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GENERATING STRATEGIES AND RECOMMENDATIONS FOR IMPLEMENTATION AND SUSTAINABILITY OF HEALTHCARE-BASED FOOD ASSISTANCE PROGRAMS: A MIXED METHODS ASSESSMENT

by

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DEDICATION

To Lee and Silas

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ABSTRACT

Background: Recognizing the connection between food insecurity and health, healthcare institutions in the past decade have begun to provide food assistance to patients. Healthcare-based food assistance programs have previously found positive impacts on food security, overall health, and healthcare spending. However, there is a lack of guidance on creating, staffing, and funding of healthcare-based food assistance programs, which is a significant barrier to the availability, accessibility, and continuation of this important resource for food insecure individuals. To address the evidence-practice gap, this dissertation sought to identify barriers and facilitators to implementation and sustainability of these programs.

Methods: First, to understand the landscape of healthcare-based food assistance programs in the United States, a scoping review of the peer-reviewed literature was completed and 42 articles regarding 35 healthcare-based food assistance programs were identified. Content analysis was used to extract programmatic information from each article. Program components were then analyzed using the constant comparative method in order create a typology of programs. Second, to investigate an exemplar healthcare-

based food assistance program, a sequential mixed methods approach, guided by the Practical, Robust Implementation and Sustainability Model (PRISM) framework, was used to evaluate the implementation and uptake of a community health center-based mobile market (MM). Data from semi-structured interviews with MM staff and participants (n=24), direct observations (n=4), and a quantitative dataset containing electronic medical record data with ICD-10 codes and demographic and attendance data collected at the MM (n=3,071 health center patients) were analyzed. Thematic analysis and multiple logistic regression were used to identify barriers and facilitators to MM use.

Results: The scoping review and typology indicate that implementation of healthcare-based food insecurity assistance programs is influenced by program goals, staffing, existence of willing community-based partners, and refrigeration and storage space. Participants reported that facilitators to use of a healthcare-based MM include financial need, simple registration processes, a centralized location, and comfort and familiarity with the health center; barriers to use include impaired mobility and lack of communication regarding MM dates. Analysis of medical record and MM attendance data indicate that cardiometabolic disease (e.g., type 2 diabetes and cardiovascular disease) is not associated with use of the MM.

Conclusion: Investment in healthcare-based food assistance programs can provide patients with needed support to improve food insecurity and maintain health. Healthcare institutions should aim to direct as much funding as possible to providing all food insecure patients, not just those with nutrition-related comorbidities, with either food or an increased ability to purchase food (e.g., financial assistance, food vouchers,

and federal food assistance program enrollment). To achieve this goal, healthcare institutions should consider: 1) maximizing benefits to patients while minimizing costs to the institution, 2) minimizing barriers to participation, 3) designing programs in line with their unique patient populations' needs, and 4) planning with sustainability in mind.

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LIST OF ABBREVIATIONS

BMI ..... Body Mass Index

CBO ..... Community-Based Organizations

CCI ..... Charlson Comorbidity Index

CHC ..... Community Health Centers

CHW ..... Community Health Worker

CSA ..... Community Supported Agriculture

EFNEP ..... Expanded Food and Nutrition Education Program

EMR ..... Electronic Medical Record

FMNP ..... Farmers Market Nutrition Program

FNS ..... Food and Nutrition Service

FQHC ..... Federally Qualified Health Center

FVRx ..... Fruit and Vegetable Prescription Program

GBFB ..... Greater Boston Food Bank

GLFHC ..... Greater Lawrence Family Health Center

MM ..... Mobile Market

PHQ-9 ..... Patient Health Questionnaire-9

PRISM ..... Practical, Robust Implementation and Sustainability Model

RCT ..... Randomized Controlled Trial

RD ..... Registered Dietitian

SDOH ..... Social Determinants of Health

SNAP ..... Supplemental Nutrition Assistance Program

SUD ..... Substance Use Disorder

US ..... United States

USDA..... United States Department of Agriculture

USPSTF ..... United States Preventative Services Task Force

WIC..... Special Supplemental Nutrition Program for Women, Infants, and Children

CHAPTER ONE: INTRODUCTION

A. Overview/Problem Statement

Food insecurity, defined as lacking consistent access to a sufficient quantity of food to live a healthful life,[1] impacts approximately one in eight Americans.[2] Low-income households are more likely to experience food insecurity than those with average incomes.[3] Evidence points to the connection between food insecurity and both negative health outcomes and increased health care costs.[4–8] While there are existing local, state, and federal programs to address food insecurity, many households continue to experience food insecurity. Recognizing this, in the past decade healthcare institutions in have begun to screen for food insecurity, and in some cases, provide resources to address the issue.

Food insecurity interventions in healthcare settings have included referrals to local resources;[9] assistance with enrolling in federal nutrition assistance programs;[10] partnerships with community-based organizations such as food banks,[11,12] clinic-based food pantries[13–15] and farmers markets;[16] provision of vouchers for local food vendors;[17,18] and home delivery of prepared meals.[19,20]

Food insecurity programs at healthcare institutions have previously found positive impacts on food security,[21] diet quality,[16,22–25] cardiometabolic biomarkers,[24] hospital admission and readmission rates,[26] and health care costs.[20] However, the US Preventative Services Task Force (USPSTF) has thus far declined to recommend that providers conduct food insecurity screening to identify patients in need of services, in part due to the challenges that institutions face in developing food insecurity alleviation interventions.[27] In 2021, the USPSTF suggested that "understanding the key elements to

improve adoption, implementation, and sustainability of effective interventions will be essential."[27] Creating, staffing, and funding interventions without guidance is a barrier to development and implementation of these vital programs.

Implementation guidance may be particularly important for community health centers (CHC), which are likely resource-constrained and may lack the capacity and resources to independently develop and implement such programs. These CHC provide care for predominantly low-income populations who are more likely to experience food insecurity.[28] Despite the challenges, their patient populations may benefit greatly from on-site food insecurity programs.

This dissertation aims to fill the research gap identified by the USPSTF and provides actionable guidance to healthcare institutions which identify food insecurity as a priority. This guidance pays close attention to the specialized needs of CHC to better assist them in screening and intervening to help their patients.

B. Research Questions and Specific Aims

To fill the research gap regarding implementation of food insecurity alleviation programs at healthcare institutions, this dissertation aims to answer the research question: "How can healthcare institutions intervene to improve food security for their patient populations?" To answer this research question, this dissertation has three aims:

Aim 1. Create a typology of healthcare-based food insecurity programs in the United States.

Aim 2. Undertake a mixed methods evaluation of a CHC-based produce mobile market designed to assist addressing food insecurity in Lawrence, Massachusetts.

Aim 3. Generate tailored, structured implementation guidance to healthcare institutions to create and sustain food insecurity programs.

C. Study Setting

While the dissertation, as a whole, aims to provide guidance to healthcare institutions located in the US, Aim 2 includes a mixed methods evaluation of a produce mobile market (MM) located at the Greater Lawrence Family Health Center (GLFHC) in Lawrence, Massachusetts. The MM has been running consistently for more than six years, since its implementation in 2016, and is now ingrained in both the health center and the Lawrence community. It is also a program that assists a particularly vulnerable community; GLFHC has and has previously found that more than half of their patients experience food insecurity. As such, a comprehensive evaluation of the MM, including a deep exploration of the intricacies of its implementation, can provide meaningful insights to future programs.

Lawrence, Massachusetts is a city of approximately 89,000 residents located in Merrimack Valley, 30 miles northwest of Boston.[29] More than 80% of Lawrence residents identify as Hispanic/Latino, and 80% of Lawrence residents speak a language other than English at home.[29] The median household income in Lawrence is $45,045, and 21% of residents live in poverty.[29] GLFHC serves as the primary source of health care for more than three-quarters of Lawrence's population[30] including the 7% of Lawrence residents who are uninsured.[29] In addition to state and federal nutrition programs, there is a regional food bank and multiple food pantries and soup kitchens available for residents of Lawrence. Language barriers, immigration status, and insurance status of Lawrence

residents all influence the complexity of obtaining government resources and services.

The MM is a partnership between the Greater Boston Food Bank (GBFB) and GLFHC. Since 2016, the MM has provided 20–30 pounds of produce monthly (approximately 6–8 produce items) to health center patients and community members. The MM takes place in a parking lot at the GLFHC for a two-hour period one Saturday per month. The GBFB obtains the produce from food industry (e.g., retailers, distributors, and farmers, etc.), donations, and the Massachusetts Emergency Food Assistance Program. Food is delivered in pallets, and MM volunteers divide the food into piles for each family. While there is a registration process for the MM, there are no eligibility requirements to obtain food from the market; anyone who attends may receive food.

D. Research Translation: Contribution to Public Health Practice

Food insecurity alleviation programs at HCI have the potential to provide food and food-related support services directly to their patients. Provision of food not only impacts dietary intake and alleviates hunger,[31] but also can free up a household's food dollars to be spent on other necessities, such as housing, transportation, utilities, or medications.[32] Healthcare-based food insecurity programs are likely to be more successful if they are consistent and sustainable.

This dissertation provides structured, evidence-based implementation guidance to healthcare institutions that intend to provide food assistance to their patient populations. To support decision-makers and implementers in these institutions, this dissertation first creates a typology of intervention components, which delineates options and decision points in the creation and implementation process, that can be used to develop an

impactful food insecurity program. Next, the dissertation evaluates a free produce market program via a case study to more deeply explore intricate details and implementation strategies that can provide insight into the process of integrating a sustainable food insecurity program into healthcare institutions. Finally, using findings from both the typology and the case study, this creates implementation recommendations and guidance for healthcare institutions to use in developing their own food insecurity programming. Table 1 describes the public health products created as a result of this dissertation.

Table 1. Summary of Public Health Products.

Deliverable	**Explanation**
Typology of Food Insecurity Programs at Healthcare Centers	A typology of intervention and implementation components and strategies that can be combined to meet the needs of healthcare institutions.
Implementation Recommendations and Guidelines	Recommendations for healthcare institutions to use in developing and implementing food insecurity programming.
Peer-Reviewed Manuscripts	One manuscript each from Aim 1, Aim 2, and Aim 3 to be submitted to peer-reviewed publications. The manuscript from Aim 1 are the scoping review and typology. The manuscript from Aim 2 is results of the mixed methods evaluation. The manuscript from Aim 3 is an editorial with recommendations for healthcare institutions.

E. Overview of Dissertation Chapters

Chapter 2 presents detailed information regarding the state of food insecurity in the US, including the scope, burden, and populations at highest risk. This is followed by a discussion of the impacts of food insecurity on health and health care utilization, and federal and local programs currently in place to address the issue. The chapter concludes with a detailed discussion of the peer-reviewed literature on food insecurity screening and intervention programs located in healthcare institutions.

Chapter 3 contains detailed information on the design and methodology to answer the research questions of this dissertation. The chapter is organized by an overview of the research question and study aims, followed by a discussion of the conceptual framework used to guide the approach, data collection processes and tools used to answer the research questions, analytic approach for the data, and strengths and limitations of the approach.

Chapter 4 continues the literature review with a scoping review of food insecurity alleviation programs since 2010 in the US. Using the results of the scoping review, we present a typology of intervention components that can be utilized by implementers at HCI to create context-specific food insecurity alleviation programs.

Chapter 5 presents the results of the mixed methods evaluation of the GLFHC MM. The chapter provides results of both the quantitative and qualitative data analysis. Qualitative data includes both direct observation of the MM and the food insecurity screening and referral process at GLFHC, as well as key informant interviews of GLFHC staff and community members with familiarity of the MM. This chapter will advance public health practice by deeply exploring perspectives of mobile market staff and participants and understanding barriers and facilitators of program uptake.

Chapter 6 provides practice recommendations that build on findings from the scoping review, typology, and qualitative and quantitative findings presented in Chapters 4 and 5. Practice recommendations provided in this chapter should advance public health practice by providing program development and implementation guidance for future implementers in healthcare institutions.

CHAPTER TWO: BACKGROUND AND LITERATURE REVIEW

A. Chapter Overview

This chapter presents detailed information regarding the state of food insecurity in the US, including the scope, burden, and populations at highest risk. This is followed by a discussion of the impacts of food insecurity on health and health care utilization, and federal and local programs currently in place to address the issue. The chapter concludes with a detailed discussion of the peer-reviewed literature on food insecurity screening and intervention programs located in healthcare institutions.

B. Overview of Food Insecurity

Food insecurity is defined as lacking enough food for a healthy, active life for all members of the household.[33] Households, defined as all persons routinely living in the dwelling as a principal residence,[34] are considered to have very low food security when one or more household members experience disrupted eating patterns or reduced food intake due to limited financial or food resources.[33] While they are related, hunger and food insecurity differ: food insecurity is an economic condition of inadequate access to healthy food, while hunger is the physiological condition that can result from experiencing food insecurity.[35] The United States Department of Agriculture (USDA) delineates four categories of food security, which are listed with their respective definitions in Table 2.

Table 2. USDA Levels of Food Security.

Level of Food Security	Definition
High	No reported indications of food-access problems or limitations
Marginal	One or two reported indications—typically of anxiety over food sufficiency or shortage of food in the house. Little or no indication of changes in diets or food intake.
Low	Reports of reduced quality, variety, or desirability of diet. Little or no indication of reduced food intake.
Very Low	Reports of multiple indications of disrupted eating patterns and reduced food intake.

Source: U.S. Department of Agriculture Economic Research Service. https://www.ers.usda.gov/topics/food-nutrition-assistance/food-security-in-the-u-s/definitions-of-food-security/

While the levels of food security defined by the USDA in Table 2 above are important to consider on an individual basis, most of the research on the topic has focused on a binary measure of food insecurity; families either do or do not experience food insecurity at a given time, based on a food insecurity screen. For clarity, the remainder of this chapter and dissertation will utilize this binary definition, combining all levels of food insecurity into one, unless otherwise specified.

Contributions to and Causes of Food Insecurity

Food insecurity is highly correlated to financial insecurity; Americans living in poverty and with insufficient financial resources are more likely to experience food insecurity than those who are not.[36] Upstream causes of financial insecurity include income inequality, an inadequate social safety net, and structural racism.[36,37] Housing instability is also correlated with food insecurity.[38]

Food insecurity is not a stable household characteristic; households often vacillate between food security and insecurity.[39] Life events, such as loss of a job, unexpected

medical or other expenses, or loss of stable housing often precipitate a change in food security status.[40] This was perhaps best exemplified in 2020 during the first wave of the COVID-19 pandemic, when rates of food insecurity rose rapidly due to economic shutdowns, but decreased when the wave subsided.[41]

Scope and Burden of Food Insecurity in the US

In 2021 the most recent year in which comprehensive data is available, 13.5 million (10.2%) US households experienced food insecurity for at least some part of the year.[42] Of these, 5.1 million households (3.8% of all US households) experienced very low food security.[42] While the COVID-19 pandemic began in the US in 2020 and spring shutdowns impacted food insecurity in the short-term,[41] the prevalence of food insecurity across the US was unchanged from 2019 to 2020, and decreased slightly between 2020 and 2021.[33,42] This may be due to a limitation in the way this data is collected and reported; households are considered food insecure if they experienced food insecurity at *any time* during 2020, but the data does not capture the length or number of times they experienced food insecurity.

There are significant disparities in food insecurity rates in the US. While only 7.0% of White non-Hispanic households experienced food insecurity in 2021, this is in contrast to rates of 19.8% in Black non-Hispanic households and 16.2% among Hispanic households.[42] In addition, higher than average prevalence of food insecurity was found in households headed by a single woman (24.3%) or man (16.2%), households with children (12.5%), and households with incomes below 185 percent of the federal poverty level (26.5%).[42]

Often, adults in food insecure households with children will first alter their own dietary intake to shield children from nutritional impacts.[43] However, alarmingly, in 2021, 274,000 households with children (0.7%) experienced such low food security that parents reported that their children experienced hunger, did not eat for a whole day, or skipped a meal because of lack of financial or food resources.[33] There is seasonality associated with food insecurity and hunger as well: children experience higher rates of both during the summer months when they do not have access to free and reduced-price school lunch.[44]

C. Impact of Food Insecurity on Health

Food Insecurity and Diet

Food insecure households spend fewer dollars on food,[33] purchase fewer calories overall, and purchase foods with lower nutritional quality than food secure households.[45] In addition, food insecure households spend 20% of their food dollars at convenience stores, compared to only 10% in food secure households.[45] For contrast, food secure households spend more food dollars at grocery stores, supermarkets and club stores (e.g., Sam's Club, Costco, etc.).[45] As convenience stores often have unhealthier food overall than other food retailers, this difference may contribute to differences in diet quality. While there has been a focus on improving the food retail environment in food deserts – areas with low access to supermarkets or large grocery stores[46] – increasing availability of healthier foods in these neighborhoods has not been found to improve dietary intake among food insecure residents.[47]

Multiple studies have found that food insecurity is associated with a lower diet

quality among children,[48] adults,[49] and seniors.[50] Findings indicate that, on the whole, food insecure individuals consume fewer vegetables, fruits, seafood, and plant protein; and more sugar-sweetened beverages, red and processed meats, high-fat dairy, and salty snacks.[48,49,51] Studies have not found a relationship between consistency and frequency of eating home-prepared meals and food insecurity.[52] However, households experiencing financial strain are more likely to consume foods from chain restaurants, which often sell ultra-processed and unhealthy foods.[53]

Food Insecurity and Chronic Disease

Food insecurity is associated with higher prevalence of chronic disease in adults, such as obesity,[47,54] type 2 diabetes,[55–57] hypertension,[55,56] arthritis,[56] obstructive airway disease,[8,55] and depression.[58,59] While some of the relationship between food insecurity and cardiometabolic disease, such as diabetes and hypertension, can be explained in part by its impact on obesity, the relationship persists in studies that control for weight.[60] There are multiple theories on contributing factors which may influence the relationship between food insecurity and chronic disease development, which are described below.

The periodic nature of financial and food insecurity among low-income individuals is also theorized to impact development of chronic disease. The amount of stocked food and portion sizes in food-insecure households often varies throughout the month, as families draw down dollars from paychecks or federal food assistance programs.[61,62] This can impact nutritional quality and quantity of foods consumed. Cyclical restriction of foods is associated with consumption of energy-dense, rather than nutrient-dense, foods, and people who anticipate future food insufficiency may

overconsume in anticipation.[63] This, combined with the ability to pay for chronic disease-related medications, can impact not only development of chronic disease but also its management.

Additionally, other social determinants of health (SDOH) are related to food insecurity and exacerbate chronic disease. These include the financial resources to pay for medication, lack of quality and continuous health insurance, lack of social support, experiences of structural and systemic racism, and exposure to environmental pollutants and toxins.[60,64] In particular, elevated measures of allostatic load, the physiological consequences of chronic stress due to negative life experiences, including the experiences of systemic racism and poverty, are associated with chronic disease.[65] A recent study of adults over 50 in the US found that adults with food insecurity had increased measures of allostatic load,[66] and allostatic load is theorized to contribute to development of chronic disease among those with food insecurity.[65]

Food Insecurity and Health Care Utilization

Food insecurity is associated with increased health care utilization, including outpatient, inpatient, and emergency department visits.[67–69] This increased use is likely multifactorial. Food insecure households are more likely to have less access to routine care, which can increase reliance on emergency departments for care.[70] Additionally, food insecurity exacerbates the other health-related difficulties that those with chronic conditions experience.[57] For example, people experiencing food insecurity who have insulin-managed diabetes report instances of erratic blood glucose levels, often related to the inability to purchase food.[4,71]

Food Insecurity and Children's Health

Household food insecurity has similarly detrimental impacts on children's health; children from food insecure households are more likely to be in fair or poor health than those with food security.[8] Children in food insecure households experience higher rates of acute and chronic diseases such as asthma,[8,72] upper respiratory infections,[73] stomachaches,[73] headaches,[73] and iron-deficiency anemia.[73] They also have higher rates of depression,[8,72] anxiety,[8] aggressive behavior,[8] and suicidal ideation.[8] These children experience missed medical care on more occasions than children from food secure households,[72] and, like adults, have higher rates of emergency department use[72] and hospitalizations,[73] compared to their food secure counterparts.

