickel et al., 2000). A 2014 population study surveying over 43,000 households utilizing the 10-or 18-item screen as indicated based on household members estimated that 14.0% of households, or a projected 48 million people in the United States, were food insecure (United States Department of Agriculture Economic Research Service, 2016). The prevalence of food insecurity is higher in households with children (19.2%) as well as those headed by Hispanics (22.4%), and Blacks (26.1%) (Coleman-Jensen et al., 2015). The highest prevalence of food insecurity is seen in households headed by single mothers (35.3%) (Coleman-Jensen et al., 2015). The American Academy of Pediatrics (AAP) recently released a policy statement "Promoting Food Security for All Children" (Council on Community Pediatrics, 2015). This statement urges clinicians to screen all children for food insecurity, not just those in underserved communities, as many middle class families are also vulnerable to food insecurity with small

changes in income ([Council on Community Pediatrics, 2015](#)). Appropriate referrals to food resources include local food pantries, Supplemental Nutrition Assistance Program (SNAP, formerly known as food stamps), Women Infants and Children (WIC), and free or reduced-price school lunch programs ([Council on Community Pediatrics, 2015](#)).

Adverse health consequences of inadequate access to food are apparent throughout the lifespan. Insufficient resources for food leads to individuals developing poor dietary habits and choosing less expensive, more filling, less healthy food options ([Drewnowski, 2010](#), [Rao et al., 2013](#)). Analyses of data from the National Health Examination and Nutrition Examination Survey (NHANES) reveal that food insecurity is associated with hypertension, hyperlipidemia, and diabetes ([Seligman et al., 2010](#), [Seligman et al., 2007](#)). Food insecurity is an independent risk factor for poor glycemic control in diabetes and nearly half of diabetics in safety-net clinics were food insecure ([Seligman et al., 2012](#)). The American Diabetes Association (ADA) recently added a section on managing food insecure patients to their Standards of Medical Care in Diabetes 2016 ([American Diabetes Association Standards of Medical Care in Diabetes, 2016](#)). The ADA described that patients with limited access to food are at risk for hyperglycemia as well as hypoglycemia, and recommended that providers seek local resources to help patients obtain nutritious foods ([American Diabetes Association Standards of Medical Care in Diabetes, 2016](#)). Feeding America, the nation's largest hunger relief agency, found that over two-thirds of their clients had to choose between paying for food or medical care within the last year ([Weinfield et al., 2014](#)). While health care providers do not routinely screen for food insecurity, most are willing to use a standardized screening instrument ([Hoisington et al., 2012](#)). Routine screening is an underutilized tool to address food insecurity, as food insecurity is often not readily apparent during clinical visits ([Hoisington et al., 2012](#)). In light of recent national guidelines changes, it is timely and pertinent for health care providers to consider systematically screening for food insecurity and referring to local resources in a broad range of settings, particularly those serving the underserved.

Student-run Free Clinics (SRFCs) are now present at over 75% of medical schools in the United States ([Smith et al., 2014a](#)). Like most SRFCs, the University of California San Diego (UCSD) Student-run Free Clinic Project (SRFCP) serves patients who are uninsured and unable to access care through the traditional health care safety-net. The UCSD SRFCP has previously been described in detail ([Beck, 2005](#), [Smith et al., 2014b](#)). All patients are screened for eligibility, do not qualify for other health care programs including Medicaid, and are unable to afford even the low sliding-scale fees of community health centers. Our patient population is largely Latino and monolingual Spanish speaking. The UCSD SRFCP includes an interdisciplinary team that routinely involves social workers and social work interns. However, we had not systematically assessed food security in our patients, nor made routine food resource referrals until this program began.

This study was conducted to implement a food insecurity screening and referral program within the UCSD SRFCP and document the prevalence of food insecurity in this patient population.

## 2. Methods

This cross-sectional food insecurity screening study was conducted from January through July 2015. Outcomes of referrals to appropriate resources were documented through January 2016.

## 2.1. Study population

We screened all patients over 18 years of age seen for a medical visit at the Downtown San Diego, Pacific Beach, and South East San Diego sites of the UCSD SRFCP. There were further no exclusion criteria.

## 2.2. Survey instrument and survey administration

We assessed food insecurity with the 6-item USDA US Household Food Security Survey, 30-day version (See Fig. 1) (United States Department of Agriculture Economic Research Se, Bickel et al., 2000). This tool is commonly used in research conducted on food insecurity in clinical settings (Seligman et al., 2012, Seligman et al., 2015, Moreno et al., 2015, Burkhardt et al., 2012). The 6-item survey has been found to be an acceptable alternative to the longer surveys as it correctly categorizes 97.7% of households when compared to the longer 10-item and 18-item formats (United States Department of Agriculture Economic Research Se, Bickel et al., 2000, Blumberg et al., 1999). The 6-item survey is intended to be filled out by an individual who represents the household, as the first four questions are constructed to ask about the household while the last two questions are targeted toward the individual (United States Department of Agriculture Economic Research Se, Bickel et al., 2000). Pre-health professional volunteer study coordinators handed surveys to patients immediately after check-in. The USDA provides this form in both English and Spanish and we offered surveys to patients in their preferred language. If patients expressed the need for assistance in filling out the form for any reason, including difficulty with literacy or vision, trained bilingual study volunteers offered assistance. Completed surveys were returned to study coordinators.