Household food insecurity also impacts a child's social and emotional development and psychosocial functioning. Young children from food insecure households score poorer on cognitive assessments[74] and tests of mental proficiency.[75] School-aged children experience higher rates of hyperactivity;[76] inattention;[76] have decreased non-cognitive skill development, such as self-control and interpersonal relations;[77] and experience poorer academic performance, including reading and arithmetic scores.[78] They also have higher rates of chronic absenteeism from school.[73]

Food Insecurity and Healthcare Costs

Beyond the burden of health problems, addressing food insecurity could reduce costs to larger health care system, as food insecurity is associated with increased health care costs.[67] Studies have found that food insecurity increases health care costs of older adults by 11–24%,[56,68] and health care expenditures among food insecure adults have

been found to be $1,834 more per year than adults with food security.[79]

D. Current Approaches to Improving Food Security

Federal Food Assistance Programs

There are 12 federal food federal food assistance programs in the US, listed in Table 3.[80,81] Some programs focus on specific high-risk populations, such as children and seniors, while others target all low-income eligible populations.

Table 3. Federal Food Assistance Programs.

Program	Brief Description
Financial Assistance Programs	
Supplemental Nutrition Assistance Program (SNAP)	Provides financial assistance to purchase food to all eligible households.
Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)	Provides federal grants to states for supplemental foods, health care referrals, and nutrition education for low-income pregnant, breastfeeding, and non-breastfeeding postpartum women, and to infants and children up to age 5 who are found to be at nutritional risk.
Farmers Market Nutrition Program (FMNP)	Provides eligible WIC participants with coupons in addition to their regular WIC benefits. These coupons can be used to buy eligible foods from farmers, farmers' markets or roadside stands that have been approved by the state agency to accept FMNP coupons.
Seniors Farmers' Market Nutrition Program	Provides low-income seniors with coupons that can be exchanged for eligible goods at farmers' markets, roadside stands, and community supported agriculture (CSA) programs.
Child Nutrition Programs	
Summer Food Service Program	Reimburses program operators who serve free healthy meals and snacks to children and teens in low-income areas in summer months.
National School Lunch Program	Provides nutritionally balanced, low-cost or free lunches to children each school day
National School Breakfast Program	Provides reimbursement to states to operate nonprofit breakfast programs in schools and residential childcare institutions.

Special Milk Program	Provides milk to children in schools and childcare institutions who do not participate in other federal meal service programs. Schools in the National School Lunch or School Breakfast Programs may also participate in the Special Milk Program to provide milk to children in half-day pre-kindergarten and kindergarten programs where children do not have access to the school meal programs.
Child and Adult Care Food Program	Provides reimbursements for nutritious meals and snacks to eligible children and adults who are enrolled for care at participating childcare centers, day care homes, and adult day care centers.
Food Distribution Programs	
Commodity Supplemental Food Program	Provides supplemental USDA foods to low-income seniors. Food packages do not provide a complete diet but are good sources of the nutrients typically lacking in the diets of the beneficiary population.
Food Distribution Program on Indian Reservation	Provides commodity foods to low-income households on Indian reservations, and to Native American families residing in designated areas near reservations.
The Emergency Food Assistance Program	Supplements diets of eligible, low-income Americans by providing emergency food and nutrition assistance.

Source: USDA Food and Nutrition Service. https://www.fns.usda.gov/programs

While all federal programs provide food assistance in some way, the emphasis in this chapter and dissertation is on SNAP and WIC because these programs are most utilized by healthcare institutions in food insecurity programming.

SNAP and WIC

The largest federal food assistance program in the US is the Supplemental Nutrition Assistance Program (SNAP), formally known as "Food Stamps."[80] SNAP is administered by the USDA Food and Nutrition Service (FNS). Approximately 41.5 million Americans (21.8 million households) (12.5%) receive SNAP benefits each year.[82] In 2021, 42.0% of households with food insecurity received SNAP benefits.[42] Unfortunately, all food insecure households are not eligible for SNAP. To be eligible to

receive SNAP, households must have gross incomes under 130 percent of the federal poverty level and have no more than $2,500 in savings.[83] Non-citizens are eligible for SNAP, but undocumented non-citizens are not.[83] SNAP also has work requirements for most households.[83] SNAP households receive different allotments based on family income and size; a family of four residing in the continental US can receive up to $835 per month in SNAP benefits.[83]

Uptake of SNAP among eligible households across the US is relatively high, with 82% nationwide enrolled.[84] Barriers to uptake of SNAP include lengthy and complex application processes, strict verification and recertification standards, stigma, lack of knowledge about the program or application process, and working full-time during non-traditional hours.[85] Latin American immigrant families, in particular, report fear of repercussion, such as military conscription, college aid ineligibility, and child removal, as well as fear that undocumented family members may be reported to the government.[86]

Another national safety net program, the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), provides food vouchers and nutrition education to pregnant women and parents of children up to age five. While WIC has income eligibility limits, immigration authorization is not required for participation.[86] In 2021, 8.2% of women and children residing in food-insecure households received WIC food vouchers.[42] In contrast to SNAP, which does not prescribe the types of foods that recipients can purchase, WIC provides coupons for pre-specified, healthful items, such as milk, breakfast cereal, juice, cheese, eggs, whole wheat bread, canned fish, and legumes.[87] In addition, families receive $8–11 in cash vouchers for fresh fruits and

vegetables, though there is legislation pending to increase this in 2022.[87] Parents of infants who formula-feed can also receive formula.[87] However, some families decide to forego participation due to the lengthy process required to maintain services, such as routine paperwork and in-person or remote visits with a nutritionist.[88]

Local Food Assistance Programs

Charitable food assistance programs, such as food banks and pantries, are local resources which families can utilize to meet nutritional needs. These programs serve low-income and food insecure families, and families often utilize charitable food assistance when their federal benefits are running low.[89] The size and scope of these programs varies widely, from once-weekly soup kitchens located in houses of worship to large regional food banks. Regional food banks receive federal funding and food products, which they distribute to smaller, local food pantries.[90] National nonprofit organizations, such as Meals on Wheels, which delivers meals to seniors in their homes, have local arms which work directly in the community.[91]

Use of food pantries is associated with improved diet quality.[92] However, these programs are underutilized.[93] Noted barriers to uptake of charitable food assistance programs in the US include long lines, food quality, and belief that programs are for those with greater need.[93] On the other hand, individuals with stronger social ties and neighborhoods with higher social cohesion are more likely to coordinate and share strategies to utilize these programs.[37]

Food Insecurity Programs within Healthcare Institutions

Despite existing federal and local community programs to address food insecurity, the need remains. In the past decade, healthcare institutions, recognizing a clear connection between food insecurity and negative health outcomes and increased health care costs,[4–8] have implemented interventions to address the issue.

Healthcare institutions have implemented programs that include screening for food insecurity and have developed multiple pathways for connecting patients to food resources. These pathways include referrals to federal, state, and local resources; partnerships with community-based organizations (CBO) to provide programming specifically for an institution's patients; or on-site provision of food. Even with these protocols in place, addressing food insecurity in a healthcare institution can be challenging because of time constraints,[94,95] administrative burden,[94] clinicians' and providers' lack of awareness of both the prevalence of food insecurity in a clinic's patient population and available resources,[95,96] staff discomfort discussing food insecurity with patients,[96] and staff fear of stigmatizing patients.[94,96] Detailed descriptions of common elements of food insecurity programs at healthcare institutions are delineated below.

Identification of Healthcare Patients in Need of Services

Food insecurity is a social determinant of health (SDOH), which are "conditions in the places where people live, learn, work, and play that affect a wide range of health and quality-of-life risks and outcomes."[97] SDOH can include a patient's housing, transportation, ability to pay for utilities, food security, interpersonal violence, financial stability, and education.[27] Over the past decade, many healthcare institutions have begun

to screen for SDOH, including food insecurity, often during primary care or well-child visits. Screening practices vary in how the process is conducted and documented. For example, some practices use a paper screener, while others embed the screen directly into the electronic medical record (EMR). While some sites have participants fill out the screen on their own in the waiting room, others have medical assistants or other clinic staff administer the screen.

SDOH screening, while not a universally established practice, is important to the health and well-being of patients. Surveys of patients and providers in practices where SDOH screening has been implemented report positive experiences. For example, patients report that they believe SDOH screening during health care visits is acceptable, important, and relevant to health.[98] It also makes patients feel that their practice cares about them.[99] Surveys of primary care providers find that they are comfortable providing care for patients with SDOH needs, and believe it is their responsibility to refer to resources.[100] The act of screening itself allows patients space to disclose any difficulties accessing food, and providers report patients express relief to be able to discuss the issue and receive services.[101] Providers report that, prior to learning about and implementing SDOH screening, they made assumptions about patients' SDOH needs based on contextual disclosures, and therefore were unable to identify all patients in need.[102] Due to the sensitive nature of SDOH, patients and providers report that a patient-centered approach that includes privacy protections and use of staff trained to show empathy is important.[98]

Similarly, patients whose providers specifically screen for and intervene on food insecurity report appreciation that their providers care about them, use their provider's office as their usual source of care, and rate their perceived quality of care highly.[99,103] Perhaps most importantly, screening and intervention for food insecurity in healthcare institutions can tangibly improve patients' access to food. Randomized controlled trials (RCT) have found that patients who are screened for food insecurity are more likely to receive food assistance referrals from providers.[19]

There are, however, barriers to effectively implementing screening practices consistently in health care settings. Providers often do not feel equipped to provide effective referral or intervention services, and feel that there are insufficient programs to which they can refer patients.[100,104] Thus, they do not feel that implementing a screening program would be efficacious.[95]

The most frequently used food insecurity screen is the Hunger Vital Sign, a brief two-item questionnaire that has been found to quickly and reliably identify households with individuals of all ages at risk of food insecurity.[105–107] The Hunger Vital Sign consists of the following two questions:

1) In the past 12 months, [my household and I] worried whether our food would run out before we got money to buy more.
2) In the past 12 months, the food [my household and I] bought just didn't last and we didn't have money to get more.

In addition to the Hunger Vital Sign, the USDA has created culturally- and age-specific food security surveys, in both 18- and 6-item forms.[108] These have been used less frequently due to their length, but are still in use in some research settings.

Connecting Patients in Need to Services

Once patients with food insecurity have been identified through screening, many healthcare institutions and providers connect or refer patients to resources. This can include passive information dissemination, warm hand-offs, care navigation, and direct provision of food.

One of the most common referral processes healthcare institutions utilize is providing printed materials that list federal, state, and local resources to patients who screen positive for food insecurity. Patients report that receiving a list of local community organizations, including food bank locations and farmer's markets, is acceptable.[99] Patients also report interest in receiving information regarding farmer's market locations and nutritionist referrals.[99]

While providing a list of resources is a low-effort intervention, ensuring that patients are connected to these resources is challenging. For example, an RCT of an SDOH screening and resource list intervention in pediatric clinics at community health centers found that only 65% of participants contacted a community resource and only 39% had enrolled in a new resource one year after receiving the handout.[9] As patients who experience food insecurity are in need of more immediate and impactful food resources, this intervention has limited value as it requires patients to take additional initiative and action. A more robust intervention is often more likely to be successful.

Care navigation (also referred to as patient navigation) is a more intensive approach to referral, in which a staff member provides an array of hands-on services to assist patients with obtaining resources. This may include a warm hand-off to a CBO or

help applying for federal food assistance programs such as SNAP. An RCT evaluating care navigation services compared to resource handouts found that participants receiving care navigation had significantly fewer social needs after intervention than participants who received the handout.[109] There are also a variety of technological innovations, like online platforms that provide closed-loop referrals for patients with social needs, including food insecurity. Examples of such platforms include Unite Us, NowPow, and Find Help. With these systems, referrals are sent from healthcare institutions directly to CBO; providers can monitor the referral to ensure the connection has been made. A benefit of these services is that they aim to continually update contact information for CBO, increasing the likelihood that a patient is actually connected to a target program and alleviating some administrative burden on individual healthcare institutions.[110]

Direct Support

Rather than refer to external CBO and federal programs, some healthcare institutions choose to offer food provision programming tailored specifically for their patients. One approach involves partnering directly with a CBO to create a program that provides an institution's patients with food resources, such as groceries or financial assistance. For example, a health center in upstate New York partnered with a local food access CBO to implement a program in which patients received free produce vouchers to use at the CBO's mobile produce market.[111] Participants who received the vouchers experienced a small decrease in weight.[111] Alternatively, some institutions implement on-site food pantries for patients, which patients report improve food security and financial stability[21,112] However, space and refrigeration constraints make this type of program

logistically difficult. Other program models include home delivery of medically-tailored meals and partnerships with farmer's markets.[19]

CHAPTER THREE: RESEARCH METHODOLOGY

A. Chapter Overview

This chapter contains detailed information on the design and methodology used to answer the research questions of the dissertation. The chapter is organized by an overview of the research question and study aims, followed by a discussion of the conceptual framework used to guide the approach, data collection processes and tools used to answer the research questions, analytic approach for the data, and strengths and limitations of the approach.

B. Research Question and Study Aims

The primary research question of this dissertation is: "How can healthcare institutions intervene to improve food security for their patient populations?" Three aims were created to answer the research question:

The goal of Aim 1 is to create a typology of healthcare-based food assistance programs in the United States. To accomplish this aim, a scoping review of the peer-reviewed literature was completed, and a typology of these programs was created, which highlights the different choices healthcare institutions can make when implementing food assistance programs.

Aim 2 includes a mixed methods evaluation of a CHC-based produce mobile market in Lawrence, Massachusetts. To accomplish this aim, both qualitative and quantitative data collection strategies were employed guided by the Practical, Robust Implementation and Sustainability Model (PRISM) framework[113] to organize the data and findings. Quantitative strategies included leveraging a combined dataset of mobile market

user demographic and health information, and qualitative included key informant interviews and direct observation. Analyses focused on both methods.

The goal of Aim 3 is to generate tailored, structured implementation guidance to CHCs to create and sustain food insecurity programs. Findings from Aims 1 and 2 were combined to formulate guidance for healthcare-based implementers.

C. Conceptual Framework

The Practical, Robust Implementation and Sustainability Model (PRISM)[113] was used to guide the second aim of this dissertation. The PRISM framework explores how health care interventions and patient populations interact to impact a program's implementation, adoption, and sustainability.[113]

PRISM is a widely used model in the field of Implementation Science. PRISM has been used to assess the implementation of health services interventions implemented within a range of settings and across multiple content areas. For example, in community-based primary care and family medicine, PRISM has been used to guide implementation and evaluation projects regarding transitions of care from hospital to ambulatory services,[114] care coordination and referral to community-based services,[114] shared decision making using patient decision aids,[115] and incorporation of physical activity assessment and guidance in primary care encounters.[116] In each of these examples, PRISM was used to guide implementation of patient-centered programs in an effort to integrate them into routine clinical practice.

PRISM evaluates four core constructs of an intervention: the program itself (from both the organizational and patient perspective), recipient characteristics, external

environment, and maintenance and sustainability (Figure 1).[113] PRISM aligns well with this project because it considers both the internal and external contexts of the intervention, as well as the organizational and patient perspectives.

Context is an important part of any healthcare-based intervention, and food insecurity programs do not happen in a vacuum. Assessing the implementation and uptake of a food insecurity alleviation program must consider the external context, such as the availability of other food programs in the region, quality and variety of food available, and cultural preferences. Food access, availability, and acceptability all impact a person's dietary intake and overall health.[117] While federal and state food assistance programs exist, there are barriers to uptake, including stigma, complicated eligibility criteria, difficult registration processes, and time and transportation barriers.[11,85,93] The PRISM framework has the most comprehensive exploration of context of the implementation science frameworks considered for this dissertation, and has an explicit focus on external context.[113,118] As such, PRISM was identified as the most appropriate for this project's needs. Table 4 delineates key questions for each PRISM construct as it relates to the MM evaluation.

Within each of the four main constructs of the PRISM framework are subconstructs and concepts, delineated below.[113] These subconstructs provide structure around which to explore programs.

1.) **Program/Intervention** takes into consideration the strength of the intervention's evidence base and how well it meets the needs of stakeholders from the organizational and patient perspective. The organizational perspective includes

readiness, how well the intervention addresses the barriers of frontline staff, coordination across departments and specialties, complexity and cost of the intervention, usability and adaptability, trialability and reversibility, and the ability to observe results. The patient perspective includes patient centeredness, how well the program provides the patient with choices, addresses patient barriers, seamlessness of transition among program elements, service and access, complexity and cost, and feedback of results. For example, in the current study this would include an analysis of social service and medical staff's capabilities and interest referring to food insecurity programs, the necessary transitions from screening and referral to obtaining services or foods from programs, and the ability of food insecurity alleviation programs to meet the cultural and material needs of the patient population, among others.

2.) **Recipients** of the program, similarly to the Program/Intervention construct, look at both the organizational and patient characteristics. The organizational characteristics include clinical leadership, staffing and incentives, systems and training, data and decision support, shared goals and cooperation, management support and communication, organizational health and culture, and expectation of sustainability. Patient characteristics include demographics, disease burden, competing demands, and knowledge and beliefs. This dissertation will assess clinical systems in place to implement food insecurity alleviation programs, management support of the programs, organizational culture regarding food insecurity, patients' beliefs around receiving food services from their clinical

providers, and patient disease burden.

3.) **External Environment** refers to influences external to the program site that impact implementation, such as community resources, regulatory environment, competition, reimbursement, and payor satisfaction. This dissertation will analyze food resources in the community surrounding the health care institution implementing the food insecurity alleviation program, federal and state statutes governing food safety, and social needs services reimbursement for health care institutions.

4.) **Implementation and Sustainability Infrastructure** refers to organizational details, such as adaptable protocols and procedures, performance data, adopter training and support, relationship and communication with adopters, facilitation and sharing of best practices, and a plan for sustainability. This dissertation will assess food insecurity alleviation programs' sustainability infrastructure, including program staffing and funders, relationships with program recipients, and ongoing training of ancillary staff.

Figure 1. PRISM Framework[113]

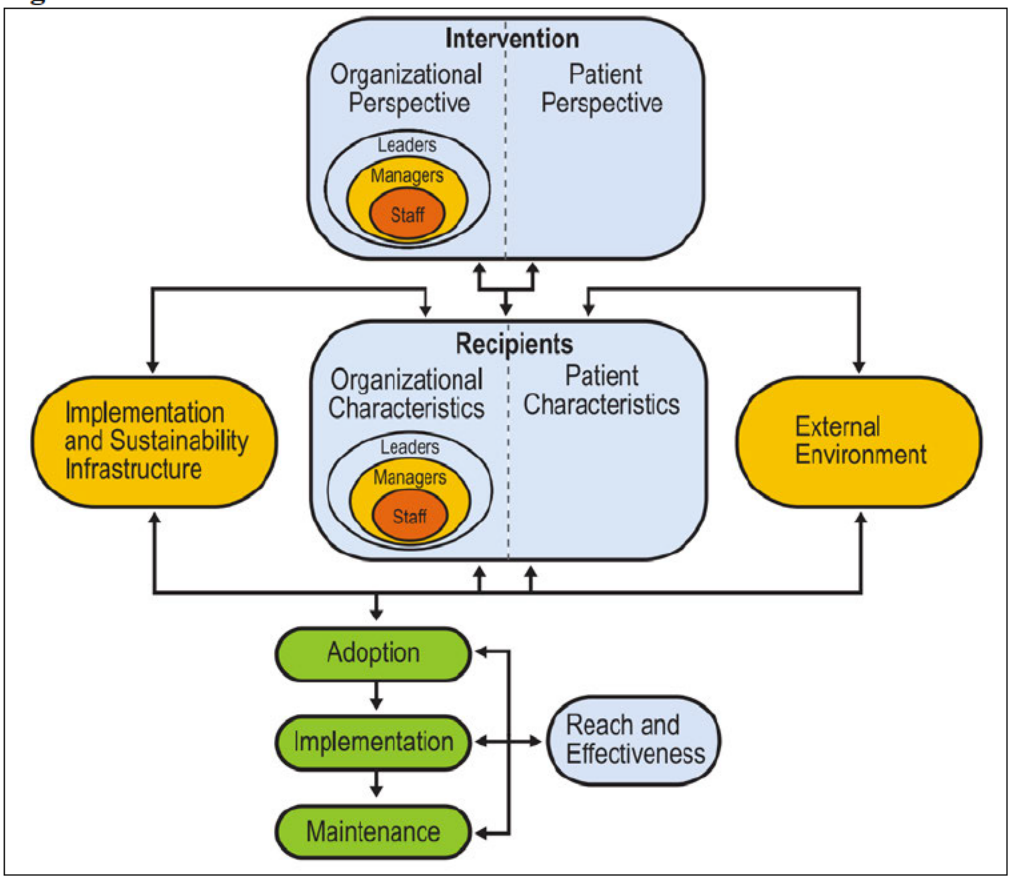


Image Source: *The Joint Commission Journal on Quality and Patient Safety*. 2008;34(4):228–243 The

Table 4. PRISM Constructs for Evaluation.

Element		Construct	Key Questions
Program/ Intervention	Organizational Perspective	Acceptability	To what extent do staff, managers, and leaders perceive the MM to be worthwhile/satisfactory?
		Feasibility	To what extent do staff, managers, and leaders perceive the MM to be easily implemented in workflows?
		Barriers and Facilitators	What are they key barriers and facilitators to staff, managers, and leaders implementing the MM?
		Sustainability	To what extent are staff, managers, and leaders interested and involved in sustaining the MM program?
	Patient Perspective	Acceptability	To what extent do patients perceive the MM program to be satisfactory/worthwhile?

		Barriers and facilitators	What barriers and facilitators do patients experience to attending the MM?
		Communication	How do patients learn about the MM? How do patients learn logistical details about the MM?
Recipients	Organizational Characteristics		What systems are in place for staff to connect patients to the MM? What feedback and data do staff receive about program uptake and acceptance by patients? How does the MM connect with organizational goals?
	Patient Characteristics		What are the characteristics of the patient population? How do these impact MM uptake and attendance?
	External Environment		What is the economic and social context in Lawrence and Merrimack Valley? How does this influence MM uptake and attendance? How does use of other food programs impact uptake of the MM?
	Implementation and Sustainability Infrastructure		To what extent has the MM been institutionalized at GLFHC? What structures are in place to implement the MM over time?

D. Research Aim 1

For Aim 1, a typology of healthcare-based food insecurity programs in the United States was created through a scoping review of the literature, followed by construction of the typology. The research approach was guided by a 2020 paper by Smithman and colleagues that created a typology of program components to improve access to primary care for vulnerable populations.[119] Smithman used a scoping review and landscape analysis to identify building blocks of successful programs, which other sites could use to

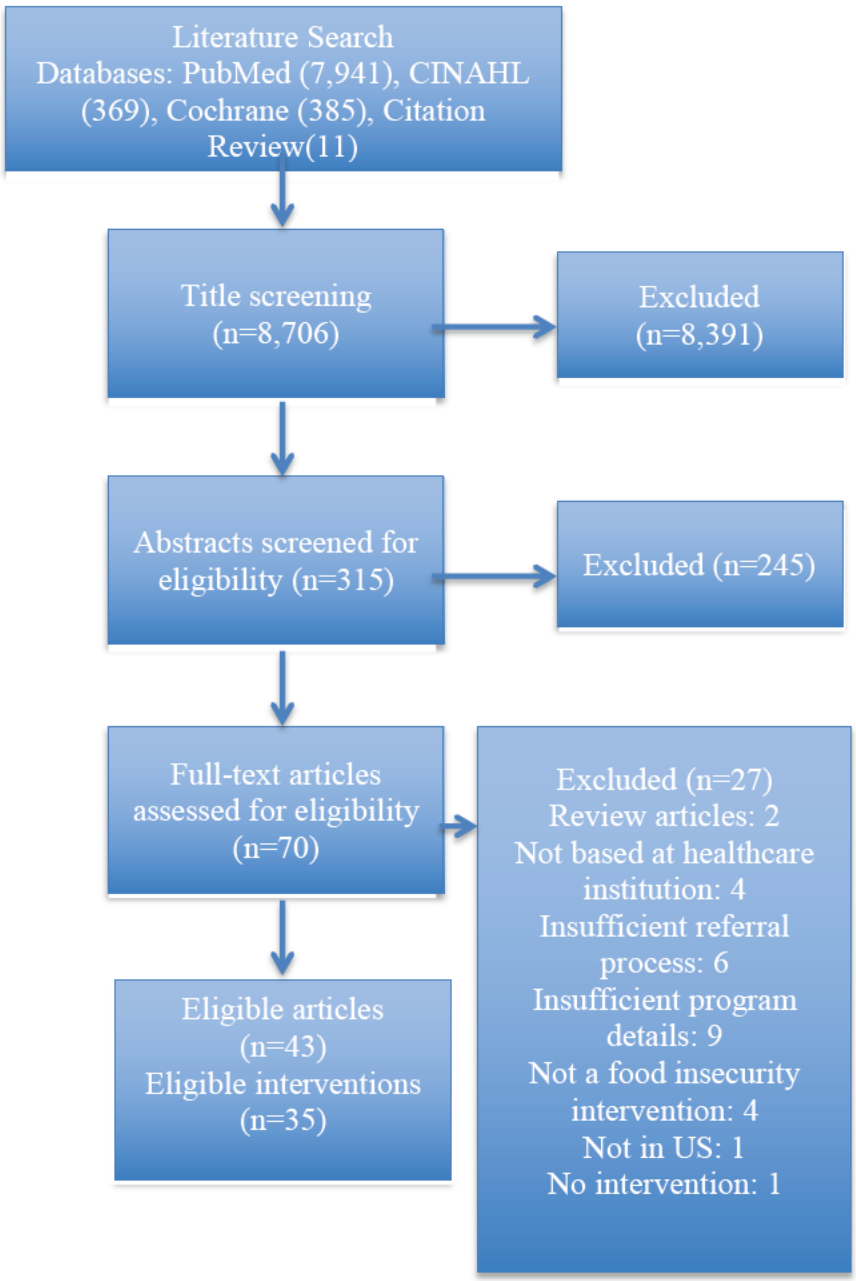
develop their own interventions. Details of each research method utilized in the typology creation are delineated herein.

Scoping Review

To achieve Aim 1, a scoping review of the peer-reviewed literature was conducted to collate the available evidence on food insecurity programs at healthcare institutions in the US. A scoping review was chosen because it facilitates synthesis of the breadth of available evidence in a broad field, as compared to the more specific aims of a systematic review.[118] We searched PubMed, CINAHL, and Cochrane databases for papers published between January 1, 2010 and December 31, 2021 with the following terms: food assistance, initiative, program, health, medical, medical center, academic, community health, federally-qualified, and food. We included peer-reviewed papers regarding interventions based at health care institutions in the US that provided some form of food assistance for their patient population, including active referral and voucher programs. All eligible papers reported implementation and intervention details and patient population descriptions; we included papers that did not evaluate outcomes as long as details regarding program design and implementation were included. We excluded interventions that screened for food insecurity without providing resources and assistance; interventions that used a passive referral process, such as handing out a list of available resources; and interventions that provided insufficient programmatic details to understand processes. Two coders reviewed selected abstracts and full texts for inclusion in the study. The researchers were initially aligned on all but two abstracts and one full-text article. Differences were reconciled through discussion of questions and concerns

about each manuscript and program. The search and review process is summarized in **Figure 2**.

Figure 2. Scoping Review Search Strategy.



Typological Analysis and Creation

A typology is a theory-based classification system that characterizes and categorizes phenomena.[120] Using qualitative analysis, the aim of typology construction is to understand complex organizational systems by creating and comparing distinguishable groupings of constructs.[120] Typologies have been used in public health and social science research methods to understand public health delivery and informatics systems,[121,122] primary health care,[119] barriers to accessing health care,[123,124] and social inequality in health.[125] For example, a 2020 paper created a typology to define a set of building blocks that future implementers could use to develop and implement programs improving access to primary care among vulnerable populations, while meeting the unique characteristics of their organizations.[119]

After identifying the manuscripts eligible for inclusion in the review, we created a data charting form with intervention component categories previously identified in the literature. Two reviewers, RR and EM, independently read through each complete manuscript and completed the chart by extracting relevant programmatic information and performing a content analysis.[126] Reviewers met regularly throughout the data extraction process to compare completed charts, discuss discrepancies, and create consensus. Any discrepancies were moderated by JG.

We then used the constant comparative method to analyze program components and create the typology.[120,127] We iteratively compared and contrasted different program components to identify patterns and groupings that often were often observed together or seemed to influence other program elements. We also compared any overlapping

components or patterns found in multiple categories to further explore these classification definitions, identifying distinguishing characteristics. We continued this process through five iterations until each category had a distinct set of characteristics, resulting in a draft typology. Last, we validated the draft typology against the research articles to ensure accuracy, with each article fitting distinctly into each category.

E. Research Aim 2

Aim 2 is a mixed methods evaluation of a CHC-based MM in Lawrence, Massachusetts. Quantitative and qualitative data were integrated to create a comprehensive analysis and evaluation of the program.

Mixed Methods

A mixed methods approach integrates both qualitative and quantitative methods to understand a phenomenon.[128] Mixed methods are frequently used in program evaluation and implementation science research,[129] and can produce more comprehensive assessment than a single research method alone.[130] A sequential mixed methods approach was used in this study,[131] in which findings from quantitative data collected from the MM and the GLFHC electronic medical record (EMR) were used to inform the creation of qualitative data collection instruments, such as the direct observation tool and key informant interview guide. After all data collection activities were completed, qualitative and quantitative data were also combined to create a holistic picture of the MM intervention at GLFHC.

Quantitative Data

Study Sample

Data for this project were retrospectively extracted from the GLFHC EMR and Oasis Insight software (https://oasisinsight.net/) from August 2016 to February 2020 for all patients who were registered for the MM either within GLFHC or on-site at the MM. Oasis Insight tracked each registrant's visit to the MM using their unique MMID. Participants were considered eligible for MM attendance on or after their date of registration; all MM dates prior to each participant's unique registration date were not included in analyses. Due to incomplete data collection resulting from the Covid-19 pandemic, MM attendance data after February 2020 were excluded. Data were merged using participant personal identifiers (e.g., address, date of birth, and name) and manually reviewed to ensure validity. A final study sample consisting of individuals with both an MMID and EMR data during the study period of August 2016 to February 2020 was used for all analyses.

Key Measures

Socio-Demographic Variables

Demographic information such as age, sex, self-reported race and ethnicity, preferred language, and primary insurance type (Medicaid, Medicare, private, or uninsured) was obtained through EMR data. Information obtained from Oasis Insight included self-reported SNAP enrollment and number of children, adults, and seniors in the household.

Medical Diagnosis Variables

ICD-10 diagnosis codes in the EMR provided information on medical comorbidities and diagnoses each participant had been given by a medical provider at any time in the patient's history with the health center. These diagnoses include diabetes, hypertension, hyperlipidemia, cardiovascular disease, heart failure, obesity, asthma, anemia, chronic kidney disease, peripheral artery disease, COPD, HIV, cancer, psychiatric diagnoses, and substance use disorder. A Charlson comorbidity index score was created for each study participant using the EMR ICD-10 codes. The Charlson comorbidity index is a validated summary measure that uses a weighted score of 19 comorbidities to predict 1-year mortality risk.[132,133]

MM Method of Registration Variable

Individuals can register for the MM in one of three ways: on-site, day-of at the MM; at GLFHC with a staff member (e.g., community health worker, medical assistant, or provider); or by calling a dedicated GLFHC MM registration phone number. The method of registration was captured by Oasis Insight.

Economic and Environmental Variables

We created a binary measure (i.e., yes/no) indicating if the market was held on the third Saturday of the month, as typically scheduled, in order to capture if alteration from the default MM date impacted attendance. To understand the broader economic context in which the market was running between 2016 and 2020, we included the Massachusetts state-level unemployment rate for each month in which there was a market. We also included monthly indicator variables (fixed effects) to control for seasonality in

attendance.

Data Analysis

We compared differences in characteristics between GLFHC patients who ever attended versus never attended the MM using t-tests for continuous and binary variables and chi-squared tests for categorical variables. Multiple logistic regression was used to analyze predictors of monthly MM attendance. Key predictors included socio-demographic characteristics, medical diagnoses, MM registration, and economic and environmental variables. Statistical significance for all analyses was indicated by a p-value less than or equal to 0.05 using R Studio (version 4.1.2)[134].

Qualitative Data

Key Informant Interviews

Semi-structured interviews with MM participants (n=19) and staff (n=5) were conducted to understand implementation and uptake of the MM. Semi-structured interviews consist of a set of previously constructed open-ended questions and prompts, but allow for a flexible interview guided by a dialogue between the researcher and participant.[135] Questions and responses were followed up with probes to elicit in-depth responses regarding perspectives, thoughts, and feelings from participants.[135] Interview guides were designed to capture stakeholders' perspectives on the MM, providing a rich description of their experiences with the program (see Appendix B).[120] The interview guides were informed by the PRISM framework and included questions related to acceptability and feasibility of the program, barriers and facilitators to implementation and uptake, internal and external contextual factors, and maintenance and

sustainability.[113] A participant interview guide was translated into Spanish verbatim from the English guide, then back-translated to ensure consistency.

MM volunteers were interviewed between May and June of 2022. Purposive and snowball sampling was used to identify MM volunteers who had significant experience with the program. The MM program coordinator at GLFHC was asked to provide a list of suggested staff and patients to interview, and interviewees were also asked to suggest additional individuals for participation. All MM volunteer interviews were conducted over Zoom by the primary investigator.

MM user interviews were conducted in September 2022. Convenience sampling was used to identify potential participants. Participants were interviewed while waiting in line for the MM to open; every effort was made to remove the interviewee from the MM line to create privacy while maintaining their space in line. English-speaking interviews were completed by the primary investigator, while Spanish-speaking interviews were conducted by a Spanish-speaking research assistant. Interviews were completed until thematic saturation was reached.[136]; all interviewees received a $20 grocery store gift card to compensate them for their time.

Direct Observation of the MM

In addition to Key Informant Interviews, direct observations of the MM were conducted by trained study team members on multiple occasions (n=4: in April, September and November 2022 and January 2023 to assess the impact of weather on the MM). A direct observation data collection tool was created to capture relevant information at the MM (Appendix A). Information regarding the registration, queueing,

and food pick-up process was collected. During the data analysis phase, data from direct observations was used in conjunction with both the quantitative and semi-structured interview data to validate findings and create a complete understanding of the MM.

Data Analysis

All interviews conducted in English were transcribed verbatim by the primary investigator. Transcription and translation of Spanish-speaking interviews was completed by DataGain (https://transcriptionclient.datagainservices.com/).

Key informant interview data were analyzed using thematic analysis.[137] A deductive coding frame was created using the PRISM framework (see Figure 1).[113] In the coding phase, two researchers (RR and SF) first independently read each interview transcript to familiarize themselves with the data. Next, both researchers coded each transcript together in weekly meetings, with a third researcher (KW) attending each meeting to ensure consensus. NVivo Release 1.7 (QSR International) software was used to manage and code the qualitative data.[138] Next, data from Nvivo was exported into a data charting matrix to display and systematically explore the data.[139,140] Both researchers then iteratively examined and sorted the matrix to identify themes.

F. Research Aim 3

Following the creation of the typology in Aim 1 and the case study evaluation from Aim 2, in Aim 3 we developed recommendations to assist healthcare institutions to create, implement, and sustain food insecurity interventions. The typology informed the building blocks of food insecurity intervention design, while the case study provided a deeper exploration of the intricacies of implementation of the program. As a long-

standing food insecurity program at a large CHC, a comprehensive evaluation of the GLFHC MM can provide meaningful insights to implementation in the CHC and healthcare setting.

G. Limitations

A limitation to the scoping review and typology creation is the focus on programs that have published their findings in the peer-reviewed literature. There are many other programs across the country who have not published their processes or findings in the literature, but whose perspectives would be valuable. I aimed to ameliorate this issue by including a confirmation of findings and follow-up with the identified programs, in order to obtain information that had not yet been published. The MM case study also sheds light on a previously un-published program. This work does, however, add to the literature base of these programs. Further research should aim to contact additional programs, who have not published in the literature, to obtain their perspectives.

A second limitation of this dissertation is the generalizability of the case study findings. The MM is a program that exists only in eastern Massachusetts, and the patient population of GLFHC is unique in that the vast majority of its patients are Hispanic, as are 91% of the patients who registered for the MM. However, as a long-standing and sustainable food insecurity program at a large CHC, a comprehensive evaluation of the GLFHC MM can provide meaningful insights to implementation in the CHC setting. By delving deeply into the experience of GLFHC and the MM, one can better understand the intricacies of the program and its implementation. By exploring internal and external context, as well as staff and patient perspectives, the lessons learned from the case study

can be applied to those in other institutions wishing to develop a similar program. In addition, health care institutions can identify similarities between their specific context and study findings to implement programs that are most appropriate for their unique needs.

The use of the PRISM framework, which is widely used in health services and implementation science research, also creates a standard by which others can apply the lessons learned in this work to their own programs. Use of theoretical frameworks can also increase generalizability and external validity.[120] Triangulation of multiple data sources, including the quantitative dataset, direct observation, and key informant interviews are used to both confirm findings and achieve a holistic understanding of the program.

H. Protection of Human Subjects

Ethical approval for this dissertation was obtained from the Boston University Medical Campus and Boston Medical Center IRB. Qualitative data was given an exempt determination (IRB Number H-42323). Participants were read an information sheet prior to participating in interviews. Quantitative mobile market data was determined to be non-human subject research (IRB Number H-42103).

CHAPTER FOUR: SCOPING REVIEW AND TYPOLOGY

A. Introduction

Food insecurity impacts approximately one in eight Americans.[2] People who are food insecure lack reliable, consistent access to a sufficient quantity of food to live a healthful life.[35] While they are related, food insecurity and hunger differ: food insecurity is an economic condition of inadequate access to healthy food, while hunger is the physiological condition that can result from experiencing food insecurity.[35] Low-income households are more likely to experience food insecurity and hunger than those with average incomes.[42]

Evidence points to the connection between food insecurity and negative health outcomes and increased healthcare costs.[4–8,141] Recognizing this, healthcare institutions in recent years have begun to screen for food insecurity and provide resources to address the issue. Food insecurity screening is also often part of mandatory social determinants of health screens in certain institutions and states.[142] Food insecurity alleviation programs at healthcare institutions have the potential to provide food and food-related support services directly to their patients. Provision of food not only impacts dietary intake and alleviates food insecurity, but also can free up food dollars to be spent on other necessities, such as housing, transportation, utilities, or medications.[32] Food insecurity programs implemented at healthcare institutions have previously found positive impacts on food security,[15] diet quality,[16,22–25] cardiometabolic biomarkers,[24] hospital admission and readmission rates,[26] and health care costs.[20] They can also connect patients to resources that can alleviate food insecurity[143,144] and improve management of chronic

conditions and health outcomes.[145] Healthcare-based food insecurity programs are likely to be more successful if they are consistent and sustainable.[146]

There is a growing literature base regarding healthcare-based food insecurity programs.[19,147] Nonprofit and advocacy organizations, such as Feeding America, the Food Research & Action Center, and Children's HealthWatch, have established guidelines on creating and executing these programs.[148] However, there is a lack of specific, detailed, and actionable implementation guidance for health care institutions of differing sizes and types to design, operate, and maintain an array of food insecurity alleviation programs. Healthcare providers have also expressed that education and assistance with logistics would facilitate implementation of food insecurity alleviation programs.[149]

As a result of United States Department of Agriculture (USDA) funding, there is a small, but growing, evidence base of evaluations of produce prescription programs,[150] a type of food insecurity intervention located at health care institutions in which a provider writes a "prescription" for fruits and vegetables,[151] However, produce prescription programs may not be the right intervention for every healthcare institution and its patient population.

To support decision-makers and implementers, we aimed to create a typology of intervention components that can be used to create and execute impactful food insecurity programs at health care institutions. We conducted a scoping review of food insecurity interventions based at health care institutions and used the constant comparative method[120,127] to create a typology of programs. This typology may assist program

implementers consider programmatic intended impact, institutional logistical constraints, and planning for sustainability in an effort to effectively achieve their goals.