Fig. 1

United States Department of Agriculture (USDA) US Household Food Security Survey 6-item screening tool used for the University of California San Diego (UCSD) Student-run Free Clinic Project (SRFCP) food insecurity screening and referral program at three **...**

## 2.3. Scoring surveys

The USDA Food Security survey is scored on a scale of 0 to 6, with a score of 0–1 indicating high or marginal food security, 2–4 indicating low food security, and a score of 5–6 indicating very low food security (United States Department of Agriculture Economic Research Se, Bickel et al., 2000). High food security refers to individuals who have no food-access limitations. Marginal food security refers to those who often have anxiety over food shortages but do not tend to experience altered eating habits or diminished intake (United States Department of Agriculture Economic Research Se, Bickel et al., 2000). In contrast, low food security typically

describes individuals who have reduced variety or quality of diet without reduced food intake, while very low food security typically describes both reductions in variety or quality as well as food intake ([United States Department of Agriculture Economic Research Se](), [Bickel et al., 2000]()). Individuals with a score of 2–6 are considered to be food insecure according to USDA definitions ([United States Department of Agriculture Economic Research Se](), [Bickel et al., 2000]()).

## 2.4. Referrals

After study coordinators received completed food security surveys, they provided all patients with information regarding local food pantries based on their home addresses. Resources were provided even if participants were not currently food insecure, as food insecurity is often episodic. Study coordinators asked patients if they had any concerns, tried to decrease stigma associated with not having enough food, explored common barriers to utilizing food resources, including food pantries, and answered questions. Study volunteers then verbally assessed patients to determine if they met eligibility criteria for SNAP based on immigration status, family income, household size, and current government assistance. They provided information on applying for SNAP benefits, if eligible. To decrease barriers to SNAP application, the UCSD SRFCP partnered with the County of San Diego, Feeding San Diego, San Diego Hunger Coalition, and Third Avenue Charitable Organization to initiate a pilot program to allow for same-day SNAP enrollment onsite monthly, in addition to providing the traditional two-step application process onsite regularly. If patients had diabetes, they were also offered the opportunity to receive monthly food distributions onsite as part of a new program to provide diabetes-appropriate nutritious foods. A predetermined study outcome included assessing if any differences existed in the prevalence of food insecurity in patients with and without diabetes in this population. Diabetes status was confirmed by checking the Problem List of the Electronic Health Record.

## 2.5. Addressing food insecurity as part of routine medical visits on an individual and systems-based level

Brief educational sessions were offered for medical students, residents, and faculty on food insecurity, its impact on health, and the importance of screening and referral. During routine visits, trainees or faculty were informed of their patients' food insecurity screening results, asked to address access to food, then record food insecurity status and the referral plan in the Electronic Health Record. They were instructed how to add food insecurity to the Problem List and the medical note, including in the Assessment and Plan, to facilitate follow up at subsequent visits. During daily clinic announcements, medical students, attending physicians, interdisciplinary students and faculty, including social workers, were regularly reminded to address food insecurity during clinic visits. A secure online spreadsheet was created as a patient registry that allowed study volunteers to follow up on referrals on an individual and population-level. These volunteers followed up with patients at each subsequent medical visit to assess if patients had gone to food pantries or received SNAP benefits. They tried to identify perceived barriers and help continually encourage patients connect with available food resources. Study volunteers populated the registry manually after direct interaction with patients during each clinic.

## 2.6. Evaluation of food insecurity screening and referrals in health care as a public health intervention

We assessed this project using the reach, effectiveness, adoption, implementation, and maintenance (RE-AIM) framework (Glasgow et al., 1999). This framework is designed to capture data needed to enhance the quality and public health impact of efforts to translate research into practice (RE-AIM. Reach Effectiveness Adoption Implementation Maintenance, 2016).

## 2.7. Data analysis

We summarized patient demographics using descriptive statistics, including means and standard deviations for continuous variables, and percentages for categorical variables. We determined the percent of patients with food insecurity (USDA Food Security Survey score 2–6), low food security (score 2–4), and very low food security (score 5–6). We used the Chi-squared test to compare the categories of food security status between groups. We summarized the number of patients who had received food resources as tracked in the patient registry. We calculated the number of health care professionals present using course rosters and clinic schedules. The UCSD Institutional Review Board approved this project.

# 3. Results

## 3.1. Screening rate and patient demographics

We screened 92.5% (430/463) of all patients for food insecurity. No patients refused to participate, and all were able to complete the survey themselves or with assistance from pre-health professional volunteers in either English or Spanish. Patient demographics are listed in Table 1. The mean age was 51.2 (SD 11.4) years old. The majority of patients were Latinos (420/430; 97.7%). Non-Latinos included 7 Caucasians (1.6%), 2 Asians (0.5%), and 1 Black (0.2%). Most of the patients were female (318/430: 74.0%). Nearly half of patients had diabetes (208/430; 48.4%). There were no differences in age, gender, race, or diabetes status between the three clinic sites.
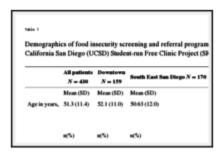


Table 1

Demographics of food insecurity screening and referral program participants at three sites of the University of California San Diego (UCSD) Student-run Free Clinic Project (SRFCP) from January–July 2015.

## 3.2. Food insecurity prevalence

When including all three sites, 74.0% (318/430) of UCSD SRFCP patients screened were food insecure, including 30.7% (132/430) who had very low food security (Table 2). The prevalence of food insecurity ranged from 65.9% (112/170) at the South East San Diego Elementary School site, to 72.3% (73/101) at the Pacific Beach site, and 83.6% (133/159) at the downtown San Diego clinic site (*p* < 0.001) (Table 2). A higher percentage of patients with diabetes were food insecure (82.7%; 172/208) than those without diabetes (65.7%; 146/222) (*p* < 0.001) (Table 2).
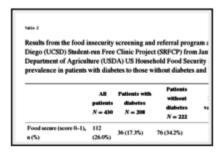


Table 2

Results from the food insecurity screening and referral program at three sites of the University of California San Diego (UCSD) Student-run Free Clinic Project (SRFCP) from January–July 2015. Utilizing the United States Department of Agriculture **...**

## 3.3. Utilization of local food resources and government assistance

Study coordinators documented that Feeding San Diego provided monthly boxes of nutritious foods onsite for 201 patients with diabetes, 66 patients had obtained food from an off-site food pantry, and 64 patients were receiving SNAP.