B. Methods

We searched PubMed, CINAHL, and Cochrane databases for papers published between January 1, 2010, and December 31, 2021, with the following terms: food assistance, initiative, program, health, medical, medical center, academic, community health, federally-qualified, and food. We also mined reference lists of relevant research articles. We included peer-reviewed papers of interventions based at healthcare institutions in the United States that provided food assistance for their patient population. Papers were eligible for inclusion if they reported implementation and intervention details and patient population descriptions. We included papers that did not evaluate outcomes as long as details regarding program design and implementation were included. We excluded interventions that screened for food insecurity without providing assistance obtaining food, and those that used a passive referral process, such as handing out a list of available resources, as these interventions have been found to have minimal success connecting patients to resources.[152] Our search strategy is summarized in **Figure 2**.

After identifying the manuscripts eligible for inclusion in the review, we created a data charting form with intervention component categories previously identified in the literature. Two reviewers, RR and EM, independently read through each complete manuscript and completed the chart by extracting relevant programmatic information and performing a content analysis.[126] Reviewers met regularly throughout the data extraction process to compare completed charts, discuss discrepancies, and create consensus. Any

discrepancies were moderated by JG.

We then used the constant comparative method to analyze program components and create the typology.[120,127] We iteratively compared and contrasted different program components to identify patterns and groupings that often were often observed together or seemed to influence other program elements. We also compared any overlapping components or patterns found in multiple categories to further explore these classification definitions, identifying distinguishing characteristics. We continued this process through five iterations until each category had a distinct set of characteristics, resulting in a draft typology. Last, we validated the draft typology against the research articles to ensure accuracy, with each article fitting distinctly into each category.

C. Results

Among 8,706 identified articles, 43 met inclusion criteria. Several articles reported on the same intervention; ultimately, 35 distinct interventions were represented in the 43 articles identified for inclusion. They are summarized in **Table 5**.

Results of Content Analysis

In our content analysis, we identified eight core characteristics of health care-based food insecurity programs: screening for food insecurity, defining eligibility criteria, direct provision of food, provision of vouchers, provision of referrals, offering patient education, health care team involved in staffing, and program length. These characteristics were consistent with the literature, used to assess the 43 articles in our review, and informed the creation of the typology.

Table 5. Description of health care-based food assistance programs.

First Author, Year	Location in U.S.	Type of Health Care Institution	Program Overview	Program Participation Duration	Patient Eligibility
Adams, 2021[12] & Dunn, 2021[11]	Revere, MA	Community health care system	Free produce market	Ongoing	No eligibility requirements
Aiyer, 2019[153]	North Pasadena, TX	Federally qualified health center	Fruit and vegetable prescription program	6 months	18+, Food insecure based on two-question clinic screener, residing in one of 3 target zip codes
Beck, 2014[154]	Cincinnati, OH	Urban academic pediatric primary care clinic adjacent to Cincinnati Children's Medical Center	Screening, Provision of Infant Formula, Referral	Ongoing	Families with children <12 months with food insecurity (answered yes to at least 1 of 2 screening questions), or failure to thrive. Clinical provider given latitude to deem eligible.
Berkowitz, 2021[155] & Xie, 2021[156]	North Carolina	9 primary care clinics (primarily Federally qualified health centers)	SNAP subsidy for fruits and vegetables	6 months	18+, current SNAP beneficiaries and identified by staff at primary care clinic as "likely to benefit from program b/c of health status"
Blitstein, 2020[157]	"Large Midwest City"	Federally qualified health centers	Screening, referral, nutrition education, enrollment assistance	Ongoing	Diagnosis of diabetes [All participants received intervention regardless of food insecurity status]
Bryce, 2017[158]	Detroit, MI	Federally qualified health center	Fruit and vegetable prescription program	13 weeks	FQHC patients with diabetes mellitus, hypertension, obesity, hyperlipidemia, pregnant or with children, and have

First Author, Year	Location in U.S.	Type of Health Care Institution	Program Overview	Program Participation Duration	Patient Eligibility
					limited access to fruits and vegetables
Cavanagh, 2017[111]	Upstate NY	Community clinic	Fruit and vegetable prescription program	13 weeks, can receive additional 13 weeks if all coupons used	Low income persons with at risk or with obesity, hypertension, or diabetes
Cohen, 2017[159] & 2019[17]	Ypsilanti, MI	Ypsilanti Health Center primary care clinic	Waiting room intervention encouraging Double Up Food Bucks use	One-time	18+, currently SNAP enrolled, self-identified as a primary food shopper for household
Cook, 2021[160] & Newman, 2021[146]	Atlanta, Athens, Augusta, GA	Primary care clinics	Produce Prescription Program with nutrition education	6 months	SNAP-eligible and/or screen positive for food insecurity on USDA 2-item screener and diagnosed for 1 or more condition: overweight/obesity, diabetes mellitus, pre-diabetes, hypertension, or hyperlipidemia
Esquivel, 2020[161]	Rural community near Honolulu, HI	Federally qualified health center pediatric clinic	Fruit and vegetable prescription program, on-site farmer's market (pre-existing)	3 months	Children aged 2–17 with "poor nutrition" based on growth assessment or BMI% <5% or >85%.
Ferrer, 2019[24]	San Antonio, TX	Primary care practice	Nutrition education and free box of food	6 months	A1c>9%, screen positive for food insecurity on Hunger Vital Sign
Gany, 2020[15]	NYC, NY	Outpatient Cancer Clinics	Co-located medically tailored food pantries at clinics	Throughout treatment/Ongoing	Screen positive for food insecurity on USDA household food insecurity survey

First Author, Year	Location in U.S.	Type of Health Care Institution	Program Overview	Program Participation Duration	Patient Eligibility
Ghouse, 2020[162]	Michigan	Primary care clinic	Nutrition education and free bag of food	6 weeks	Pre-diabetic (A1c 5.7–6.4%), screen positive for food insecurity using USDA 5-item, able to converse in English
Greenthal, 2019[112]	Northeastern US	Academic urban safety-net hospital	Medically-tailored food pantry	Ongoing	Patients who screen positive for food insecurity in hospital's outpatient clinics
Hager, 2020[163]	Minneapolis, MN	Safety-net Medical Center hospital, outpatient clinics, and community primary care clinics	EMR Hunger Vital Sign screening and auto-faxed referral to food bank partner, food bank calls patient to provide assistance with obtaining food assistance in the community	One-time	Screen positive for food insecurity on Hunger Vital Sign
Izumi, 2020[164]	Multnomah County, OR	Federally qualified health center safety-net clinic	Subsidized Community-Supported Agriculture	23 weeks	English and Spanish-speaking who receive services at the FQHC.
Jones, 2020[165]	Navajo Nation, NM	19 HC facilities in Navajo Nation (range from small clinics to hospitals)	Fruit and vegetable prescription program	6 months	Families with pregnant woman or children </= 6 years. Some sites used Indian Health Services Food Insecurity Screening Questionnaire to specifically enroll food insecure families.
Knowles, 2018[94]	Philadelphia, PA	Academic medical center pediatric primary care outpatient clinics	Screening, Referral, Benefits eligibility screening and application assistance	One-time	Pediatric patients of center clinics who screen positive for food insecurity

First Author, Year	Location in U.S.	Type of Health Care Institution	Program Overview	Program Participation Duration	Patient Eligibility
Kulie, 2021[166]	Washington, DC	Urban academic Emergency Department	Screening, Referral	One-time	18+, non-life threatening emergency severity index score, insured by DC Medicaid and approved for ED discharge, English speaking
Milliron, 2017[167]	North Carolina	Urban outpatient clinic (free or reduced price services)	Community garden	Ongoing	None
Mirsky, 2021[13]	Revere, MA	Community-based academic medical center	On-site plant-based food pantry	12 weeks* original plan that was altered due to COVID-19 in March 2020	Food insecure with diagnosis of obesity, hypertension, or diabetes mellitus. Pilot pts were English-speaking only.
Morales, 2016[168]	Chelsea, MA	Community health center	Screening, enrollment assistance and pantry info	One-time	Pregnant women 18+ receiving care at the health center
Paolantonio, 2020[169]	NYC, NY	4 cancer clinics	Food voucher program	6 months	18+, able to answer survey questions in English or Spanish, living independently, score low or very low for food insecurity on the USDA Household Food Security Screener, be within 2 weeks of starting radiation or 1 month of starting chemo. Those receiving or applying for SNAP were ineligible.

First Author, Year	Location in U.S.	Type of Health Care Institution	Program Overview	Program Participation Duration	Patient Eligibility
Sastre, 2021[26]	Greenville, NC	Academic medical center inpatient	Hospital-based Medical Food Pantry	One-time	Screen positive for food insecurity on Hunger Vital Sign
Saxe-Custack, 2018[170] & 2019[171]	Flint, MI	University-affiliated residency training pediatric clinic	Fruit and vegetable prescription program	Ongoing	All pediatric patients of practice [all receive Rx regardless of need]
Schlosser, 2019a[18]; Schlosser, 2019b[172]; & Joshi, 2019[173]	Cuyahoga County, OH	3 safety-net clinics	Produce Prescription Program	3 months	Patient of clinic positive for food insecurity on 2-item screen and diagnosis of hypertension
Slagel, 2021[174]	Athens, GA	"Clinics"	Produce Prescription Program with nutrition education	6 months	18+, SNAP-eligible or otherwise underserved, with a dx of at least 1 condition: overweight/obesity, diabetes mellitus, pre-diabetes, hypertension, or hyperlipidemia
Smith, 2017[175]	San Diego, CA	Student-run free clinic associated with medical school	Food Insecurity Screening and Referral with federal program sign-up assistance, food provided only for patients with DM	One-time; *Patients with diabetes received food bag monthly for unknown amount of time	18+ and patient of student-run free clinics
Stenmark, 2018[40]	Colorado	2 pediatric clinics	Screening, Referral, Assistance signing up for fed asst programs	One-time	Patient of clinic, screen positive for food insecurity on Hunger Vital Sign

First Author, Year	Location in U.S.	Type of Health Care Institution	Program Overview	Program Participation Duration	Patient Eligibility
Stotz, 2019[176]	Georgia	Safety-net clinic	Nutrition education, 12-week receipt of 1 bag of locally-grown produce	12 weeks	Adults eligible for SNAP-Ed living in households below 185% federal poverty level (as evidenced by enrollment in safety-net clinic) and diagnosis of diabetes mellitus, hypertension, &/or hyperlipidemia
Veldheer, 2021[177]	Reading, PA	Primary care clinic in community-based hospital	Fruit and vegetable prescription program	7 months	A1c>=7%, adults>18 years, BMI >=25
Walker, 2021[178]	"Large metropolitan region in Ohio"	2 community-based family medicine practices within an academic medical center	Screening, Referral, Vouchers	90 days	18+, patients of primary care clinics, screen positive for food insecurity, and meet clinical criteria, including diagnosis of diabetes mellitus, obesity, hypertension, HgbA1c>9%, or pregnant w/ gestational diabetes
Weinstein, 2014[179]	Bronx, NY	Primary care or diabetes clinics at urban public hospital	Nutrition education and food voucher	One-time	>18 years and established patient on clinics, with diagnosis of type 2 diabetes mellitus, BMI>25, A1c>7%
Wetherill, 2018[180]	Oklahoma	2 academic medical center-affiliated free clinics	Nutrition education and free box of food	6 months	Any patient of affiliated clinics

First Author, Year	Location in U.S.	Type of Health Care Institution	Program Overview	Program Participation Duration	Patient Eligibility
Wynn, 2021[181]	Cook County, IL	Large urban academic medical center -- 3 inpatient units for pilot	Screening for SDOH, paper referral, bag of non-perishable food	One-time	Inpatient on participating floors, screen positive for food insecurity on Hunger Vital Sign

Screening for Food Insecurity

Eighteen[13,15,18,20,24,26,94,96,146,153,154,157,160,162,163,169,172,173,175,178,181] of the 35 programs discussed screening for food insecurity. Of these, six programs[21,146,157,160,162,169,175] used the USDA Household Food Security Survey, with number of items ranging from two to 18. Twelve programs[13,18,24,26,94,96,153–156,163,172,173,178,181] screened for food insecurity using the Hunger Vital Sign.[105–107] One[165] program used the Indian Health Service Food Insecurity Questionnaire, two[17,159,166] used unique screeners, and one used a "standardized assessment form."[168] Programs that did not screen for food insecurity were either open to anyone regardless of food insecurity status,[11,12,167] open to patients of clinics that serve primarily low-income populations, or used medical records to identify patients with "poor nutrition."[161] One program used the clinical expertise of an on-site nutritionist to identify eligible patients.[111]

Defining Eligibility Criteria

Sixteen[13,18,24,111,146,155,156,156–158,160–162,169,172–174,176–179] of the 35 programs included a cardiometabolic diagnosis (e.g., overweight, obesity, pre-diabetes, diabetes mellitus, hypertension, or hyperlipidemia) as part of their eligibility criteria. One program[168] was created explicitly for pregnant women, four[94,154,161,171] for children, and one[165] for families with either pregnant women or children under age seven. Fourteen[13,15,18,24,26,94,96,112,153,154,162,163,169,172,173,181] programs required patients to screen positive for food insecurity in order to be enrolled. One program[146,160] required patients to be eligible for the Supplemental Nutrition Assistance Program (SNAP) or to screen positive for food insecurity.

Direct Provision of Food

Fourteen programs[11–13,24,26,112,154,162,164,167,169,175,176,180,181] provided food directly to patients. Of these, eight[13,15,24,26,112,162,164,180] provided both produce and non-perishable foods, three[11,12,167,176] provided only produce, one[181] provided only non-perishable foods, and one[154] provided baby formula. Refrigerated storage capacity was noted as a barrier to providing produce directly to patients.[13,15] Programs circumvented this issue by partnering with community-based organizations (CBOs) to provide same-day delivery and distribution of produce,[11,12,15,164,176] while others obtained dedicated refrigeration space.[13,112] One program[167] utilized an on-site community garden. Two programs[15,112] that provided food directly to patients offered a choice of food, while 10 programs[11–13,24,26,162,164,167,176,180,181] provided participants with a pre-packed bag. Three programs[15,26,112] provided medically-tailored foods, that is, foods that met the nutritional requirements of the patient based on their medical status, as designated by their physician or registered dietitian. These three medically-tailored programs operated as on-site food pantries.

Provision of Vouchers

Fourteen programs[17,18,111,146,153,155,156,158–161,165,169–175,177–179] provided vouchers or other cash incentives that allowed participants to increase their purchasing power for food. By virtue of providing cash assistance to purchase foods, all 14 programs provided the participant with some form of choice in the foods they received. None of these programs provided medically-tailored foods.

The amount of money provided to participants in voucher programs ranged from a

minimum of $6 for the entire program[179] to a maximum of $230 per month for six months.[169] Four programs[146,160,165,174] provided $1 per household member per day.

Ten programs[17,18,111,146,158–161,170–174,177,179] allowed the vouchers to be utilized only for fresh fruits and vegetables, and three programs[153,155,156,165] allowed voucher use for both fresh and non-perishable healthful (e.g., fruits, vegetables, or whole grains, etc.) foods. One program allowed participants to use the voucher for any food purchases, though they were reminded to choose healthful foods.[169] Ten programs[17,18,146,158–161,165,170–174,177,179] partnered with farmer's markets to accept the vouchers, two[158,161] of which were markets located on-site at the health care center where the program was implemented. One program[153] provided vouchers for a food pantry, and one program[111] provided a voucher to be used at a mobile produce truck that parked at the health center where the intervention was implemented once weekly. Three programs[155,156,165,169] allowed participants to utilize the program at participating partner supermarkets, and one[165] at convenience stores. Three[158,165,169] used debit cards and one program[155,156] loaded additional funds onto EBT cards. Others used printed vouchers or tokens.

Nine programs[18,18,146,153,158,160,161,165,170,171,173,174,177] were fruit and vegetable prescription (FVRx) programs, in which clinicians wrote "prescriptions" that patients could take to farmer's markets to purchase a certain number of fruits and vegetables.

Provision of Referrals

Thirteen programs[15,26,94,96,105,154,157,162,166,168,175,178,181] provided referrals to local or national food programs, such as local food pantries, SNAP, or the Special Supplemental Nutrition Program for Women, Infants, and Children, commonly referred to as WIC. Of

these, twelve[26,94,96,105,154,157,162,166,168,175,178,181] of these programs referred to local CBOs, such as food pantries, and eight[15,94,96,105,154,157,168,175] assisted with enrollment in SNAP and WIC. Seven programs[15,94,96,105,154,157,168,175] provided both. Six programs[26,157,166,168,175,178] utilized on-site benefits specialists to assist with referrals, while five[94,96,105,154,181] used electronic referrals to alternative CBOs (e.g., food bank,[178] NowPow,[181] Benefits Data Trust,[94] medical-legal partnership,[154] or Hunger Free Colorado[96]), who then followed up with the patient.

Offering Patient Education

Nineteen programs[13,18,24,26,112,146,153,154,157,158,160,162,164,165,167,172–174,176,177,179,180] provided education to patients, which included nationally-available courses such as Cooking Matters[162,182] and "Eat Right When Money's Tight,"[157] as well as education produced by the intervention health care institution. Of the 19, sixteen programs[13,18,24,26,146,153,154,157,160,162,165,167,172–174,176,177,179,180] provided nutrition education, while eight[112,146,158,160,162,164,165,174,176] provided cooking demonstrations or education. Five programs[146,160,162,165,174,176] provided both. Seven of the 19 programs[18,24,146,154,157,160,172,173,176,180] provided education on cooking on a budget or food resource management. Six programs[18,18,153,154,157,172,176,180] used passive nutrition education, such as with printed materials or online videos, while nine[13,24,112,146,158,160,162,167,174,177] provided in-person education or cooking demonstrations. Two programs[164,165] provided both printed materials and in-person cooking demonstrations. Four programs[13,158,164,167] provided education informally, such as during other health care visits,[167] in passing and without billing,[13] or during a farmer's

market.[158,164]

Health Care Team Members Involved in Staffing

Staffing of interventions was varied. Screening and/or referral into interventions was completed by clinic staff in eight programs,[15,96,153,155,156,164,165,177,180] by a physician in three programs,[161,163,179] by a program manager in one program,[13] by a nutritionist in one,[111] and by research study staff in four programs.[17,94,159,166,169] Seven other programs listed "providers" as tasked with screening and/or referring patients into the program, but did not specify which type of provider.[18,18,112,146,157,158,160,167,168,173]

Programming was staffed by an array of volunteers and professionals. While some programs had only one type of staff member running programming, other programs used a variety of staff to execute different functions of the program, in addition to their primary responsibilities. Community volunteers were utilized by three programs,[11,12,153,167] while staff volunteers were used by one.[181] CBOs delivered programming in seven interventions.[24,94,96,154,166,175,178] A range of medical staff was used in program delivery, such as for education: four programs used providers,[153,154,165,171,179] one used Registered Nurses,[26] one used Nurse Practitioners,[174] five used Registered Dietitian Nutritionists,[26,111,174,177,180] and three used Community Health Workers.[24,164,177] One program utilized a nutrition educator and licensed chef to deliver education.[162] Research staff delivered programming in one intervention.[175]

Program Length

Eight programs[11–13,15,112,154,167,170,171,175] were permanent. These programs included on-site food pantries[13,112,169] and gardens,[167] two monthly on-site food

distributions,[11,12,175] on-site distribution of baby formula,[154] and a produce prescription program.[170,171] Eleven programs[17,26,94,96,157,159,163,166,168,175,179,181] included programming that each patient received only once, even if they attended the health care institution repeatedly. All of these programs, except one,[179] included food insecurity screening and referral to federal or local food assistance programs. Two of these programs also provided participants with one bag of non-perishable foods from a hospital-based food pantry,[26,181] and one included ongoing monthly on-site food distributions to participants with diabetes.[175] Eighteen[18,24,111,146,153–156,158,160,161,164,165,169,172–174,176–178,180] programs were time-limited, ranging from three to nine months. Fourteen[18,111,146,153–156,158,160,161,165,169,172–174,177,178] of these programs utilized cash assistance to increase participants' purchasing power of food, while four[24,164,176,180] provided food directly to patients.