## 3.4. Health care providers

At least 112 medical students, 42 faculty physicians, 18 residents, 1 physician assistant, 2 social workers, 4 social work interns, 3 community health promoters participated in clinical care during the study time-frame and were encouraged to discuss food insecurity with their patients. Health care trainees and providers received food insecurity screening results for their patents, incorporated assessing access to food as a part of routine health care visits, documented food insecurity in the Electronic Health Record, and followed up on referrals at subsequent visits.

## 3.5. Program assessment and potential public health impact

The reach, effectiveness, adoption, implementation, and maintenance of this program were analyzed using the RE-AIM framework summarized in Table 3 (Glasgow et al., 1999, RE-AIM. Reach Effectiveness Adoption Implementation Mainten).
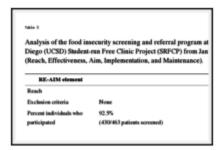
**Table 3**

Analysis of the food insecurity screening and referral program at three sites of the University of California San Diego (UCSD) Student-run Free Clinic Project (SRFCP) from January–July 2015 using the RE-AIM framework (Reach, Effectiveness, Aim, **...**

## 4. Discussion

This study documents the implementation of a food insecurity screening and referral program for low-income patients at three different SRFC sites. Nearly all patients were successfully screened for food insecurity over a 6-month period. Previous studies in underserved safety-net clinics have documented food insecurity prevalence as high as 46% (Seligman et al., 2012). Nearly three-quarters of patients in this study reported food insecurity, with the range of 66% to 83% within the three clinic sites. To the authors' knowledge, this is the highest prevalence of food insecurity documented in a primary care setting to date. This data suggests that food insecurity is likely quite prevalent in underserved settings. SRFCs may be serving a particularly disadvantaged population, yet national data on food insecurity indicate that this problem affects approximately one in six people in the general population, including over a third of single mothers (Coleman-Jensen et al., 2015).

This study highlights the importance of screening for food insecurity, particularly in underserved populations, as it is likely under-recognized, under-diagnosed, and under-treated. Even with the very high level of food insecurity seen in this population, UCSD SRFCP's clinic's history of routinely addressing social determinants of health, and the availability of social workers on site, food insecurity was not an issue often discussed during medical visits before the implementation of this project.

Awareness of food insecurity, its effects on health, and the need for screening is likely to increase with the recent release of the AAP policy statement on promoting food security (Council on Community Pediatrics, 2015). They highlight the need for advocacy and to focus on medical education to teach about the health consequences of food insecurity (Council on Community Pediatrics, 2015). Since the majority of medical students now participate in SRFCs during their education (Smith et al., 2014a), SRFCs may be an ideal setting in which students can be empowered to implement food insecurity screening and referral programs, alongside interdisciplinary partners.

Pediatric, Family Medicine, Internal Medicine, and Primary Care clerkships and residencies also provide excellent opportunities to educate future physicians regarding the importance of

screening for food insecurity and to role model these behaviors. Continuing Medical Education programs are needed to reach practicing physicians.

Screening for food insecurity takes little time and can be done by self-administered patient questionnaires. This study utilized the 6-item USDA survey that is often used in clinical research as it allows for documenting the severity of food insecurity, however an even shorter survey is available (Seligman et al., 2012, Hager et al., 2010). A simple two-item screening questionnaire is considered easiest for use in clinical practice and is commonly recommended as it has been shown to have a 97% sensitivity when compared with the longer USDA surveys (Hager et al., 2010). A positive response to either item is considered food insecure.

Physicians, dietitians, and nutritionists often counsel patients on the benefits of changing their diet to lose weight and improve control of their chronic health conditions. However, much of the advice, such as increasing fresh fruits and vegetables may be perceived as impractical for those who are most food insecure. Providers need to be educated on how to counsel patients to eat healthy foods on a limited budget and what resources are available. Social workers and community health workers may address food insecurity or other social determinants of health with patients as a result of screening conducted in a busy primary care setting (Page-Reeves et al., 2016). Electronic Medical Records can be used to trigger a reminder for screening and generate referrals.

The patient registry created as a result of this program allowed us to begin to follow not only food insecurity status, but if patients followed through with food pantry resources, and if they received SNAP benefits. We began a dialogue with patients to explore perceived barriers to visiting a food pantry or enrolling in government food assistance programs and attempted to address these barriers. However, utilization of off-site resources was still low. We are now partnering with Feeding San Diego to provide nutritious food distributions to all patients on-site at the UCSD SRFCP.

Recording food insecurity screening results into the medical record enabled us to address food insecurity as an ongoing issue in medical care. This project allowed nearly 200 health care providers and trainees to learn to address food insecurity. This is a skill that can be applied to initiate conversations regarding access to food, even when working in other inpatient or outpatient health care settings that do not include a systems-based approach to food insecurity.

Patients with diabetes had a higher prevalence of food insecurity than patients without diabetes in this study. Cyclic access to food has been linked to increased hospitalizations for hypoglycemia in the poor toward the end of the month as food supplies run out (Seligman et al., 2014). Many low-income households have varying access to food that changes based on number of hours worked or government assistance that is typically received at the beginning of each month. Patients are also often faced with the difficult decision of choosing to pay for food or medication in resource poor settings (Weinfield et al., 2014). Addressing food insecurity and other social determinants of health may one day become a part of the routine social history during medical visits as standard as assessing for alcohol, tobacco, or drug use.

This study has several limitations. Patient-administered surveys relied on self-report to assess food insecurity. Results may be inaccurate due to recall-bias, education-level, literacy barriers, influenced by shame, or preference not to discuss with a health care provider. However, we used the USDA 6-item survey to standardize our data with other large published data sets and

provided assistance to anyone requesting help. Although conducted at three separate clinic sites, all were SRFCs, in one city, affiliated with one institution in San Diego, California, with a predominantly Latino patient population. Similar food insecurity prevalence may not be found at other low-income clinics across the country. However, based on national data and current policy statements, it is likely that screening for food insecurity would be useful in other settings. We did not determine directionality or evaluate confounding factors with regard to the association between food insecurity and diabetes. Finally, we have not yet determined if patients are less food insecure as a result of this project. This remains an area for further inquiry.

Other future areas of study could include examining if the level of food insecurity is correlated with health outcomes in this population, assessing the impact of this program on medical student and provider knowledge, skill, attitudes, documentation, and referral patterns. Multi-institutional studies are needed to examine generalizability. However, presentation of this data has resulted in the implementation of additional food insecurity screening programs in other low-income clinics.

In conclusion, implementing food insecurity screening and referral programs can serve as a useful tool in determining and addressing food insecurity within a clinical setting. Systematic food insecurity screening and referrals should be considered in SRFCs, in other medical education settings, and more broadly in health care settings, particularly in underserved practices including community health centers who serve those most likely to be food insecure.

## Ethical approval

The University of California San Diego Institutional Review Board approved this project 141481.

*References made available at the end of this document.*

# Appendix C

Manuscript: **Smith, S.,** *Malinak, D.,* **Chang, J., Schultz, A., & Brownell, K. Educating Family Medicine Residents and Medical Students About Food Insecurity Modified Individual Clinical Practices and Systems-Level Changes. Academic Medicine. 2016, Jul**; **Pub Status: Accepted.**

## Abstract

Background and Objectives: Food insecurity is associated with poor health outcomes yet is not routinely addressed in healthcare. This study was conducted to determine if education regarding food insecurity as a health issue could modify knowledge, attitudes, and clinical behavior.

Methods: Educational sessions on food insecurity and its impact on health were conducted in 2015 at three different Family Medicine residency programs and one medical school. A pre/post survey was given immediately before and after this session. Attendees were encouraged to identify and implement individual and system-based changes to integrate food insecurity screening and referrals into their clinical practices. Participants completed follow up surveys approximately one year later and the authors obtained systems-level data from Electronic Health

Records and databases. Pre/post means (SD) were compared using t-tests.  The numbers of patients screened and referred were calculated.

Results: Eighty-five participants completed the pre/post survey during the educational sessions (51 medical students, 29 residents, 5 faculty). Self-reported knowledge of food insecurity, resources, and willingness to discuss with patients increased (p<0.0001 for all).  Each program identified a feasible systems-based change.  Follow up surveys demonstrated increased discussion of food insecurity during clinical visits and referrals to food resources.  Over 1600 patients were screened for food insecurity as a result of systems-based changes.

Conclusion: Educational interventions focused on the role of food insecurity in health can produce improvements in knowledge and attitudes towards addressing food insecurity, increase discussions with patients about food insecurity, and result in measurable patient and systems-level changes.

## Introduction

Food security means that all members of a household have access to enough food at all times to maintain an active and healthy life.[1] In contrast, food insecurity is defined as limited or uncertain access to nutritiously adequate food.[1,2] The United States Department of Agriculture (USDA) routinely measures household food security and differentiates food insecurity from hunger.[1] While hunger is a multifactorial physiologic experience of an individual, food insecurity refers to a household's impaired access to nutritious foods, which often coexists with unhealthy dietary habits.

Traditional images of people without access to sufficient nutritious foods may include underweight or malnourished individuals in developing countries, during episodic famine, in times of war, extreme poverty, or during the Great Depression.  However, in 2014 there were approximately 48 million food insecure people living in the United States (14% of the population) and the historical images of food insecurity generally do not apply here.[3] Episodic or chronic food insecurity in the U.S. and Canada does not typically result in readily recognizable clinical syndromes.

Physicians routinely counsel patients to eat a more healthy diet, including increasing the amount of fresh fruits and vegetables, without considering that these are the least affordable foods.[4] Low-income families would have to spend up to 70% of their monthly food budget on fruits and vegetables to follow the USDA recommended food plans.[5] Limited household food budgets practically ensure that families will have to choose energy-dense foods with low nutrient content.[6] Food insecurity is associated with many poor health outcomes throughout the lifespan.[7,8]  Food insecure individuals are more likely to have hypertension, hyperlipidemia, diabetes, depression, and suicidal ideation.[9-14]  Nearly half of patients with diabetes seeking care at low-income clinics were food insecure.[15]

Although medical education routinely teaches the importance of obtaining a social history, which sometimes includes a dietary history, we have not traditionally taught medical students, residents, or physicians to ask patients if they have enough food to eat, much less how to ask that sensitive question.[16] Patients are unlikely to bring up the inability to provide food for their

families due to shame, stigma, and social norms as this has not been an issue typically addressed in the health care setting. With providers and patients both unlikely to discuss food insecurity, this has been an under-recognized and under-treated issue in medical care.[17,18]

The American Academy of Pediatrics (AAP) released a policy statement in December 2015, urging practicing clinicians to screen all children for food insecurity.[8] The AAP specifically encouraged teaching medical students and residents to regularly screen for food insecurity. The American Diabetes Association (ADA) recently added a section on managing food insecure patients to their Standards of Medical Care in Diabetes 2016.[19] The ADA noted that patients with limited access to food are at risk for hypoglycemia as well as hyperglycemia, and recommended that clinicians seek local resources to help patients obtain nutritious foods.[19] Education on food insecurity has been demonstrated to increase pediatric resident identification of food insecurity.[20]

This study was conducted to determine if brief educational interventions on the physician's role in addressing food insecurity could improve awareness of food insecurity, its impact on health, and result in change in clinical practices.