Results of Typology Development

We identified three types of food assistance programs located at health care institutions: those that provide food directly to patients, those that refer patients to resources that provide food, and those that provide vouchers or cash assistance in order to purchase food. These are summarized in **Table 6**.

Table 6. Typology of Healthcare-based Food Assistance Programs.

	Provides Food Directly	**Refers to Resources that Provide Food Assistance**	**Provides Vouchers to Purchase Food**
Recipients	Patients who are both food insecure and have a diagnosis of chronic disease (e.g., diabetes mellitus, cardiovascular disease, or cancer, etc.). Sometimes participants with food insecurity and no additional eligibility requirements.	All patients who screen positive for food insecurity	Patients who are both food insecure and have a diagnosis of cardiometabolic disease (e.g., diabetes mellitus or cardiovascular disease, etc.) or health status associated with nutritional risk (e.g., pregnancy, obesity, or underweight, etc.)
Length of Intervention	Ongoing, allows for repeat use by participants.	One-time intervention to connect people to resources	Time-bound, providing resources for an average of 3–6 months
Type of Food	Both produce and non-perishable foods	No type of food prioritized (referral to programming, regardless of food provided)	Priority to provide produce (fruits and vegetables)
Choice of Food	Limited choice, if any. Typically offer standard bags of food that do not provide patient with choices	No tangible food provided	Moderate choices offered. Allow participants to choose foods within certain parameters (e.g., fruits and vegetables)
Education	Typically provides nutrition education, sometimes with cooking demonstrations included	No education provided	Often provides nutrition education, sometimes includes cooking demonstrations
Partnerships	Partnerships with CBOs to obtain food to be distributed.	No formal partnerships required. Some programs set up direct lines to local CBOs	Partnerships with food purveyors (e.g., farmers, grocery stores) to accept vouchers.

		(e.g., food pantries, food banks, Feeding America franchise).	
Reach	Varied. Can be limited in size or available to a large proportion of patients (in the case of on-site gardens, pantries)	Significant. Available to a large proportion of patients. Successful reach may be dependent on capacity of referred CBOs.	Limited in size
Staffing	Referral and enrollment process facilitated by varying clinic staff members. Two programs were entirely open access.	No permanent staff focused on this programming. Often filled though research staff roles	Often require a physician to refer patient into program

Programs that Provide Food Directly

Programs that provide food directly to patients provide both produce and non-perishable foods and tend not to offer patients a choice of food, instead, providing a standardized pre-packed bag or box. These programs frequently include nutrition education, and sometimes cooking demonstrations, and tend to be permanent and on-site. Examples include food pantries, community gardens, and on-site food delivery and distribution in partnership with a local food bank. Often, institutions and programs partner with CBOs for obtaining the food to be provided.

Patients can be referred to these programs by their healthcare providers (e.g., physicians or dietitians) and utilize the program at any time at any time in their care, as they are static programs. These programs vary in size: some provide assistance to a limited number of patients, while others provide food to any patient who would benefit. Often these programs are only developed for and provided to patients with certain diagnoses, most often nutrition-related cardiometabolic diagnoses, such as diabetes,

obesity, and cardiovascular disease. However, it is not uncommon that these programs also provide foods for all patients with food insecurity, regardless of cardiometabolic diagnosis.

Programs that Refer Patients to Resources that Provide Food Assistance

Programs that refer to resources that provide food assistance are typically available for all patients that screen positive for food insecurity, either on the Hunger Vital Sign[105–107] or another screening tool.[108] These programs can be time-limited or permanent at the health care institution, but each participant's interaction with the program happens only once, when they are referred to resources.

Referrals can be to local CBOs such as food pantries, regional resources such as a Feeding America site, or enrollment assistance with federal food assistance programs such as SNAP and WIC. Enrollment assistance happens both on-site or via referral to a CBO to assist.

Referral programs are more limited in scope than other food assistance programs. Because the program consists of a referral to an outside entity, the health care institution has no control over the type of food provided; patients instead receive food assistance from the CBO or federal program. Nutrition education is rarely provided by the health care institution in tandem with the referral program. Reach for these programs is significant; many patients are able to be referred. The referral programs we identified used research staff to complete the patient identification and referral process. Use of temporary research staff, rather than permanent health care staff, highlights the uncertainty of program funding and sustainability.

Programs that Provide Vouchers to Purchase Food

Programs that provide vouchers to purchase food are time-bound, providing patients with vouchers for an average of three to six months. They are typically available for patients with both food insecurity and a health status associated with nutritional risk (e.g., pregnancy obesity, underweight) or cardiometabolic disease. Produce prescription programs, which are a type of voucher program, are frequently funded by the USDA National Institute of Food and Agriculture, who requires that they reach low-income populations with diet-related health conditions.[151]

Voucher programs prioritize the procurement of fruits and vegetables over non-perishable foods and provide a choice of foods within this limitation (i.e., patients can choose which fruits or vegetables they would like to purchase with their voucher). Nutrition education and cooking demonstrations are frequently paired with these programs. Partnerships with food purveyors, such as farmers, farmer's markets, supermarkets, and convenience stores, are necessary for providing a venue in which the vouchers are accepted.[151,183] These programs are often limited in reach, helping fewer patients than other types of programs, likely due to the cost of providing financial assistance. These programs often require a physician to refer the patient to the program; they are rarely open to all patients; only those with a prescription can participate.

D. Discussion

Our scoping review resulted in the creation of a typology that identified three distinct types of health care-based food insecurity interventions: those that provide food directly to patients, those that refer patients to resources that provide food assistance, and

those that provide vouchers to purchase food. Our findings from the typology indicate that logistical considerations and constraints impact feasibility of health care-based food insecurity interventions. Important logistics to consider include staffing, refrigeration and storage space, existence of willing community-based organizations and partners, and program goals.

Staffing of food insecurity alleviation programs varied by type of program: programs that provide vouchers or financial assistance to patients often require a physician to refer qualifying patients to the program, while programs that provide food directly to patients utilize a variety of clinic staff members, such as registered dietitians and community health workers. Referral programs rarely used permanent staff, and often filled these positions with members of the research team.

Implementation science literature indicates that staffing of health care-based programming heavily influences implementation and sustainability.[184] Analyzing staff capacity prior to program development and implementation and aligning program choice with existing capacity should help to ensure that adequate human resources are in place. Physicians have previously reported that limited training and time during patient visits are barriers to implementing voucher programs.[150] If adequate training and time is unavailable, implementers may wish to consider a program that does not require physician involvement, such as a referral program. Importantly, having a dedicated, paid, staff member, rather than a volunteer program champion, to run any type of food insecurity alleviation program improves provider experiences and overall programming.[150]

Refrigeration and storage space for food provision also heavily impacts the type of programming a health care institution can implement. For example, many of the programs we included in the review lacked refrigeration space for storing fresh produce; some programs chose to ameliorate this issue by providing only non-perishable foods, while others partnered with community-based organizations to deliver fresh produce to be distributed to patients on the same day. Securing space agreements and identifying community partners early in program development not only help to increase likelihood of program success but also dictate what type of program may best fit the needs of the health care institution and patient population.[13]

Community partnerships were influential in almost all the programs we identified. Programs that provided food directly to patients often partnered with local food banks to source the food; referral programs partnered with CBOs to assist with registering patients for SNAP and WIC, or to local food pantries for additional food resources; and programs that provided vouchers to patients often partnered with food purveyors such as farmers markets or supermarkets. Identifying and working with community partners early in development and implementation of food assistance programs will dictate what programming can be provided effectively.[13,96,151].

In addition to logistical constraints, health care institutions should consider their goals for the program, including how many and what type of patients they aim to reach and the length of time of the intervention they foresee. As evidenced in the typology, programs that wish to serve a greater number of food insecure patients may wish to implement a referral program, which allows for higher throughput than a voucher or food

provision program.[96,105] Alternatively, institutions that wish to provide programming for patients with the dual burden of food insecurity and cardiometabolic disease may choose to implement a more rigorous, but less wide-reaching initiative, such as a fruit and vegetable prescription program.[151] It is, however, important to consider the length of the intervention; provision of food for a months-long period is a worthy goal but may lack durability of any health or food security outcomes observed.[146]

A limitation of this typology is that we do not include information on program sustainability. Health care institutions that aim to create food insecurity alleviation programs should consider not only their implementation, but their plan for sustainability. Research indicates that sustainability of health care-based programs is heavily influenced by organizational support, staff turnover, and funding.[146,184] Being explicit about program components and clearly defining scope of work and processes can increase sustainability and achievement of strategic outcomes.[185] Referral programs may be best able to reach the largest number of patients, but follow-through to ensure that patients are connected to and receive resources is a challenge.[19]

A second limitation to this typology is that we did not assess program outcomes, but rather the implementation and programming. Importantly, a 2019 review of health care-based food insecurity interventions found that the majority of studies were low quality and most analyzed only process outcomes.[19] Evaluation of program impacts and outcomes, such as improvements in health or decreased health care utilization, can lead to increased funding, and thus sustainability, of these programs.[150] Formal evaluations are often not done, however, because many of these programs are small in scope and created

by clinical staff members to help patients, rather than researchers aiming to evaluate a program.[186] Additionally, it is difficult to assess the body of literature as a whole because of the heterogeneity of program components[19,186] and goals: some to improve food security and some to improve overall health and health care spending. Future research should aim to identify which program components and outcomes are most important for improving food insecurity among patient populations.

Lastly, this scoping review and typology included only interventions from the peer-reviewed literature; there are certainly other healthcare-based food insecurity programs in the United States that have not published peer-reviewed literature of their findings.[145,147,187] There is likely significant institutional knowledge at other sites, and the field would benefit from tapping into both the positive and negative experiences of existing programs. Communities of practice, focused forums, and other forms of information sharing may be the best way to identify learnings and innovations, and ultimately share effective practices.

CHAPTER FIVE: MIXED METHODS EVALUATION OF THE MOBILE MARKET

A. Introduction

Food insecurity, defined as lacking consistent access to a sufficient quantity of food to live a healthful life, impacts more than one in ten American households.[42] Food insecurity is associated with higher prevalence of chronic disease, such as obesity,[47,54] type 2 diabetes,[55–57] hypertension,[55,56] arthritis,[56] obstructive airway disease,[8,55] and depression.[58,59] In the past decade, healthcare institutions have recognized the significant influence of food insecurity on health, and some institutions have initiated food assistance programs to address the issue. Food insecurity interventions in healthcare settings have included referrals to local resources;[9] assistance with enrolling in federal nutrition assistance programs;[10] partnerships with community-based organizations such as food banks,[11,12] clinic-based food pantries[13–15] and farmers markets;[16] provision of vouchers for local food vendors;[17,18] and home delivery of medically-tailored prepared meals.[19,20]

Food assistance programs, both in the community and at health centers, are often underutilized.[19,93,153] Previous studies have shown barriers to participation in healthcare-based food insecurity programming include lack of transportation, lack of time, scheduling conflicts, and lack of clear information about the program location and time.[18,152,153,188] Additionally, having to manage medical conditions has been found to be a barrier to uptake,[188] but there is limited evidence on which medical conditions are associated with program participation.

Understanding the impact of medical conditions, socio-demographic characteristics, and economic and environmental conditions on participation in healthcare-based food insecurity programs can decrease barriers to uptake and improve program delivery. We used attendance data from a monthly free produce market (MM) located at a federally-qualified health center (FQHC), combined with the health center's electronic medical record (EMR) data to assess medical conditions, demographics, and other characteristics to identify variables associated with MM uptake.

B. Methods

Study Design and Setting

We conducted a sequential mixed methods[128,131] evaluation of a MM located at the Greater Lawrence Family Health Center (GLFHC) in Lawrence, Massachusetts. Mixed methods are frequently used in program evaluation research,[129] and can produce more comprehensive assessment than a single research method alone.[130] In our study, quantitative findings from the MM and the GLFHC EMR data were used to inform the creation of qualitative data collection instruments, including a direct observation tool and key informant interview guide. The Practical, Robust Implementation and Sustainability Model (PRISM) framework, which explores how healthcare interventions and patient populations interact to impact a program's implementation,[113] was also used to guide our qualitative data collection and analysis. After all data collection activities were completed, qualitative and quantitative data were combined to create a holistic picture of the MM.

Lawrence, Massachusetts is a city of approximately 89,000 residents located in

Merrimack Valley, 30 miles northwest of Boston.[29] More than 80% of Lawrence residents identify as Hispanic/Latino, and 80% speak a language other than English at home.[29] The median household income in Lawrence is $45,045, and 17% of residents live below federal poverty level.[29] GLFHC serves as the primary source of healthcare for more than three-quarters of Lawrence's population.[30] The MM has been operating consistently for more than six years since its implementation in 2016, and is now ingrained in both the health center and the Lawrence community. It is also a program that assists a particularly vulnerable community; GLFHC has previously found that more than half of its patients who were screened for food insecurity were positive.[189]

The MM is a partnership between the Greater Boston Food Bank (GBFB) and GLFHC. Since 2016, the MM has provided 6–8 produce items (approximately 20–30 pounds) monthly to health center patients and community members. The MM takes place in a parking lot at GLFHC for a two-hour period on the third Saturday of each month, though some months it occurs on alternate Saturdays due to holidays and other scheduling issues. The GBFB obtains the produce from the food industry (e.g., retailers, distributors, and farmers, etc.) and the Massachusetts Emergency Food Assistance Program. Food is delivered in pallets, and MM volunteers divide the food into piles for each registered family. While the MM has no eligibility requirements and is open to anyone who wishes to receive, all prospective clients must register for the MM. The MM registration process entails completion of a short survey, which includes contact information (name and address), household size, the Hunger Vital Sign[105] food insecurity screen, and a single question about SNAP participation. Prospective users are also asked

to provide photo ID to streamline the registration process, but legal ID is not required. Registrants receive a MMID card, which they show at each visit to the MM.

Quantitative Data Collection

Study Sample

Data for this project were retrospectively extracted from the GLFHC EMR and Oasis Insight software (https://oasisinsight.net/) from August 2016 to February 2020 for all patients who were registered for the MM either within GLFHC or on-site at the MM. Oasis Insight tracked each registrant's visit to the MM using their unique MMID. Participants were considered eligible for MM attendance on or after their date of registration; all MM dates prior to each participant's unique registration date were not included in analyses. Due to incomplete data collection resulting from the Covid-19 pandemic, MM attendance data after February 2020 were excluded. Data were merged using participant personal identifiers (e.g., address, date of birth, and name) and manually reviewed to ensure validity. A final study sample consisting of individuals with both an MMID and EMR data during the study period of August 2016 to February 2020 was used for all analyses. The Boston University Medical Campus and Boston Medical Center IRB approved all study procedures.

Key Measures

Socio-Demographic Variables

Demographic information such as age, sex, self-reported race and ethnicity, preferred language, and primary insurance type (Medicaid, Medicare, private, or uninsured) was obtained through EMR data. Information obtained from Oasis Insight

included self-reported SNAP enrollment and number of children, adults, and seniors in the household.

Medical Diagnosis Variables

ICD-10 diagnosis codes in the EMR provided information on medical comorbidities and diagnoses each participant had been given by a medical provider at any time in the patient's history with the health center. These diagnoses include diabetes, hypertension, hyperlipidemia, cardiovascular disease, heart failure, obesity, asthma, anemia, chronic kidney disease, peripheral artery disease, COPD, HIV, cancer, psychiatric diagnoses, and substance use disorder. A Charlson comorbidity index score was created for each study participant using the EMR ICD-10 codes. The Charlson comorbidity index is a validated summary measure that uses a weighted score of 19 comorbidities to predict 1-year mortality risk.[132,133]

MM Method of Registration Variable

Individuals can register for the MM in one of three ways: on-site, day-of at the MM; at GLFHC with a staff member (e.g., community health worker, medical assistant, or provider); or by calling a dedicated GLFHC MM registration phone number. The method of registration was captured by Oasis Insight.

Economic and Environmental Variables

We created a binary measure (i.e., yes/no) indicating if the market was held on the third Saturday of the month, as typically scheduled, in order to capture if alteration from the default MM date impacted attendance. To understand the broader economic context in which the market was running between 2016 and 2020, we included the Massachusetts

state-level unemployment rate for each month in which there was a market. We also included monthly indicator variables (fixed effects) to control for seasonality in attendance.

Quantitative Data Analysis

We compared differences in characteristics between GLFHC patients who ever attended versus never attended the MM using t-tests for continuous and binary variables and chi-squared tests for categorical variables. Multiple logistic regression was used to analyze predictors of monthly MM attendance. Key predictors included socio-demographic characteristics, medical diagnoses, MM registration, and economic and environmental variables. Statistical significance for all analyses was indicated by a p-value less than or equal to 0.05 using R Studio (version 4.1.2)[134].

Qualitative Data Collection

Key Informant Interviews

Semi-structured interviews with MM participants (n=19) and staff (n=5) were conducted to understand implementation and uptake of the MM. Semi-structured interviews consist of a set of previously constructed open-ended questions and prompts, but allow for a flexible interview guided by a dialogue between the researcher and participant.[135] Questions and responses were followed up with probes to elicit in-depth responses regarding perspectives, thoughts, and feelings from participants.[135] Interview guides were designed to capture stakeholders' perspectives on the MM, providing a rich description of their experiences with the program.[120] The interview guides were informed by the PRISM framework. The MM volunteer interview guide included

questions related to acceptability and feasibility of the program, barriers and facilitators to implementation, internal and external contextual factors, and maintenance and sustainability.[113] A participant interview guide, which included questions regarding acceptability and accessibility of the MM (Appendix B), was translated into Spanish verbatim from the English guide, then back-translated to ensure consistency.

MM volunteers were interviewed between May and June of 2022. Purposive and snowball sampling was used to identify MM volunteers who had significant experience with the program. The MM program coordinator at GLFHC was asked to provide a list of suggested staff and patients to interview, and interviewees were also asked to suggest additional individuals for participation. All MM volunteer interviews were conducted over Zoom by the primary investigator.

MM user interviews were conducted in September 2022. Convenience sampling was used to identify potential participants. Participants were interviewed while waiting in line for the MM to open; every effort was made to remove the interviewee from the MM line to create privacy while maintaining their space in line. English-speaking interviews were completed by the primary investigator, while Spanish-speaking interviews were conducted by a Spanish-speaking research assistant. Interviews were completed until thematic saturation was reached.[136]; all interviewees received a $20 grocery store gift card to compensate them for their time.

Direct Observation of the MM

In addition to Key Informant Interviews, direct observations of the MM were conducted by trained study team members on multiple occasions (n=4: in April,

September and November 2022 and January 2023 to assess the impact of weather on the MM). A direct observation data collection tool was created to capture relevant information at the MM (Appendix A). Information regarding the registration, queueing, and food pick-up process was collected. During the data analysis phase, data from direct observations was used in conjunction with both the quantitative and semi-structured interview data to validate findings and create a complete understanding of the MM.

Qualitative Data Analysis

All interviews conducted in English were transcribed verbatim by the primary investigator. Transcription and translation of Spanish-speaking interviews was completed by DataGain (https://transcriptionclient.datagainservices.com/).

Key informant interview data were analyzed using thematic analysis.[137] A deductive coding frame was created using the PRISM framework (see Figure 1).[113] In the coding phase, two researchers (RR and SF) first independently read each interview transcript to familiarize themselves with the data. Next, both researchers coded each transcript together in weekly meetings, with a third researcher (KW) attending each meeting to ensure consensus. NVivo Release 1.7 (QSR International) software was used to manage and code the qualitative data.[138] Next, data from NVivo was exported into a data charting matrix to display and systematically explore the data.[139,140] Both researchers then iteratively examined and sorted the matrix to identify themes.

C. Results

Quantitative Results

The study sample consisted of 3,071 GLFHC patients registered for the MM between August 2016 and February 2020. The average age of participants was 53 years (SD: 15); most patients were female (80%), Hispanic (94%), and Spanish-speaking (85%). The majority of participants had Medicaid (58%) and Medicare (26%) insurance, and 41% were enrolled in the Supplemental Nutrition Assistance Program (SNAP). The average number of MM visits over the 43-month study period was 4.5 (SD: 7.6), with 1992 (65%) participants attending at least once.