## Methods

### Study population

The study population included Family Medicine residents and faculty from three residencies in San Diego County and medical students from the University of California San Diego (UCSD). UCSD Family Medicine Residency is based in an academic medical center, Scripps Chula Vista Family Medicine Residency is a community-based program affiliated with UCSD, and Family Health Centers of San Diego is a Teaching Health Center based in a Federally Qualified Health Center. The study also included medical students from the pre-clinical elective course associated with the UCSD Student-Run Free Clinic Project (SRFCP).[23] Participants included those who were present during protected resident or medical student didactic educational sessions.

### Survey design

We conducted a literature review and were unable to identify a well-validated survey instrument to meet our needs for measuring knowledge, skills, attitudes, or clinical practices in health care practitioners or trainees related to food insecurity. Faculty and medical students worked alongside a community-based hunger organization (San Diego Hunger Coalition) and a large food bank (Feeding San Diego) to become better informed on hunger issues in San Diego and best practices for food insecurity assessment and referrals. We then designed a survey instrument for use in this project. We had food insecurity experts to review this instrument, provide input, and help revise the survey. We pilot tested the survey with a small group of residents and finalized the Food Insecurity Survey for Health Professionals (FISHP) pre/post survey instrument used in this study (Table 1).

### Intervention

The authors created a 30-50 minute presentation that was delivered from January through July 2015 using a traditional lecture-based format, but also encouraged discussion throughout. Toward the end of the session, participants were asked to discuss how they might approach

addressing food insecurity in their clinical practice and what systems-based changes might be possible.

**Survey administration**

All faculty, residents, or medical students present at didactics were handed a paper survey at the beginning of the session. Participants completed the pre/post-survey immediately before and after the session and returned it the same day.

Approximately one year later, in June and July of 2016, residents and faculty were asked to fill out a final follow-up survey on paper during their routine educational half day to assess any lasting impact. We emailed a link to a web-based survey instrument to medical students as they were dispersed on clinical rotations. We contacted faculty members and representatives of health care systems to obtain information regarding systems-based program changes and number of patients screened or referred, if available.

**Data analysis**

Cronbach's alpha was determined for internal consistency. We calculated means and standard deviations for each survey item. For five point likert-scale items we determined the percentage of each response. Pre/post test scores were compared using t-tests. To assess systems-based changes we inquired with program leadership and queried Electronic Health Records (EHR) and registries used for tracking food insecurity screening or referrals, if available. Food insecurity screening tools included the USDA six-item food security survey that allows for classification of level of food insecurity and an abbreviated two-item survey that has been well validated and is considered easiest for use in clinical practice.[8,24,25] We calculated the total number of pounds and retail value of food distributed since the implementation of the new systems-based changes. Excel 14.2.5 (Microsoft Inc., Redmond, Washington) and SPSS 22.0 (IBM Armonk, New York) were used for all calculations The UCSD institutional review board certified this study as exempt.

## Results

There were 85 study participants (51 medical students, 29 residents, and 5 faculty members).

**Internal reliability**

Cronbach's alpha estimate for internal reliability for the pre-survey was 0.81 and 0.83 for the post-survey.

**Baseline data**

Before the educational sessions, 95.3% (81/85) of participants agreed or strongly agreed that it is important to assess low-income patients for food insecurity (81/85), 94.1% (80/85) of participants agreed or strongly agreed that it is important to refer low-income patients to food resources, and 89.4% (76/85) agreed or strongly agreed that food insecurity was relevant to their patient population (Table 2). However, only 17.7% (15/85) often or always asked their patients about food insecurity and 51.8% (44/85) had rarely or never asked their patients about food insecurity. Most had never or rarely referred their patients to a food bank (63/85; 74.1%) or to

Supplemental Nutritional Assistance Program (SNAP) which is referred to as CalFresh in California, and was formerly known as food stamps (64/85; 75.3%).

**Pre/post data (immediately before and after the educational sessions)**

Mean scores for each likert-scale item including knowledge of food insecurity, food resources, importance, relevance, and willingness to ask increased significantly from baseline to the immediate post-intervention survey (p<0.0001, Table 3). When examined separately based on level of training, each group had significant improvements, therefore data was reported as a group.

**One year follow up surveys**

Approximately one year after the initial survey, the response rate of initial participants was 75.9% (22/29) for residents, 100% (5/5) for faculty, and 25.5% (13/51) for medical students. Medical student data was not included in the one year follow up analysis due to low response rate. Baseline, immediate post intervention, and one year outcomes for residents and faculty are presented in Table 4. Self-reported knowledge regarding food insecurity remained improved one year later. Residents and faculty reported asking their patients about food insecurity and referring to appropriate resources more often.

**Individual and systems-level changes**

Each program was able to identify a systems-level change that seemed feasible and appropriate for their setting (Table 5).

At the UCSD SRFCP, a team of pre-health volunteers was recruited to assist with food insecurity screening that began in January 2015. This team successfully implemented a universal food insecurity screening and referral program using the USDA six-item screening tool, with a screening rate of 92.5% (430/456 patients seen had a food insecurity screening score recorded).[26] A detailed description of this food insecurity screening program including the reach, effectiveness, adoption, implementation, maintenance (RE-AIM) framework designed to enhance the quality and public health impact translating research into practice is available.[26] Two lead medical students collaborated with San Diego Hunger Coalition, Feeding San Diego, the County of San Diego, and Third Avenue Charitable Organization to implement a pilot same day on-site Cal-Fresh enrollment for hard to reach populations, including homeless individuals and families with mixed immigration status. This same-day enrollment program has resulted in over 150 individuals receiving Cal-Fresh benefits to date.[27] Pre-health volunteers, medical students, and faculty worked alongside San Diego Hunger Coalition and Feeding San Diego to create and implement a program that delivered monthly boxes of nutritious foods to over 200 diabetic patients on site at the free clinic sites and examined the impact of this intervention. Due to the success of the initial diabetes food box program, the clinics expanded into a clinic-based food pantry/food prescription model in July 2016 where all patients now receive fresh produce as well as healthy non-perishable items onsite free of charge as part of clinic visits. Over 100,000 pounds of food has been provided by Feeding San Diego to free clinic patients onsite as a result of this program, with a retail value of over $170,000.