Differences in characteristics between MM users and never-users are presented in **Table 1.** MM users were statistically significantly more likely to be older, female, Hispanic, Spanish-speaking, on Medicare or uninsured (as opposed to on private insurance or Medicaid), and SNAP participants. They were also more likely to have more older adults and fewer children in the household than non-users. MM users were more likely to have a diagnosis of diabetes or pre-diabetes, hypertension, and hyperlipidemia, and less likely to have a diagnosis of substance use disorder (SUD). Users were also more likely to have registered for the MM day-of and on-site.

Table 7. Descriptive Statistics of Patients who Did and Did Not Use the MM

Variable	**Ever Used (n=1992)**	**Never Used (n=1079)**	**Statistical test of significance**
Age	55.20 (14.43)	49.52 (15.57)	p<0.001
Female	81.6%	76.8%	p=0.0017
Language			p<0.001
Spanish Speaking	92.1%	79.4%	
English Speaking	7.1%	18.5%	
Other Language	0.8%	2%	
Missing	2.7%	3.3%	
Race/Ethnicity			p<0.001
White, non-Hispanic (race = 1)	2.5%	5.6%	
Black, non-Hispanic (race = 2)	0.8%	2.9%	
Other, non-Hispanic (race = 3)	0.1%	0.5%	
Hispanic or Latino	96.4%	89.2%	
Missing	0.2%	1.8%	
Insurance Status of Respondent			p=0.004
Medicaid (insurance = 1)	55.5%	61.2%	
Medicare (insurance = 2)	28.1%	22.6%	
Private insurance (insurance = 3)	4.8%	5.5%	
Uninsured (insurance = 4)	11.6%	10.7%	
Health Outcomes			
Depression (as measured by PHQ-9)			p<0.001
None	52.3%	42.3%	
Mild	17.5%	21.0%	
Moderate	11.3%	12.2%	
Severe	10.0%	15.1%	
Missing	8.8%	9.3%	
Charlson Comorbidity Index Score	1.24(1.81) [0,13]	1.31 (1.98) [0,13]	p=0.3218

Charlson Comorbidity Index Category			p=0.3094
None	47.4%	48.7%	
Mild	35.7%	32.8%	
Moderate	9.8%	10.1%	
Severe	7.0%	8.3%	
Has Diagnosis of Diabetes or Prediabetes			p<0.001
Yes	38.7%	31.2%	
No	60.0%	64.6%	
Missing	1.4%	4.8%	
Has Diagnosis of COPD	3.3%	4.7%	p=0.042
Has Diagnosis of Asthma	12.4%	14.5%	p=0.116
Has Diagnosis of Obesity	49.4%	46.9%	p=0.1853
CVD	4.8%	5.1%	p=0.687
HTN	48.3%	41.3%	p<0.001
SUD	4.3%	10.3%	p<0.001
HLD	47.6%	38.2%	p<0.001
Diabetes	30.8%	26.3%	p=0.009
Household Size			
Number of children in household	1.02 (1.19) [0,6]	1.10 (1.25) [0,6]	p=0.09
Number of adults in household	1.92 (1.21) [0,8]	1.88 (1.16) [0,7]	p=0.43
Number of seniors in household	0.38 (0.61) [0,3]	0.27 (0.54) [0,4]	p<0.01
SNAP Enrollment			p<0.001
Enrolled	42.4%	39.3%	
Unenrolled	52.7%	48.4%	
Unknown/Missing	4.9%	12.3%	
Registration Type			p<0.001
Same Day On-Site Registration	48.5%	6.1%	
Clinic Registration	20.5%	64.7%	
Phone Registration	30.9%	29.2%	

Socio-Demographic Characteristics

MM registrants concurrently enrolled in SNAP were less likely to attend the MM than those who were not enrolled (OR = 0.989 95% CI =0.984,0.994, p-value<0.005) (**Table 8)**. MM registrants with Medicaid and Medicare insurance were more likely to attend the market than those with private insurance (OR = 1.019, 95% CI = 1.01,1.03, p-value<0.005 and OR = 1.014, 95% CI = 1.00,1.03, p-value=0.02, respectively).

Medical Diagnoses

The odds of MM attendance decreased by 0.7% (95% CI = 0.992,0.995, p-value<0.005) for each one-point increase in a participant's CCI score, indicating that GLFHC patients with multiple chronic conditions are less likely to attend the market. Similarly, having a psychiatric or substance use disorder diagnosis was associated with lower odds of MM attendance (OR = 0.986, 95% CI = 0.981–0.991, p-value<0.005 and OR = 0.958, 95% CI = 0.949–0.968, p-value<0.005, respectively) compared to participants without these diagnoses. Participants with asthma diagnoses were also less likely to attend the MM than those without (OR = 0.993, 95% CI = 0.985,0.999, p-value=0.043). Notably, diagnoses of diabetes, hypertension, and hyperlipidemia were not associated with MM attendance.

Market Registration

Participants who self-registered for the market on-site and day-of were more likely to attend the MM in any given month relative to those who self-registered for the MM on non-market days (OR = 1.077, 95% CI = 1.07–1.08, p-value<0.005). On the other hand, participants who were registered for the MM in the clinic with a staff member

on non-market days were less likely to attend the MM than those who self-registered for the MM on non-market days (OR = 0.922, 95% CI = 0.917–0.928, p-value<0.005). This may indicate that participants who self-register are interested in the MM but are experiencing barriers to attendance on MM days.

Economic and Environmental Characteristics

MM users were more likely to attend when the market was held on the third Saturday of the month, as scheduled (OR = 1.017, 95% CI = 1.01–1.03, p-value<0.005). The odds of attendance increased by 14.2% (95% CI [1.13,1.15], p-value<0.005) for each one percentage point increase in Massachusetts state unemployment during the month the market was held, indicating that macroeconomic fluctuations may impact MM use.

Table 8. Results of Multiple Logistic Regression

Variable	**OR**	**95% CI**	**p-value**
Age	1.003	1.003–1.003	<0.005
Number of Children in House	0.988	0.986–0.990	<0.005
Number of Adults in House	0.996	0.994–0.998	<0.005
Number of Seniors in House	1.003	0.999–1.008	0.173
MA State Unemployment	1.142	1.133–1.150	<0.005
SNAP Participant	0.989	0.984–0.994	<0.005
Uninsured	0.989	0.977–1.001	0.084
Medicaid	1.019	1.008–1.030	<0.005
Medicare	1.014	1.002–1.026	0.021
Same Day On-Site Registration	1.077	1.071–1.084	<0.005
Clinic Registration	0.922	0.917–0.927	<0.005
Primary Care Site	1.007	1.002–1.012	0.008

Social Services Screen	0.993	0.985–1.000	0.064
CCI Score	0.994	0.992–0.995	<0.005
Substance Use Disorder Dx	0.958	0.949–0.968	<0.005
Psychiatric Dx	0.986	0.981–0.991	<0.005
Asthma Dx	0.993	0.985–0.999	0.043
COPD Dx	0.981	0.968–0.993	<0.005
Diabetes Dx	1.006	1.000–1.014	0.064
Hypertension Dx	0.997	0.999–1.012	0.274
Hyperlipidemia Dx	1.005	0.999–1.011	0.072
Heart Failure Dx	1.004	0.987–1.022	0.633
Cardiovascular Disease Dx	0.981	0.970–0.992	<0.005
Obesity Dx	1.011	1.006–1.016	<0.005
Anemia Dx	1.001	0.995–1.007	0.730
Peripheral Artery Disease Dx	1.004	0.970–1.039	0.831
Chronic Kidney Disease Dx	1.018	1.007–1.029	<0.005
Third Saturday of the Month	1.017	1.008–1.025	<0.005
January	0.995	0.982–1.009	0.482
February	1.014	1.000–1.027	0.050
March	1.006	0.991–1.020	0.456
April	0.998	0.985–1.011	0.798
May	0.989	0.975–1.003	0.111
June	1.015	1.003–1.028	0.016
July	1.006	0.992–1.020	0.406
August	1.027	1.013–1.042	<0.005
September	1.025	1.010–1.039	<0.005
October	1.017	1.003–1.030	0.0145
November	1.025	1.014–1.035	<0.005

Qualitative Results

Qualitative data, including findings from key informant interviews and direct observations, add insight and context to our quantitative findings. Analysis of key informant interviews identified five prominent themes that impact attendance at the MM. Both users and MM volunteers shared that 1) financial need drives the decision to use the MM, 2) people come to the MM specifically for healthy and natural food, 3) participants feel a connection to the health center which increases participation, 4) social networks increase interest and usage, and 5) there are barriers to MM attendance.

Financial need drives the decision to use the MM

Financial concerns drove users to the MM. Users reported that the MM was helpful in providing food that they may not otherwise be able to afford. Many users mentioned the high cost of fruits and vegetables and discussed forgoing produce at the grocery store in favor of less expensive, but also less healthful, foods.

"But you know, sometimes money is tough. Sometimes, you know, you have to buy a hot dog or hamburger, because they're [vegetables are] very expensive." – Participant #8

In light of increasing living costs and inflation, the MM is an opportunity not only to obtain healthy foods, but also to alleviate financial hardship. Financial issues were the users' primary barrier to purchasing food at the supermarket; many acknowledged competing financial demands impacting their ability to purchase food.

"Everything is so expensive and you know how rent has shot up that everything you get is for the rent because you don't even have enough for food." – Participant #17

This portrayal of household budgetary strain, and how significant living costs absorb much of users' monthly incomes, illustrates the value of the MM and its potential to fill

financial gaps. Even when participants are enrolled in other financial assistance programs (e.g., SNAP) to bolster insufficient income, it is still not enough to be able to purchase healthful, or simply enough, food.

"I'm running out of food stamps. I'm almost out. I'm feeding them [my family] off of my income. We get his income, but you know we pay the rent, he's got his phone bill, I've got mine, the electric I take care of, we try to take care of the cable, there's still laundry. Nothing is free." – Participant #3

People desire the healthy and natural food offered at the MM

The MM not only provides food assistance to those with financial hardship but also provides access to high-cost healthful foods. Because many users forgo produce at the supermarket due to financial constraints, they appreciated that the MM was able to provide a consistent and reliable source of fruits and vegetables.

"I think it's very helpful. I'm coming every month and it helps a lot, especially the fruits and vegetables, because I am diabetic, and I have stomach problems so I can't eat much other stuff, fruits and vegetables the most, and they're the most expensive in the store. So before the market I wouldn't buy fruits or vegetables, especially fruits, in Market Basket and I was craving it so much because I couldn't afford it. So this is a big help." – Participant #2

At its core, the MM aims to increase access to nutritious foods. Users commonly noted that they frequented the MM specifically because of the healthy and natural foods provided.

"To be very honest with you, I like the market due to the fact that a lot of the vegetables they give here …I use them. They're very beneficial for me" – Participant #6

"Because they give healthy things. They don't give junk food, as people call it." – Participant #17

Users were knowledgeable about the positive impacts of fruits and vegetables on their health, and explicitly discussed reasons they choose fruits and vegetables over other

foods. They noted that they believed that the produce helped them maintain a healthy weight and manage chronic illness.

"Oh, I love it, I love it. Because I started at um, getting the food from the market, I eat better. You know, because of the vegetables and other stuff. Honest to God, I love it. I love it." – Participant #8

"Vegetables are a healthy diet, and besides, I also had heart surgery. I normally don't eat junk food. I'm always with vegetables, fruits and all that." – Participant #14

"Because I just like vegetables, because I have gastric bypass and vegetables help me a lot. I've lost weight." – Participant #19

The community in which the MM is located has many food assistance resources, such as pantries and soup kitchens. Participants noted that while they can obtain food from these other sites, they perceive the offerings from other places to be less healthy. Although participants had utilized these other resources in the past, they reported that they have been using them less frequently due to the unhealthful nature of the foods provided elsewhere.

"Yeah the canned food, the cholesterol...it's government food. There's cholesterol, sodium, and you're feeding it to seniors who are on blood pressure medicine but you're feeding it to them? That's what they do, and you're keeping them sick." – Participant #1

"Sometimes when you go to different food pantry it's not fresh. Here it's delicious, it's always good and fresh" – Participant #2

Lastly, during the Covid-19 pandemic, the MM began providing non-perishable foods in addition to fresh produce. This has included canned options (e.g., beans, vegetables, fruits, soups), as well as bags of rice and other shelf-stable foods. Users reported that they did not care for this change, perceiving these foods to be less healthful, and preferred the produce for health reasons.

"Sometimes when they give you the cans, because I don't use too much cans, not healthy. Not natural. Not food." – Participant #7

Participants feel a connection to the health center

While the MM is open to anyone who wishes to attend, it is located in the parking lot of the health center, providing a de facto endorsement of the MM by the center. Patients felt a sense of ownership of and belonging at the health center, which impacted their interest in attending the MM hosted there. When asked how they first found out about the MM, users noted that this was "their" health center. Many did not remember exactly who originally told them about the MM but remembered hearing about it from a staff member at the health center. The type of staff member or their relationship to them was not noted as an important factor in attending the MM. Other patients noticed a flyer on the wall at the health center and started attending the MM. One participant commented,

"Because I use this clinic here. I come here. My pharmacy, everything is here." – Participant #13

MM users also noted that the health center is well-known in the community and in a centralized location, making it easier to get to. Because the health center provides many medical and social services, users noted they could combine multiple errands with a visit to the MM, saving time and decreasing the need for an additional trip.

"I come to the clinic and if it's there I grab my food in one go. I don't have to make another trip here." – Participant #17

MM volunteers felt that holding the MM at the health center, as opposed to other locations, decreased the stigma of asking for help. They noted that they hoped that by

promoting and normalizing the MM at the health center as part of routine health care, more individuals would come who may not otherwise seek assistance.

"It kind of allows people to access food resources, who might otherwise feel like…'well I'm not dying of starvation, I don't need to go to the food pantry. Like, save that for the people who really need it' or 'I'm too embarrassed for the food pantry I don't want my neighbors to see me there' and it's kind of a safer place to go that has less stigma attached you're just going to the doctor's office and …while you're there you get food." – Volunteer #1

Patients' relationships with their doctors at the clinic influenced attendance in differing ways. Some patients reported attending because they were influenced by their doctor, who suggested the MM during a healthcare visit. Others reported that their doctor's recommendation had no bearing on their decision to attend, but they came simply because they needed the food. However, MM volunteers believed that a doctor's recommendation to attend the market was especially influential to patients, affecting both MM attendance and self-care. Volunteers felt that the MM exemplified the types of changes the doctors espoused in clinic visits, and providing healthy food was a way of "putting money where your mouth is."

"And that I think it just makes it makes an impact on like okay, they really think I should eat vegetables, you know. So that piece just in terms of like my communications with patients around kind of health planning and nutrition, I think, really makes a big impact." – Volunteer #4

Though the MM is open to any participants regardless of need, affiliation, or location, some participants who were referred to the MM by their doctor incorrectly believed that a doctor's approval was required in order to use the MM. They noted the referral process, which included getting "papers" together, as part of how they were originally connected to the MM. The formality of the referral process may have led to their belief that the MM

was reserved only for those with a physician's approval. Patients who had this belief seemed motivated to attend in part due to their physician's formal directive, for example,

"My doctor, you have to have your doctor, or somebody, approve you to get this. It isn't just walk in line and get it." – Participant #1

Social networks increase interest and usage

Community connections and social networks helped to spread the word about the existence of the MM. Users who did not hear about the MM from the health center learned about it from a friend or family member. Many discussed telling other friends and family members about the MM, as well. Group settings, such as religious and civic institutions, were noted as places where individuals shared information about the MM.

"And, at some point, all of a sudden, [registration] started exploding like I was checking every single hour and I had 20–25 messages a day and I asked and was like 'how did you find out?' and the person was like 'Oh, you know, someone mentioned that church group,' you know so just having people who are part of the different groups, and you know, um, church group and XX group just letting the other members know that this is available for them." –Volunteer #3

Individuals who received foods that they did not care for or did not have the ability to cook reported sharing foods with others, thus increasing knowledge of the MM and access to these foods. Many of these subsequent recipients are not formal MM users, but also receive value from the MM.

"I use what I can, like I like the carrots, I like the peaches. The stuff I can keep in my truck I keep. If it's cabbage or potatoes or something she'll cook it and give it to people who can use it. I take what I can eat and I give the rest away." – Participant #1

In addition to increasing knowledge about the MM's existence, social networks also allowed community members to utilize the MM, even if they could not physically attend themselves. Users noted that when they could not get to the MM for various

reasons (e.g., acute health conditions, family issues, scheduling conflicts, etc.), they gave their MMID card to a friend or family member who picked up their bag for them and delivered it to their home. Direct observations confirmed that this is a very common occurrence; users frequently come to the MM with multiple MMID cards and take multiple bags of food to be delivered to acquaintances. These community connections and networks thus improved MM access for individuals who may not otherwise be able to attend due to logistical, mobility, or other constraints.

"If I can come, I come. And if not, if I'm suffering from asthma, then I don't come. So, in that case, if I find a friend who could do the favor for me, I give her my card and she comes and she gets it for me." – Participant #12

There are barriers to market attendance

Users noted barriers to MM attendance, including long lines, inclement weather, inaccessibility for those with limiting health co-morbidities, and the clinic's inconsistent communication about market dates. Wait time was noted as an impediment to attendance for some users, while others expressed that they did not mind the wait and were used to standing in line for food assistance.

"You can see the line is getting huge. So I come always two hours early just to be in the front because there's so many people in need." – Participant #2

"I'm used to being out in the cold, ever since 1997 when I had to go to a food pantry to have supper. I'm used to standing in line for meals in the winter just to be fed." – Participant #3

However, for some, the combination of cold weather and long lines was noted as a deterrent to attendance. Those who attended despite the weather hoped that the line could move faster to decrease the amount of time in the cold.

"It's very hard for me to come in winter because I can't – I'm afraid of the snow." – Participant #11

"Towards the winter and stuff, I think it should be a little bit more organized because, you know, we freeze out here. But right now the wind is hectic and a lot of us, are…it's cold." –participant #6

Volunteers noted that accessibility of the market could be difficult for those with mobility issues, given that there is nowhere to sit while waiting outside in lines that can be longer than an hour. Very few mobility aids, such as canes, walkers, or scooters, were noticed during direct observation, indicating that those with mobility issues are likely not attending the MM with much frequency.

"I think another piece, there is accessibility, so I think for folks who are disabled getting to the markets is really hard." – Volunteer #2

Similarly, MM participation requires physically carrying the food home. Most users reported that while the bags were heavy, this was not a deterrent to attendance because they either drove to the MM or lived close enough that they could take the bags home themselves. However, some users suggested that for people who struggled to attend the market due to issues with mobility or accessibility, home delivery would be helpful.

"The transportation for people who really need it, who qualify for it to be delivered home." –Participant #11

Lack of communication about MM dates was commonly discussed as a barrier to attendance. While the MM has historically and consistently been held on the third Saturday of each month, it sometimes changes due to holidays, inclement weather or other logistical issues. The health center creates and distributes a flyer with MM dates that almost all users reported relying on to know when the MM will take place. However, when the MM needs to be rescheduled, users and volunteers expressed frustration that

there was not an easy way to notify users. When asked how they would prefer to be alerted to any date changes, some users stated they would like to receive a phone call. Conversely, volunteers noted that some of the health center's patient population does not necessarily have reliable or consistent phone access and questioned if phone calls would be an effective form of communication.

"When we have last minute cancellations, because of like snowstorms and stuff like that, I think they try, they send out the text messages, they put it on the website and whatnot but we don't reach everybody." – Volunteer #1

"When I started coming here they were giving flyers. I missed a few months because I didn't know when to start and I guess they don't have my phone number. I don't know if they call or not." – Participant #2

D. Discussion

This mixed methods evaluation of a health center-based MM aimed to explore factors associated with uptake of the program. These findings were enhanced by use of both quantitative methods to understand socio-demographic characteristics, medical diagnoses, registration logistics, and environmental and economic factors associated with MM attendance, and qualitative methods to further understand perceived program benefits, and barriers and facilitators to attendance. We found that people who frequently use the MM attend because they require financial assistance, desire fruits and vegetables, and feel a connection to the health center.