One residency program decided in February 2015 that they wanted to implement a universal food insecurity screening and referral program as a residency quality improvement project. Residents

and faculty met with healthcare organization leadership and obtained approval to pilot this food insecurity screening program at their continuity clinic site. They successfully advocated for their home grown EHR to be modified to include a two-item food security screening tool that was successfully implemented in November 2015.[8,25] This two-item food insecurity screening questionnaire asks 1) "Within the past 12 months, we worried whether our food would run out before we got money to buy more" and 2) "Within the past 12 months, the food we bought just didn't last and we didn't have money to get more."[25] Response options include: often true, sometimes true, or never true. A positive response to either question is sensitive (97%) and specific (83%) for food insecurity and is therefore considered a positive screen.[25] Patients within the residency continuity clinic completed paper or verbal screenings after check-in. These forms were available in four languages. Medical assistants transferred results into the EHR. Positive screenings automatically generated an ICD-10 code for food insecurity in the EHR and created referrals for local food pantries and onsite CalFresh application. Query of the EHR revealed that 2720 patients were seen during the first year of food insecurity screening, 1196 had food insecurity screening results recorded (44.0%), and 229 referrals were generated from these screenings.

A second residency program identified that a form provided by the state of California for complete physical exams for patients on Medicaid (known as Medi-Cal in California) included several items related to food insecurity (such as "Are you easily able to get enough healthy food" and "Do you eat fruits and vegetables every day").[28] Rather than implement their own separate food insecurity screening, they agreed that residents and faculty would routinely review the items already included on this form, discuss food security with their patients, and refer to Cal-Fresh and local food resources when indicated. This led them to identify local food pantry resources, including a food pantry next door to their clinic. Medi-Cal surveys are routinely scanned into the EHR but are not easily queried, therefore we have been unable to quantify patient-level results in this program thus far. On-site CalFresh applications will soon be available in this network of community health centers.

The third residency program decided that initial food insecurity efforts should be made in the locations that serve the highest percentage of low-income patients, including two clinics and the inpatient Family Medicine service. Residents based out of a clinic serving people affected by homelessness stated they would routinely refer to on-site assistance for CalFresh applications as well as the on-site meal program. Residents obtained food pantry and CalFresh hand-outs for their other low-income clinic where neither on-site CalFresh application assistance nor social work assistance was available. Residents identified that routine nutrition assessments were being conducted on the Family Medicine inpatient service as part of a hospital wide program and suggested conducting food security screening at the same time. Nutritionists and dieticians from this program are working towards implementing food insecurity screening for inpatients. Out-stationed county workers are being trained to screen for CalFresh eligibility and enroll patients while they are admitted.

Following the success of these interventions, San Diego Hunger Coalition (including author AS) began other pilot projects to address food insecurity in healthcare with San Diego County Public Health and hospitals.[29] They engaged the Institute of Public Health at San Diego State University and the Hospital Association of San Diego and Imperial Counties to include food insecurity in the 2016 Community Health Needs Assessment for San Diego County.[30] This

assessment subsequently identified "food insecurity and access to healthy food" as the top priority in the social determinants of health to be addressed by hospitals and community collaborations.[30] Efforts are now underway to begin to address food insecurity throughout San Diego County in multiple health care systems.

## Discussion

Nearly all medical students, residents, and faculty who participated in this study felt it was important to address food insecurity with low-income patients at baseline. However, very few had assessed patients for food insecurity or made referrals. This study adds to the literature that demonstrates that health care professionals and trainees lack sufficient knowledge regarding the impact that food insecurity can have on health and their ability to address this issue with patients.[31]

Educational interventions increased knowledge regarding the importance of food insecurity and the ability of health care providers and trainees to make appropriate referrals. This also allowed medical students, residents, and faculty to reflect upon the role of food insecurity in their patient population, propose solutions that might work in their setting. Along with support from the authors as needed, they then implemented individual and systems-based changes that resulted in over 1600 patients being screened for food insecurity thus far and referred to appropriate resources when indicated.

This study describes several ways in which medical students, residents, faculty, and staff can work together with hunger-relief organizations and government agencies to identify the most appropriate methods to start addressing food insecurity in their health care systems. Hunger-relief advocacy organizations and food banks are natural partners for clinics and hospitals to approach to devise regional approaches to addressing food insecurity in healthcare. Many resources already exist for food assistance including the Special Supplemental Nutrition Program for Women Infants and Children (WIC), National School Lunch Program, Summer Food Service Program, SNAP, and a large network of food banks throughout the country.[12] Community gardens have also been implemented in an effort to increase access to healthy food. Best practices for referrals to food assistance in health care include providing resources on-site, including application assistance or co-locating a food pantry within a clinical setting, to overcome the many barriers to successfully obtaining food assistance.[29] Referrals to off-site resources is a step in the right direction but results in lower referral completion rates.[29]

This study demonstrates that trainees and faculty can easily learn the importance of food insecurity, identify ways in which they may change the systems in which they work, or change their approach to patients to address the fundamental need for adequate nutrition. Without asking patients if they have adequate access to nutritional foods, much of the counseling on dietary changes that we provide our patients is implausible.[5,6] Perhaps one day the Social History portion of a medical interview could be expanded to include routine questions regarding food security. This would allow providers not only to refer to appropriate resources, but also to counsel patients specifically on how to eat healthy while on a restricted budget.