Financial need was a significant driver of MM attendance, as has been documented elsewhere.[11,18,190] An increase in the Massachusetts unemployment rate was associated with increased MM utilization, and many participants reported relying on the MM in the context of rising food prices and inflation in 2022. Additionally, users

reported utilizing the MM to supplement their SNAP benefits, which might run out by the end of the month. Interestingly, however, SNAP enrollees were less likely to attend the MM than MM users not enrolled in SNAP. This may reflect multiple realities. First, there are many recent immigrants in Lawrence who are ineligible for SNAP due to their current documented status. In addition, the MM aims to minimize stigma and limit barriers to use by forgoing eligibility requirements, offering same-day registration, and hosting the MM at the health center. Research has shown that stigma of using assistance, administrative burden, and fear of repercussions are barriers to SNAP uptake, especially among Latin American immigrant populations,[86] who are a plurality of Lawrence residents. It is possible that MM users who qualify for SNAP but have not enrolled for these reasons are more likely to use the MM due to its low barriers to use.

MM participants reported that locating the MM at the health center was a facilitating factor for MM attendance. MM users reported that they felt ownership of, and a connection to, the health center, which drove attendance at the MM. This finding is consistent with evaluations of similar programs which have found that hosting food assistance programs at health centers made users feel comfortable and welcome.[112,188] In addition, participants appreciated the centralized location of the MM at the health center and tried to pair visits to the MM with another health center-based errand, such as picking something up at the on-site pharmacy. This is in line with other research that has found that individuals underutilize food assistance programs if they require an extra trip solely to use the program.[191]

In order to receive food, users were required to show an MMID registration card.

Users could obtain an MMID card on-site on the day of the MM, by calling a dedicated phone line on non-market days, or by referral from a health center worker. Users who registered for the MM on-site on the same day were more likely to attend than those who obtained a referral from a health center worker or who registered by phone on a non-market day. The association of on-site same-day registration with increased uptake is in line with previous research, which has shown that uptake of healthcare-based programs is limited when participants are required to take multiple steps to obtain assistance.[152,191] In this case, some health center patients took the initiative to self-register, but then did not attend the MM, indicating that they may have experienced other barriers to attendance for the MM itself.

Many produce prescription and other health center-based food assistance programs require a physician to formally refer eligible patients into the program,[162,163] but physicians' time constraints are a noted barrier to widespread use.[150] In this MM, physicians were able to provide referrals to their patients, but such referrals were not a requirement for participation Patients had mixed responses when asked about physician referrals. While some MM users reported attending because their doctor encouraged them to, others reported that a physicians' referral had no impact on their desire to attend. All MM volunteers believed that physician referral improved likelihood of attendance. Previous research has found that the existence of healthcare-based food assistance programs facilitates patient-provider discussions of healthy eating and improve patients' ability to follow providers' dietary recommendations,[192] but it remains to be seen whether the physician referral, itself, significantly impacts program uptake.

Some MM users with physician referrals described being less likely to recommend the MM to friends and family because they believed the MM was restricted only to those who were formally approved by a physician. Thus, while physician referrals may have influenced patients to attend the MM, they also may have decreased the number of potential participants who would have otherwise been referred by peers. Since we found that community connections helped to increase individuals' knowledge of the MM, and also helped those who cannot attend obtain the food, this misconception may be dampening the program's reach. Given our mixed findings associated with physician referral, future evaluators may wish to further explore the impact of a physician referral on uptake of health center-based food insecurity programs.

Many health center-based food insecurity interventions specifically target those with nutrition-related cardiometabolic disease, such as obesity, diabetes, and hypertension.[19,186] Notably, none of these diagnoses were significantly associated with MM attendance. Users reported that the desire for healthy and natural foods was a significant driver of repeat MM attendance, and some participants reported using the MM to help manage their weight or diabetes. The MM is therefore providing nutritious food to those who desire healthful products but are otherwise unable to afford it. However, individuals, regardless of their disease status, who do not strongly desire these products, may be less motivated and ultimately less likely to attend. These results suggest that limiting program participation to only patients with specific diseases and monitoring solely for disease-specific outcomes may miss the most likely users who derive benefit from access to food assistance programs.

Higher CCI and diagnoses of asthma and COPD were mildly associated with decreased MM attendance. Qualitatively, users reported that they sometimes do not attend the MM because exacerbation of their symptoms of their chronic illness prevents them from attending, which could indicate that immobility and inaccessibility are barriers to MM utilization. However, some users with mobility issues noted that when they cannot physically attend the market, they have a friend or family member pick up the food for them and deliver it to their home. As a result of this phenomenon, some of these less mobile users may appear to have utilized a given MM in our dataset, but, while they received food from the MM, they did not physically attend. This finding highlights how community connections can increase the potential reach and value of the MM, but also underscores accessibility barriers and the importance of social networks. Individuals with mobility challenges and smaller social networks are therefore likely less able to attend the market.

In contrast to federal food assistance programs, which have strict eligibility, registration, and application requirements that are a barrier to enrollment,[85,86] the MM increases program reach by minimizing barriers to use (e.g., being need-blind, allowing same-day registration, and minimizing paperwork, etc.) and allowing others to pick up food to deliver to pre-registered friends and family. Multiple participants we interviewed noted that they valued this aspect of the MM, and it allowed them to obtain food when necessary. Future research should further explore the tradeoffs between restrictive requirements (e.g., means testing, presenteeism) and the accessibility of open access programs.

Another barrier to attendance is the lack of a system for notifying potential participants when an MM is rescheduled. MMs that did not occur on the third Saturday of the month, the default date of the MM, were less attended than those that occurred as scheduled. Users reported difficulties knowing when the MM was being held. Many users relied on a printed flyer for dates of the MM, so users had no way of knowing a date was changed after the flyer's original publication. MM volunteers also expressed frustration with this communication barrier. Being unaware of when to find these programs is a noted barrier in other health center-based food assistance programs.[188,191] Users suggested phone as the best way to be reached, but volunteers noted that some community members lacked consistent phone access. Implementers of health center-based food assistance programming may consider creating multiple streams of communication, including phone, text, social media, flyers, and posters to reach as many users as possible.

Strengths

A strength of this evaluation was our study of an established MM which has been operating continuously since 2016. This allowed us to interview long-term volunteers and users who had been attending the MM since its inception, as well as newer users, which provided diverse perspectives on the implementation and sustainability the program. Our use of mixed methods provides a deep understanding of the nuances to MM uptake, which allows for targeted program improvements to increase uptake and improve food security among the Lawrence population.

Additionally, our use of EMR data to capture information on participant demographics and medical diagnoses allowed us to investigate the association of an array

of characteristics associated with MM use beyond the limited information collected for MM registration. Further, EMR data has been shown to better capture diagnoses of chronic disease than patient self-report.[193,194] In addition to our quantitative data, we used both key informant interviews and direct observation to get a holistic view of the MM program. These three data sources were able to be triangulated to validate our findings and better explain factors that influence uptake of the MM.

Limitations

Our study had a few limitations. First, we were only able to interview people who attended the market, not people who never attended or came once and chose not to attend again. In this way, we likely had a biased perspective of the benefits of the program, rather than downsides and barriers to attendance. However, our qualitative findings were in line with findings from similar programs in different locations,[188] which helps to validate our findings. Second, our quantitative dataset tracked attendance by using MMID swipes, but we found during interviews and direct observations that users frequently swipe MMIDs for friends and family and deliver the food directly to their homes. While this is a significant qualitative finding that helps to shed light on a phenomenon that increases reach of the market, it limits the interpretation of physical barriers to attendance in the quantitative dataset, as people who seemed to attend may not have physically been at the MM. Lastly, our quantitative data is from 2016 to 2020, but our qualitative interviews were conducted in 2022, and therefore there is likely not perfect overlap between individuals in each arm of our evaluation.

E. Conclusions

Study findings indicate that a MM at a FQHC is attended by patients who desire healthy and natural foods and who may struggle to make ends meet financially. Patients and MM users feel a sense of ownership and belonging at the health center, which may have decreased the stigma of utilizing a food assistance program. Participants relied on social networks not only to obtain information about the MM, but also to utilize the MM if they were unable to attend. These findings offer insight on how FQHC patients view an on-site food assistance program and may help implementers at other sites to design programs that attract patients in need.

CHAPTER SIX: PRACTICE RECOMMENDATIONS AND CONCLUSION

A. Overview

This study explored the implementation of healthcare-based food assistance programs in the United States, including a mixed methods evaluation of a long-standing mobile produce market (MM) located at a federally qualified health center (FQHC). This chapter provides practice recommendations that build on findings from the scoping review, typology, and qualitative and quantitative findings presented in Chapters 4 and 5. Practice recommendations provided herein can be used to assist decision-makers, executives, program managers, and clinicians at healthcare institutions to develop and implement their own food assistance programs.

Healthcare-based food assistance programs in the US primarily subsist on limited budgets and are often funded by grants.[150] We suggest that healthcare institutions direct as much funding as possible to providing food insecure patients with either food or an increased ability to purchase food (e.g., financial assistance, food vouchers, and federal food assistance program enrollment). To achieve this goal, we recommend that healthcare institutions: 1) maximize benefits while minimizing costs, 2) minimize barriers to participation, 3) design programs in line with their unique patient populations' needs, and 4) plan with sustainability in mind.

B. Practice Recommendations

Practice Recommendation 1: Design programs that provide the maximum benefit to patients for the least institutional cost per participant

The institutional capacity of a healthcare organization can limit the feasibility of implementing an effective food assistance program. Institutions should consider what

funds, staff time, and space are available when designing a program to ensure successful implementation. In resource-scarce environments, such as community health centers and safety-net hospitals which cater to a disproportionately high percentage of food insecure patients, these factors can restrict the ability of an institution to implement a wide-reaching and impactful program.

Therefore, we suggest that healthcare institutions intending to address food insecurity prioritize connecting patients to food and/or financial assistance and follow a focused progression in order to maximize the amount of assistance each patient receives. Healthcare institutions can do this by leveraging existing external resources: first, by tapping into federal food assistance programs, then by partnering with local community-based organizations (CBO), such as food pantries or soup kitchens. Leveraging existing federal resources and partnering with CBOs with overlapping goals will increase tangible benefits to patients while decreasing costs to the healthcare institution. After incorporating existing available resources, institutions can consider developing or hosting a novel healthcare-based food assistance program to address these needs.

Federal Food Assistance Program Enrollment

First and foremost, healthcare institutions should ensure that all patients receive the maximum public benefits for which they are eligible. Federal food assistance programs provide individuals who qualify with financial resources to obtain food. Though both the Supplemental Nutrition Assistance Program (SNAP) and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) are programs intended to only supplement families' food budgets, they can provide a significant source

of help. SNAP provides a family of four with an average of $684 per month for groceries,[195] which is significantly more assistance than any healthcare-based food insecurity alleviation program we identified in the peer-reviewed literature.

While the formal financial benefit to SNAP and WIC recipients is provided by the federal government, there is a cost the healthcare institution to actively sign patients up for this resource, as staff must be trained and have the time to assist patients with enrollment. Healthcare-based community health workers (CHW) can deliver this service effectively.[196] If CHWs or other staff do not have the capacity to assist with federal food assistance enrollment, healthcare institutions should consider identifying CBO partners who can assist patients with enrollment. Referrals should be in the form of warm hand-offs,[197] which are explained below. Often, food banks[198] and nonprofit food advocacy organizations[199] have the staffing capacity to provide this enrollment assistance. The Feeding America website[1] also has a tool to help individuals search by zip code for CBO that assist with SNAP registration.

Unfortunately, not all patients are eligible for federal food assistance, and federal programs are created only to *supplement* a family's food purchasing power, not provide funding for their full nutritional needs. Programs that provide SNAP and WIC enrollment assistance have found that patients who are food insecure, despite already receiving the maximum federal benefit for which they are qualified, experience frustration with these programs, and feel that they have wasted their time by engaging with healthcare-based enrollment programs.[94] Therefore, while federal program enrollment assistance is likely

[1] https://www.feedingamerica.org/need-help-find-food/apply-for-food-assistance

to result in the greatest return on investment, this may not be sufficient to help all patients, and institutions may consider supplementing with other resources.

Community-Based Organizations

Referrals to existing CBO that provide food assistance, such as food pantries and soup kitchens, can serve as a solution to benefit a substantial number of patients with relatively minimal operating costs incurred by the healthcare institution. It is not enough, however, to provide a simple handout of resources, as this method has been found to have limited success in connecting patients to programs.[152] Warm hand-offs, in which a member of the healthcare team transfers care to a local resource in front of the patient,[197] have been found to improve rates of successful connection to resources.[200] Providing a hand-off in front of the patient allows the patient to engage with the resource and gives them the opportunity to ask questions.[197] CHWs and social workers have been successful at providing these hand-offs.[200,201] While implementing such a process requires knowledge of resources, training, and staff time, the costs associated are likely to be much less than providing the tangible benefit that the CBO ultimately provides (e.g., connecting a patient to a food pantry is less expensive than purchasing and providing patients with food directly).

Healthcare Institution-Based Programs

If healthcare institutions find that federal and local food resources are insufficient to meet the needs of their patient populations, they may consider developing their own programs. These programs can provide food or food vouchers to patients. As these can be costly and potentially limited in scope, we recommend that institutions only consider this

option after maximizing the utilization of existing federal and community resources.

Healthcare institutions that have opted to provide additional food to patients have done so on-site or through home delivery. Some healthcare institutions have developed on-site food pantries,[13] farms,[112] and gardens.[167] A significant barrier to these types of programs, however, is food storage space and refrigeration capacity.[13,15] Partnering with CBO, such as food banks, to provide and distribute on-site produce on specific days are a way to provide food at the healthcare institution without obtaining additional storage or refrigeration space.[11,12,15,164,176]

Alternatively, voucher programs, in which the healthcare institution provides vouchers that can be redeemed at local food purveyors, such as farmer's markets and grocery stores, are another popular option among healthcare institutions.[17,18,111,146,153,155,156,158–161,165,169–175,177–179] Produce prescription programs, wherein a medical provider writes a "prescription" for fruits and vegetables and the patient receives a voucher to use at local food purveyors, are the most popular form of voucher program.[150] These programs have been associated with improvements in dietary intake, food insecurity and health, [165] but have significant associated costs, including staff time, information technology costs to ensure purveyors can use vouchers and receive funds, and the costs of food.[150] Further, healthcare institutions have experienced challenges incorporating the program into current workflows, staffing the intervention, [150] Patient engagement with voucher programs is a challenge, as patients often need reminders to redeem their vouchers.[150] Medical providers who were involved in produce prescription programs have also reported that there was a steep learning curve with a long

trial and error period at the beginning of the program, which negatively impacted provider buy-in.[150] Patients who were required to use their voucher at off-site markets have reported that they did not use vouchers because it markets were at inconvenient times and locations, and required an additional shopping trip outside their usual routine.[191] Given that these programs provide a range of $6 to $230 per month,[169,179] which is significantly less than that provided by federal programs, these programs may require more costs than benefits.

In summary, healthcare institutions that aim to provide assistance to patients experiencing food insecurity should first ensure that patients are enrolled in all federal food assistance programs for which they qualify. Next, institutions may wish to develop partnerships with CBOs, such as food pantries and soup kitchens, and provide warm hand-offs to these organizations. Finally, after exhausting connections to existing resources, institutions may opt to create their own programs, providing food or vouchers directly to patients. We expect this prioritized progression to result in increased patient benefit, while minimizing costs incurred by the healthcare institution.

Practice Recommendation 2: Limit barriers to participation

Requiring extensive registration processes and referral into the program by a physician or other provider, limiting participant eligibility, and increasing stigma of program use all limit program participation and dampen program reach.[85,202] These factors should be considered as healthcare institutions make efforts to minimize barriers to participation in food insecurity alleviation programs.

Extensive Registration Processes

Burdensome registration processes, especially those that require extensive paperwork, have been identified as obstacles to participation in food assistance programs.[85,202] Similarly, documentation of eligibility requirements, as is necessary for enrollment in federal food assistance programs, such as SNAP and WIC, also limit participation, especially among individuals who are not US citizens or receive salary payments in cash and therefore do not have legal documentation of income.[152] The MM allows individuals to bring the MMID cards of others, which allows those with functional limitations to benefit from the program. This indicates that decreasing barriers to access programs, such as a requirement for in-person attendance, increases reach.

In our study, participants frequently noted that long lines at the MM deterred users from attending, especially during inclement weather. While certain MM processes, such as packing individual produce bags, can slow the process of passing out food, direct observations indicated that requiring the presentation of an MMID card at each visit can increase wait times, which may further deter participation. One MM volunteer in our study noted the importance of tracking MM participation for research, program delivery (e.g., knowing how much food to have available at each market), and donor- and grant-funding reporting purposes. However, it is important to balance these requirements for data against the need to minimize the amount of paperwork and reduce the time that potential participants must invest in order to receive program benefits. Identifying the minimum data necessary to effectively deliver a program while maintaining funding should be considered the gold standard.

Limiting Program Eligibility to Only Those with Diagnoses of Cardiometabolic Disease

In our scoping review, many healthcare institutions we identified limited food assistance participation to patients with specific diagnoses, most commonly nutrition-related cardiometabolic diagnoses such as type 2 diabetes, obesity, and cardiovascular disease.[13,18,24,111,146,155,156,156–158,160–162,169,172–174,176–179] This practice creates an unnecessary administrative burden, increases the cost per participant, and reduces program reach. Utilizing time and funds that are required for staff to identify and recruit participants with eligible diagnoses diverts funds that could be spent to connect more patients to resources that provide patients with needed food.[150]

Food insecurity impacts more than just cardiometabolic diagnoses. For example, a recent study found that participants in a community health center-based produce market experienced improvement in depression, as measured by the Patient Health Questionnaire (PHQ-9).[203] Further, SNAP, which does not target those only with specific diagnoses and provides the largest cash subsidy for food in the United States, is associated with both improved health outcomes and lower health care costs,[144] indicating the potential health improvement for all patients with food insecurity. Limiting food assistance program participation to only those with diagnoses of cardiometabolic disease excludes all food insecure potential participants who could benefit from participation. Programs should aim to provide food to any patient experiencing food insecurity, independent of comorbidities.

Physician Referral

Based on the belief that leveraging the symbolism of a formal prescription increases patient adherence to recommendations, produce prescription programs frequently require a physician to refer patients into the program.[150] However, restricting participation in healthcare-based food assistance programs to only those patients who are referred by a physician increases the administrative burden and may dampen program reach. Requiring a physician referral is just one more barrier to entry and may cause those who could benefit most from the program to not obtain assistance. Physicians who have been required to refer patients to food insecurity alleviation programs report a steep learning curve to implementing this practice.[150] Further, appointment times with physicians are limited,[150] and patients' time with providers may be better spent addressing health issues. If physicians find that referring patients into these programs enhances discussions of food insecurity and health,[150] they should do so, but this should not be the only way to gain access to the program.

Importantly, participants in our study reported feeling a strong connection to the FQHC which increased their comfort using the MM, but did not report a connection to their specific physicians or care providers. Hosting a food insecurity alleviation program at a healthcare institution decreases the stigma of utilizing assistance and makes users feel more comfortable and welcome.[112,188] Healthcare institutions should make every effort to make food assistance programs open to all patients who need food assistance, regardless of clinical approval, and market the program to both staff and patients. This will allow for the highest uptake of programs.

Stigma

Last, the stigma of using food assistance programs has consistently been found to be a barrier to participation.[85,152] Users of food pantries have reported feeling as if they were being judged by pantry workers, and perceive themselves to be surveilled by those in a different social class while accessing assistance.[204] Users have also reported feeling that they have to act overtly grateful for receiving this food, which adds to feelings of embarrassment and shame of seeking assistance.[204] While pantry workers who help users find specific foods may believe they are providing needed assistance, users who are helped by those pantry workers with their food selections also report feeling a lack of freedom to choose what they want.[204]

Participants in our study reported that they felt the MM volunteers were friendly and welcoming, which minimized their discomfort. The importance of ensuring that staff is welcoming in order to decrease stigma of food assistance use has been documented in the literature.[11] Training volunteers and providers to interact with participants in culturally-appropriate and welcoming ways can decrease stigma of participation and create an environment where all potential participants feel comfortable.[188] In addition, healthcare institutions may wish to consider staffing food assistance programs with members better affiliated with the communities in which the healthcare institutions are located.[204]

In short, barriers to participation, such as extensive registration processes, limiting participation by diagnosis or physician referral, and stigma can increase administrative costs to the healthcare institution and decrease program reach. Eliminating as many

barriers to participation as possible, and marketing the program widely to staff and patients, will help to ensure that patients who require food assistance are more able to access it.