Limitations of this study include that it was conducted in one county in California. However, it was conducted at three different residency programs representing university-based, university-affiliated, and teaching health center residency models as well as a medical student-run free

clinic. It is possible that a particular food insecurity champion was needed to ensure this intervention was effective, however a varying composition of leaders participated in each session and no one person was present for all sessions. Self-reported survey data may have inherent bias. However, we were also able to obtain objective numbers of patients screened or referred based on patient registries and EHRs, verifying systems-level changes. Finally, the response rate for medical students at one year was low since they had transitioned to clinical rotations. During the two years since the inception of this project, there has been an increase in awareness of food insecurity as a health issue nationwide with the release of the AAP position statement on food insecurity. It is not possible to separate the impact attributable to these interventions versus increased societal awareness.

Future areas of inquiry include examining the impact of food insecurity education in other settings including other medical schools and residency programs. Assessment of patient experience, success of referrals, and change in household food insecurity over time are important areas of further study.

## Conclusions

It is feasible to provide educational interventions addressing food insecurity for medical students, residents, and faculty that increase knowledge, self-efficacy, and create behavior change. Educational sessions on food insecurity and its impact on health can create a space for faculty and trainees to reflect on potential changes, and empower them to implement systems-level solutions. Universal food insecurity screening and referral programs can be successfully implemented in academic medical settings and low-income clinics. Medical educators, residents, and students have the opportunity to lead the effort to address a modifiable social determinant of health.

Ethical approval: The University of California San Diego Institutional Review Board approved this project.

## Tables and Figures

Table 1. Food Insecurity for Health Professionals (FISHP) pre/post survey instrument to measure baseline knowledge, attitudes, practices, and effects of an educational intervention on food insecurity and its effects on health.

|  | Strongly Disagree | Disagree | Neutral | Agree | Strongly Agree |
|---|---|---|---|---|---|
| I am knowledgeable about food insecurity and how it can adversely affect health |  |  |  |  |  |
| I am knowledgeable about referring patients to resources that address food insecurity (local food banks, food-stamp equivalent programs) |  |  |  |  |  |
| It is important to assess low-income patients for food insecurity |  |  |  |  |  |
| It is important to refer low-income patients to food resources |  |  |  |  |  |

| Food insecurity is relevant to my patient population | | | | | |
|---|---|---|---|---|---|
| | Never | Rarely | Some-times | Often | Always |
| I am willing to ask my patients about food insecurity | | | | | |
| Pre: I have asked my patients about food insecurity -> <br> Post: plan to ask | | | | | |
| Pre: I have referred my patients to a local food bank-> <br> Post: plan to refer | | | | | |
| Pre: I have referred my patients to CalFresh (food stamps)-> <br> Post: plan to refer | | | | | |

| | |
|---|---|
| Please estimate the percentage of: | |
| My patients who have food insecurity | ____% |
| Please estimate the number of patients: | |
| I have asked about food insecurity* | |
| I have referred to a local food bank* | |
| I have referred to CalFresh (food stamps)* | |

*These 3 items were asked on the pre survey and follow up data was not collected immediately on the post survey since these items assess a change in clinical practice.

Table 2.  Responses to the Food Insecurity Survey for Health Professionals (FISHP).  Baseline self-reported knowledge, attitudes, and clinical practices before brief educational sessions on food insecurity and its impact on health conducted at 3 Family Medicine residencies in San Diego and in a pre-clinical elective course at the University of California San Diego School of Medicine. 2015. (N= 85.  51 medical students, 29 residents, 5 faculty).

| | Disagree/ Strongly Disagree | Agree/ Strongly Agree |
|---|---|---|
| I am knowledgeable about food insecurity and how it can adversely affect health* | 15 (17.7%) | 47 (55.3%) |
| I am knowledgeable about referring patients to resources that address food insecurity (local food banks, food-stamp equivalent programs)* | 53 (62.4%) | 15 (17.6%) |
| It is important to assess low-income patients for food insecurity* | 0 (0%) | 81 (95.3%) |
| It is important to refer low-income patients to food resources * | 0 (0%) | 80 (94.1%) |
| Food insecurity is relevant to my patient population* | 0 (0%) | 76 (89.4%) |
| | Never/Rarely | Often/Always |
| I am willing to ask my patients about food insecurity[+] | 8 (9.4%) | 52 (61.2%) |
| I have asked my patients about food insecurity[+] | 44 (51.8%) | 15 (17.7%) |
| I have referred my patients to a local food bank[+] | 63 (74.1%) | 10 (11.7%) |
| I have referred my patients to CalFresh (food stamps)[+] | 64 (75.3%) | 4 (4.7%) |

Note that only items with responses recorded on a likert-scale are included in this table.
Responses were recorded on a five-point likert-scale.
* Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree
[+]Never, Rarely, Sometimes, Often, Always

Table 3.  Responses to the Food Insecurity Survey for Health Professionals (FISHP). Comparison of survey results immediately before and after brief educational sessions on food insecurity and its impact on health conducted at 3 Family Medicine residencies in San Diego and a pre-clinical elective course at the University of California San Diego School of Medicine. 2015. (N= 85.  51 medical students, 29 residents, 5 faculty).

| | Pre Mean (SD) | Post Mean (SD) | P value |
|---|---|---|---|
| I am knowledgeable about food insecurity and how it can adversely affect health* | 3.45 (0.95) | 4.48 (0.52) | <0.0001 |
| I am knowledgeable about referring patients to resources that address food insecurity (local food banks, food-stamp equivalent programs).* | 2.48 (1.02) | 4.31 (0.67) | <0.0001 |
| It is important to assess low-income patients for food insecurity * | 4.45 (0.59) | 4.89 (0.35) | <0.0001 |
| It is important to refer low-income patients to food resources * | 4.54 (0.61) | 4.91 (0.30) | <0.0001 |
| Food insecurity is relevant to my patient population* | 4.45 (0.65) | 4.92 (0.32) | <0.0001 |
| I am willing to ask my patients about food insecurity[+] | 3.73 (0.98) | 4.52 (0.63) | <0.0001 |
| I have asked my patients about food insecurity -> In post: plan to ask[+] | 2.52 (1.02) | 4.52 (0.65) | <0.0001 |
| I have referred my patients to a local food bank-> In post: plan to refer[+] | 1.83 (1.10) | 4.41 (0.76) | <0.0001 |
| I have referred my patients to CalFresh (food stamps)-> in post: plan to refer[+] | 1.72 (0.98) | 4.33 (0.82) | <0.0001 |
| Estimate of the % of my patients who have food insecurity | 47.3%(23.4) | 64.2%(22.4) | <0.0001 |

* Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree
+ Never, Rarely, Sometimes, Often, Always

Table 4. Responses to the Food Insecurity Survey for Health Professionals (FISHP). Comparison of survey results before, immediately after, and one year after a brief educational session on food insecurity and its impact on health conducted at 3 Family Medicine residencies in San Diego 2015 – 2016. (N= 34. 29 residents, 5 faculty).

| | Pre Mean | Immed. Post | P value (Pre vs | One year Post | P value (Pre vs |
|---|---|---|---|---|---|

|  | (SD) | Mean (SD) | Immed. post) | Mean (SD) | One year post) |
|---|---|---|---|---|---|
| I am knowledgeable about food insecurity and how it can adversely affect health* | 3.68 (1.01) | 4.65 (0.49) | <0.0001 | 4.31 (0.68) | 0.008 |
| I am knowledgeable about referring patients to resources that address food insecurity (local food banks, food-stamp equivalent programs).* | 2.56 (1.13) | 4.53 (0.51) | <0.0001 | 4.08 (0.80) | <0.0001 |
| It is important to assess low-income patients for food insecurity * | 4.41 (0.56) | 4.88 (0.33) | 0.005 | 4.62 (0.57) | 0.171 |
| It is important to refer low-income patients to food resources * | 4.53 (0.62) | 4.88 (0.33) | 0.011 | 4.69 (0.47) | 0.266 |
| Food insecurity is relevant to my patient population* | 4.41 (0.79) | 4.85 (0.44) | 0.0002 | 4.40 (0.82) | 0.859 |
| I am willing to ask my patients about food insecurity[+] | 3.74 (0.96) | 4.38 (0.65) | <0.0001 | n/a | n/a |
| I have asked my patients about food insecurity -> In post: plan to ask[+] | 2.56 (0.96) | 4.35 (0.69) | <0.0001 | 3.16 (1.19) | 0.045 |
| I have referred my patients to a local food bank-> In post: plan to refer[+] | 1.97 (1.14) | 4.21 (0.88) | <0.0001 | 3.08 (1.65) | 0.003 |
| I have referred my patients to CalFresh (food stamps)-> in post: plan to refer[+] | 1.79 (0.91) | 4.23 (0.78) | <0.0001 | 3.12 (1.66) | 0.0002 |
| Estimate of the % of my patients who have food insecurity | 37.1% (23.2) | 49.7% (24.9) | <0.0001 | 43.2% (29.9) | 0.323 |

\* Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree
+ Never, Rarely, Sometimes, Often, Always
Immed: Immediate
n/a: not asked

*References made available at the end of this document.*

# Appendix D

***"Student Spotlight"* Article for the UCSD Free Clinic Newsletter**

It was my first year of medical school that I started working at the UCSD Free Clinic. This was the year my white coat was still white, albeit crumpled, and the first time I tried doing doctor-like things. I learned

to nod in a knowledgeable sort of way, fooled myself into thinking I could multitask, and enthusiastically urged consumption of fruits and vegetables. This last recommendation (universally met with an unconvincing nod) was what became a focus of mine for the next three years.

What if I ate a bag of chips as my breakfast, lunch, and dinner? What if I ate lettuce with some butter on it before school? What if I had two dollars each day for food?

These were some of the scenarios that Free Clinic patients began relaying to me. How could I expect them to control their weight-associated diseases (diabetes, hypertension, arthritis...) when healthy food is so expensive, and my advice so unrealistic?

I set out to recruit a team of volunteers to survey the Free Clinic population for 'food insecurity' - that is, the condition of having inadequate or inconsistent access to quality food. Hundreds of Free Clinic patients turned up as being food insecure - potentially the highest percentage (75%) ever recorded in a U.S. clinical population, surprising us all.

Together with the generous backing of a local food bank, Feeding San Diego, we constructed a large-scale research study for two hundred patients with diabetes, providing monthly boxes of healthy foods with nutrition education classes. We soon found improvements in many parameters, including glucose control, weight, and depression. Similarly our patients impressed upon us their gratitude, leaving us with memories of kids hopping up and down as they received bags of apples with a tub of peanut butter, or a man yelling out from the back of an ambulance (which he was placed in due to the fact he was actively having a heart attack) fervently urging us to bring his food box inside the ambulance with him.

In reflection this project has had its challenges. Not least among them was learning to navigate the mercurial balance of supply and demand (on occasion having left from clinic driving with a thousand onions in my back seat, blinking through tears). Yet for me the Free Clinic became a place of innovation for a project that was pioneering, and something truly unique. We have since expanded our program to all patients, calling the food bags we distribute "food prescriptions". This phrase is intended to reinforce how food is medicine - a concept so fundamental it is easily forgotten.

More about the author: David Malinak is a fourth year medical student at UC San Diego and, in his spare time, enjoys singing songs that are too ambitiously high for him; occasionally they are sung for reluctantly listening friends and family. He is also writing a far-fetched fiction novel, and still nods knowledgeably from time to time, if less frequently than before.

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