Practice Recommendation 3: Provide programming that meets the unique needs of patients

To increase uptake, healthcare institutions should recognize the importance of developing food assistance programs that meet the unique needs of their patient population. For example, patients who can easily incorporate foods into their daily routines are more likely to be enticed to participate in the programs offering those foods.[205] This can be achieved by providing foods that are well aligned with patients' kitchen and cooking capacities and being judicious about the use of nutrition education in food assistance programs.

Be Aware of Clients' Kitchen and Cooking Capacity

Healthcare institutions aiming to implement food insecurity alleviation programs should be aware of program recipients' kitchen and cooking capacity. Participants in our study discussed difficulty consuming some of the produce provided at the MM because they lacked the kitchen capacity to prepare items. For example, an unhoused participant reported that they were only able to eat items they could consume raw and intact, rather than those foods they had to chop or cook to consume. Our findings align with other studies' findings: an evaluation of an on-site food pantry located at a safety-net hospital also found that unhoused patients desired ready-to-eat foods.[112] In addition, previous studies have reported that patients experience barriers to preparing foods provided by on-site food provision programs, including a lack of clean cooking facilities,[152] preparation

space,[205] kitchen equipment (e.g., large and small appliances, pots, and pans)[205,206], and food storage facilities.[152]

While patient populations are heterogenous and have varied barriers to healthy eating, identifying common obstacles to healthy food preparation will help to ensure that foods provided are more likely to be consumed. Registered Dietitians (RDs) who work on-site are likely to be knowledgeable about the barriers patients face,[207] and should be engaged in the development of food insecurity alleviation programs. Providing an array of ready-to-eat foods will overcome barriers of kitchen capacity, while also limiting preparation time, which is noted in multiple studies as a barrier to healthy eating among food insecure patients.[207–209]

Be Judicious about Provision of Nutrition Education

Nutrition education is commonly provided as part of healthcare-based food assistance programs; 54% of the programs we identified in our scoping review provided education.[13,18,24,26,112,146,153,154,157,158,160,162,164,165,167,172–174,176,177,179,180] The theory behind provision of nutrition education with food assistance is that those with food insecurity may lack knowledge of healthy eating practices, identifying healthy foods, reading nutrition labels, and shopping for healthy foods on a budget.[210] However, studies have shown that patients with food insecurity are knowledgeable about healthy eating and, in fact, the lack of ability to afford healthy foods is the main barrier to healthy eating.[48,204,205,211] Some programs we identified provided information about eating on a budget,[18,24,146,154,157,160,172,173,176,180] but patients who experience food insecurity have been found to be knowledgeable about increasing their food purchasing power with limited

financial resources.[205] A needs assessment or thoughtful analysis of patients' baseline food knowledge and barriers to healthy eating can provide insight to how much, if any, nutrition education is needed to ensure program success.

Pairing nutrition education with healthcare-based food insecurity programs creates additional barriers to uptake and increases program costs. It also adds to the stigma of utilizing resources, as programs that require nutrition education make patients feel shame and embarrassment about their perceived lack of knowledge about taking care of themselves.[204] Additionally, healthcare institutions that have implemented food insecurity programming with associated nutrition education have reported difficulties engaging patients in nutrition education, especially if it requires an additional clinic visit.[150] Staffing of additional nutrition also education increases program costs. As many of these programs are grant-funded, staffing and funding nutrition education components limit the amount of money that can be spent on food.[150] The treatment for food insecurity is food, not education. Nutrition education is an individual-level solution to a system-level problem, which healthcare institutions should aim to avoid.

Nutrition education provided in medical settings from non-nutrition professionals can have negative consequences. Patients who receive nutrition education from different providers report frustration that results from receiving mixed dietary messages.[207] Most non-nutrition professionals receive minimal nutrition training themselves,[212,213] and have been found to provide nutrition information to patients that is sub-optimal, and often difficult to follow and implement.[207] If healthcare providers identify a need for nutrition education among individual patients, referrals to RDs can be provided, though

reimbursement for these visits can sometimes be a challenge. Medical nutrition therapy provided by RDs for renal disease and diabetes is covered by public and private insurance plans,[214] but other comorbidities may be harder to get reimbursed. If healthcare-based nutrition counseling can not be reimbursed, there are multiple federal and community-based nutrition education programs to which patients can be referred. These include Cooking Matters;[182] SNAP-Ed, which is administered by the USDA and provides an array of nutrition education materials;[215] and the Expanded Food and Nutrition Education Program (EFNEP), which provides nutrition education to families and children with limited resources through each state's Cooperative Extension Service.[216]

In summary, food assistance programs developed and provided by healthcare institutions will be most successful by focusing explicitly on their unique patient populations' needs. Research shows that many food insecure patients are knowledgeable about healthy eating, and therefore do not require additional nutrition education. Addressing barriers to healthy eating, such as kitchen and cooking capacity, will ensure that patients enroll and utilize programs.

Practice Recommendation 4: Plan with sustainability in mind

While the impact of food assistance programs can be significant,[19,203] they are not designed to address the underlying causes of food insecurity, such as poverty. Therefore, their value is only in the moment, not after. The majority (80%) of healthcare-based food assistance programs identified in the peer-reviewed literature provided food or vouchers as a means of alleviating food insecurity.[11–13,17,18,24,26,111,112,146,153–156,158–162,164,165,167,169–181] When these programs end, participants lose access to the additional food, and any food

security or health improvements achieved are unlikely to continue.[146]

During program development and prior to program implementation of healthcare-based food assistance, the program's sustainability should be considered. Continued success of these programs depends on institutionalization and commitment by the host institution, along with proper funding and staffing. In addition, the literature indicates that sustainability of healthcare-based programs is facilitated by sustainability planning, connection to and communication with stakeholders, and ideal fit between organizational capacity and program characteristics.[184] These factors should be evaluated to ensure a program has the highest chance for sustainability.

Many healthcare-based food assistance programs are funded by time-bound grants,[146,151] which limits sustainability. Costs of these programs include food, staffing, and space for food storage and distribution. With the right program model and partnerships, many of these costs can be defrayed while still providing high quality programming. For example, healthcare institutions can partner with CBO to decrease food assistance program costs, which, in turn, should increase sustainability. For example, the MM in our study obtains all foods from the regional food bank. The food bank's business model harnesses philanthropy to provide free food to organizations and families experiencing food insecurity. Further, they have the partnerships, resources, and infrastructure to be more effective at procuring and distributing the food. Collaborations such as these allow each institution to focus on their primary value-adding activity: the health center can focus on identifying and recruiting patients with food insecurity, while the food bank supplies food. Additionally, the health center's costs to run the program are

significantly decreased, as they no longer need to purchase or store food. While a food bank of this scope and size may not be available in all areas of the US, local and regional CBO that provide food assistance may be similarly effective partners.

Staff stability and buy-in of health care-based programming heavily influences sustainability.[184] The MM we evaluated is reliant on staff-based volunteers; employees of the health center who are not formally responsible for running the program as part of their roles. These staff-based volunteers are passionate about improving the lives of the patient population they serve, regardless of their job descriptions. These individuals have sustained the MM for more than seven years through extraordinary dedication to the program, but this model is unlikely to be replicated consistently in every community because of differences in staff capacity and commitment. Depending on volunteer champions can increase risk of burnout, and therefore staff turnover, which is a barrier to staff stability and program sustainability.[217] Therefore, compensating staff appropriately for time spent on food assistance programming and incorporating these activities into job descriptions and formal responsibilities should be considered whenever possible. While this may only be a fraction of an employee's full-time role, this formal commitment increases the likelihood of program sustainability. In resource scarce environments, like many nonprofit healthcare institutions, this relatively small cost could be covered by philanthropy (in the form of institutional grants[218] or individual or corporate donations). In designing for sustainability, existing structures that could defray costs also should be considered. For example, these types of programs are community benefit, as defined and required by the Affordable Care Act,[219] and would help nonprofit healthcare institutions

meet this legal requirement.

C. Conclusion

Our findings highlight the importance of creating healthcare-based food assistance programs designed with the absolute goal of providing the greatest amount of assistance to the greatest number of patients and sustained over time. Healthcare institutions should make every effort to minimize barriers to program entry, such as extensive registration requirements, and partner with community-based organizations to defray costs and increase program sustainability. As often as possible, healthcare institutions should aim to connect patients to local, state, and federal food assistance resources through warm hand-offs and registration assistance.

While healthcare-based food insecurity interventions are important programs that address a key social determinant of health, they are, in effect, an individual-level solution to a societal-level problem. Policies that decrease barriers to SNAP and WIC enrollment, increase SNAP and WIC allotments, and improve access to healthy foods are likely to be the most effective and sustainable interventions. Healthcare institutions and physicians can use their considerable influence to advocate for improved food security for American families.[220] Alleviating food insecurity in our communities improves health equity and is a worthy goal; a multi-level approach, with institutions, community leaders, and other stakeholders, will be necessary to achieve it.

APPENDIX A. MOBILE MARKET DIRECT OBSERVATION TOOL

Observer Initials: _____	**Weather condition at time of observation (check all that apply):** ___ typical sunny/cloudy ___ very cold ___ very hot ___ rain/stormy ___ very windy
Visit Date: _____	

A. REGISTRATION PROCESS	
1. How many people are registering for the market? TALLY HERE:	
2. At the time of the observation, how many staff/volunteers are assisting with registration? Enter # _____	
3. Is there a line to register? Circle: YES / NO If **yes**, how many people are in line at time of observation? Enter # _____ at [time] _____ a.m. If **no,** what is the process for registration (e.g., someone walking around asking people if they need help)?	
4. Approximately how long does it take for one person to register for the market? (i.e., time from obtaining paperwork to completed registration)	
5. What is the primary language being spoken for registration purposes?	□ English □ Spanish □ Other
5a. Do patrons and staff/volunteers effectively speak the same language(s)? Please list any observations:	□ Yes □No

6. Is there adequate signage advertising/explaining:

The Mobile Market's existence?:	□ Yes	□No
How to register?:	□ Yes	□No
What documents/materials are needed?:	□ Yes	□No
Where to line up?:	□ Yes	□No

6a. What language is the signage in? □ English □ Spanish □ Other: _____

7. Approximately what percent of people come to the market with their registration paperwork in hand/already filled out (i.e., need to register but have the paperwork already completed)?	□ <10% □ 11% – 50% □ >50%

B. WAITING IN LINE FOR FOOD

1. Approximately what time did the line start forming? Enter Time: _____

2. How many customers are waiting in line at:

9:30: _____ 10:00: _____10:30: _____11:00: _____11:30: _____

3. Approximately how long does the average person wait in line (from getting in line to receiving food)?

□ <15 min □ 15–30 min □ 30–45 min □ 45–60 min □ 60–90 min □ 90+ min

4. Is it apparent that any patron came with another person? If **yes,** approximately what percent of people showed up in groups of 2+ people? _____	□ Yes □ No □ Unsure

5. How organized and calm is the line? Are people cutting in line? List observations here:

6. Is there clear signage about where the line starts? □ Yes □ No

6a. If there is signage about the line, what language(s) is it in?
□ English □ Spanish □ Other

7. What are people doing in line at time of observation?

- □ Speaking on cell phones What percent of people are doing this? _____%
- □ Typing/Swiping on cell phones What percent of people are doing this? _____%
- □ Speaking to each other What percent of people are doing this?_____%
- □ Other (list other activities below)

_____ What percent of people are doing this? _____%

_____What percent of people are doing this? _____%

_____What percent of people are doing this? _____%

8. What does patrons' body language say about their mood while in line at time of observation?

- □ Frustrated What percent of people are displaying this emotion? _____%
- □ Bored What percent of people are displaying this emotion? _____%
- □ Happy What percent of people are displaying this emotion? _____%
- □ Excited What percent of people are displaying this emotion? _____%
- □ Neutral What percent of people are displaying this emotion? _____%
- □ Other (list other emotions below)

_____What percent of people are displaying this emotion? _____%

_____What percent of people are displaying this emotion? _____%

_____What percent of people are displaying this emotion? _____%

C. FOOD PICK-UP

1. Approximately what time did the first person in line receive food?
Enter Time: _____

2. Are foods pre-packaged into bags/boxes/piles before the market opens?
□ Yes □ No

3. What percent of recipients brought reusable bags?

□ <25% □ 25–50% □ 50–75% □ >75%

3a. For those who don't bring bags, how do they transport their produce home? (List below)

_____ What percent of people use this method? _____%

_____ What percent of people use this method? _____%

_____ What percent of people use this method? _____%

4. Is anyone choosing not to take certain foods? □ Yes □ No □ Unsure

If **yes,** approximately what % of people are doing this?

What food is being left behind?

5. Are people trading items with each other? □ Yes □ No □ Unsure

6. What fruit and vegetable items are available at the market today? List below:

7a. What percent of fruits are visually appealing (e.g., not bruised, not rotting)?

□ 0% □ 25% □ 50% □ 75% □ 100%

7b. What percent of vegetables are visually appealing (e.g., not bruised, not rotting)?

□ 0% □ 25% □ 50% □ 75% □ 100%

8. Are there any non-produce items available at the market today? □ Yes. □ No

If yes, what are they? List below:

9. What does patrons' body language say about opinion of produce quality and choices at time of observation?

□ Frustrated What percent of people are displaying this emotion? _____%

□ Disappointed What percent of people are displaying this emotion? _____%

□ Happy What percent of people are displaying this emotion? _____%

□ Excited What percent of people are displaying this emotion? _____%

□ Neutral What percent of people are displaying this emotion? _____%

□ Other (list other emotions below)

_____What percent of people are displaying this emotion? _____%

_____What percent of people are displaying this emotion? _____%

_____What percent of people are displaying this emotion? _____%

10. Can patrons see what foods they are receiving before getting to the front of the line?

□ Yes □ No

10a. If yes, is anyone clearly leaving after seeing the foods and deciding they don't want them?

□ Yes □ No □ Unsure

10b. How many people are leaving for this reason? TALLY BELOW:

D. MOBILE MARKET ENVIRONMENT

1. Is the parking lot free of litter and visually appealing? □ Yes □ No

2. Does the mobile market set-up look visually appealing and inviting?
□ Yes □ No

List any observations here:

3. What barriers to access do you notice?

□ Cars blocking entrance □ Litter □ Police Presence
□ Traffic □ Unappealing environment (list details below):

APPENDIX B. MOBILE MARKET EVALUATION INTERVIEW GUIDE

Greater Lawrence Family Health Center (GLFHC) Mobile Market Interview Guide

(Note to interviewer- you will only administer a select set of questions during any given interview. This interview set will be determined prior to the initiation of the interview and the guide customized to limit questions to fit within a 60-minute interview. The codes for the questions indicate the related Practical, Robust Implementation and Sustainability Model (PRISM) framework construct and are not to be read to the participant. Selection of questions may be based on participant role in the organization or relationship to mobile market.)

Thank you for agreeing to participate in this research interview to help us learn more about the Greater Lawrence Family Health Center Mobile Produce Market. From now on I'll refer to it as the "Mobile Market." You are being asked to voluntarily participate in this research study. We are doing this study to understand how people view and utilize the mobile market. This includes exploring the processes of the mobile market, the benefits to and ease of using it, and the challenges and barriers encountered. If you agree, we will ask you to participate in this interview, which will last no more than one hour, and I may direct the conversation in order to ensure we cover all themes relevant to you. In this interview we are interested in hearing your perspectives as you reflect on the mobile market and your experience with it.

All responses are confidential that are collected as part of this research study. Your name will not be used in any reports, and any information you share during this interview will be combined with other responses so that only aggregate information is reported. Your responses (which are never connected to direct identifiers, like name) will be accessed only by others associated with this project. It is hypothetically possible that someone could deduce your identity from your responses, but we have measures in place to protect your data. This interview is voluntary and you can skip any questions if you do not wish to answer them. If you have any questions about the study at any time, please contact the Investigator Rebecca Rudel at rrudel@bu.edu or [redacted].

I have some questions that will guide our discussion today, but they are just a guide. If it is okay with you, I would like to record our meeting so that I can be sure to maintain the integrity of the information you are sharing. I will also be taking notes. Our study team will use the recording and notes to categorize and summarize your information along with that collected from other stakeholders and key informants.

_____ Gave permission to audio record

1) Can you describe your role at the Greater Lawrence Family Health Center?

Knowledge & Beliefs (Characteristics of Individuals)

2) How familiar are you with the mobile market and its operation so far?

Acceptability & Feasibility (Organizational and Patient Perspective)

3) How did/do you feel about the mobile market operating in partnership with the Health Center?

4) Based on your experience, what do you think could be improved about the mobile market?

5) Who were/are the key individuals who had to get on board with using the mobile market?

6) Do you think there is a strong need for the mobile market? Why or why not?
    a. If the mobile market didn't exist, what services would you use/refer to instead?
    b. Has this view changed overtime? If so, how?
    c. Do you think others in your setting see a need for the mobile market?

7) Has/does the mobile market meet any unmet needs? Which ones?

8) How well does the mobile market fit with existing work processes and practices in the health center?
    a. How complicated has implementing the mobile market been for your organization?
    b. What kinds of infrastructure changes were or will be needed in order to accommodate the mobile market?

9) How did/does the mobile market impact your work or the work of your organization?
    a. In what ways does it change your organizational processes?
    b. Does it help you achieve certain outcomes?
    c. Does it make anything more difficult?

10) What is the general level of receptivity in the health center to the mobile market?

11) How do you think the individuals served by the health center have or will respond to the mobile market?
    a. What stories have you heard about the experiences of community members?

Barriers & Facilitators (Organizational and Patient Perspective)

12) What were/are the key factors that prompted your involvement with the mobile market?

13) To what extent was it easy or difficult to access the mobile market?

14) Are there financial or other incentives or burdens involved with engaging the mobile market?

15) Based on your experience what would make it easier to access and use the mobile market?

16) How has COVID-19 impacted your work and the mobile market overall?

Communication (Organizational and Patient Perspective)

17) How did you find out about the mobile market?
    a. How did you feel about the communication you received about the mobile market?

18) How/who did/will you or your colleagues communicate to the health center's patient population about the mobile market?

19) Who do you ask if you have questions about the mobile market? How available are these individuals?

20) What could be done to improve communications about the mobile market?

Maintenance & Sustainability

21) How would you judge if this program is successful? What outcomes matter most?

22) What kind of information have you collected about using the mobile market? How have you used this information? (Probe for monitor, adapt, expand, etc.)

23) If you could implement any intervention in the health center to address food insecurity, what would it be? In order to implement these interventions what resources would you utilize that you currently do or do not have?

24) What kind of support or actions did you expect from leaders in the health center to help make the mobile market successful?

a. Were your expectations met?

25) To what extent (or in what capacity) would you want the mobile market to be sustained to address food insecurity?

26) What do you see as the likelihood of the mobile market becoming a permanent program within the health center? Do you have any thoughts about how to increase sustainability?

27) If the mobile market were expanded what changes, if any, would need to be made?

External Environment

28) How will the mobile market impact the health center's ability to meet local, state, or national measures, policies, regulations, or guidelines?

29) Can you describe what other food insecurity-addressing programs exist in the area?

30) To what extent did the efforts of the mobile market address disparities in your community? To what extent do disparities still exist? (Probe for language, race/ethnicity, age, sexual orientation, etc.)?

31) Based on your experience, what do you see as the major unmet needs or gaps in food security in Lawrence, MA?

32) How do you think the mobile market fits in with other local, state, or national food programs?

Conclusion

33) Is there anything additional that you'd like to share based on your experience with the mobile market to date?

34) Is there anyone else you would suggest we reach out to in order to obtain this information?

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