FEBRUARY 2013

FOOD AS MEDICINE

MEDICALLY TAILORED, HOME-DELIVERED MEALS CAN IMPROVE HEALTH OUTCOMES FOR PEOPLE WITH CRITICAL AND CHRONIC DISEASE

COMMUNITY SERVINGS
DELIVERING MEALS
DELIVERING HOPE

FEBRUARY 2013

FOOD AS MEDICINE

Medically Tailored,
Home-Delivered Meals
Can Improve Health Outcomes
for People with Critical
and Chronic Disease

DANIEL J. COHN
Emerson National Hunger Fellow
Congressional Hunger Center

DAVID B. WATERS
Chief Executive Officer
Community Servings, Inc.

TABLE OF CONTENTS

EVIDENCE INDICATES THAT MALNUTRITION PUTS CHRONICALLY ILL PATIENTS AT INCREASED RISK FOR COMPLICATIONS AND THAT IMPROVED NUTRITION CAN IMPROVE HEALTH OUTCOMES.

EXECUTIVE SUMMARY

BACKGROUND

Access to nutritious food is essential for the health and well-being of people suffering from critical and chronic disease. Evidence indicates that malnutrition puts chronically ill patients at increased risk for complications and that improved nutrition can improve health outcomes. However, millions of Americans each year face the vicious cycle of chronic illness, poverty, and malnutrition. Community Servings, a non-profit organization of Boston, MA, seeks to break this cycle by providing two medically tailored meals to chronically ill patients, five days per week, as well as regular nutrition assessments, counseling, and education. At present, there is little research available regarding the impact of this or other similar programs on the health outcomes of the people they serve. The purpose of this study is to examine the role of medically tailored meals on the health of people with critical and chronic disease from the perspective of the healthcare workers who referred them to Community Servings' services. Ultimately, this report seeks to stimulate conversation regarding the role of nutrition in promoting public health and curbing healthcare costs.

METHODS

Semi-structured qualitative interviews and brief online surveys were administered to healthcare workers (case managers, nurses, physicians, etc.) who referred clients to Community Servings' services within the past year. In total, we conducted 14 phone interviews and received survey responses from 69 healthcare workers. We coded interview data using word processing software and analyzed it for common textual themes and analyzed survey data using descriptive statistics. Altogether, both data sets were contextualized with a review of the public health literature examining the potential impact of medically tailored meals for people suffering from the most common diseases Community Servings' clients face: diabetes, HIV/AIDS, and cancer.

PHOTOS KATE MCELWEE PHOTOGRAPHY & HEATH ROBBINS PHOTOGRAPHY

EXECUTIVE SUMMARY

RESULTS

Interview data provided insight into some of the obstacles Community Servings' clients face in accessing nutritious food prior to enrolling in the meals program. In addition, four major themes emerged from the interview data regarding the impact of the meals program in clients' lives. These themes include the provision of nutritious food to: (1) improve psychosocial well being; (2) promote healthy weight; (3) provide high-quality, holistic care; and (4) improve adherence to medications and treatments.

Nearly all survey respondents noted the importance of medically tailored meals in promoting the health of Community Servings' clients. In fact, 95.6 percent believed that the home delivered meals program improved the health of clients "a lot" (n=36) or "some" (n=21). Approximately two-thirds of survey respondents believed the meals program resulted in decreased hospitalizations, and 94.1 percent believed the meals program improved clients' access to healthy food. Seventy-two percent believed the meals program increased clients' knowledge about healthy food and good nutrition "a lot" (n=15) or "some" (n=33). And, overall, healthcare workers were satisfied with the program: 100.0 percent were "very likely" (n=62) or "fairly likely" (n=6) to refer clients to Community Servings in the future.

CONCLUSIONS

The survey, interview, and literature review data support the principle that nutritious food is vital to the health of people with critical and chronic disease. From these findings, we include five recommendations aimed at nutrition services organizations, advocates, and legislators: (1) stakeholders should execute additional research to explore the impact of nutritious food on clients' health outcomes; (2) state and national legislatures should consider expanding government-sponsored health insurance programs to include the provision of nutritious food within medical nutrition therapy; (3) nutrition services organizations, advocates, and researchers should come to consensus to standardize the definition of medical nutrition therapy to include the provision of food; (4) nutrition services organizations should collaborate in collecting client data including food security and hospitalization rates; and (5) nutrition services organizations and other stakeholders should ensure fair representation of clients' voices in further research and advocacy efforts.

BACKGROUND

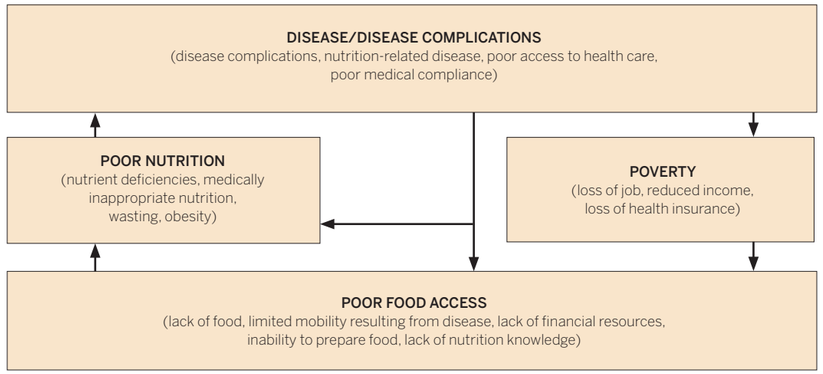
FOOD AS MEDICINE

Critical and chronic diseases pose a significant threat to the health of people living in the U.S. In 2005, half of the adult population had been diagnosed with at least one chronic disease,[1] and among them, 25 percent had one or more daily activity limitations.[2] Seven of every ten American deaths are caused by chronic disease each year,[1] and the costs of these diseases are substantial. Annually, the United States government spends billions of dollars treating late-stage disease through Medicaid, Medicare, and other specialized programs,[3] and chronic diseases are estimated to cost the American economy more than $1 trillion.[4] By the middle of the century, this figure is expected to swell to $6 trillion per year.[4]

The severity and progression of critical and chronic disease can be mitigated by improved nutritional status.[3] Indeed, growing evidence indicates that many medical treatments are less effective without adequate nutrition. For some people, medical nutrition therapy (MNT) is the best or the only way to access nutritious food. MNT is an in-depth nutrition assessment, nutritional diagnosis, and counseling service provided by a licensed, registered dietitian pursuant to a physician's recommendation.[5] In 2000, Congress expanded Medicare Part B to include coverage of MNT for people with diabetes and renal disease.[6] Four years later, a Report to Congress prepared by the Secretary of Health and Human Services supported the benefits of MNT for cardiovascular disease and suggested its potential benefit for other diseases, such as cancer, as well.[7] Since then no governmental movement has been made to include MNT as part of Medicare coverage for patients with other critical or chronic diseases. In 2009 the Health Resources and Services Administration updated the official definition of MNT within the Ryan White HIV/AIDS Program to include the provision of food and nutritional supplements under the direction of a licensed, registered dietitian for people living with HIV/AIDS (PLWHA).[5] Still, the definition of MNT varies among government agencies, researchers, and nutrition services providers.

The public health literature indicates that proper nutrition can improve health outcomes for a variety of conditions including cardiovascular disease,[8,9] cancer,[10,11] diabetes,[12,13] HIV/AIDS,[14,15] and renal disease.[16,17] However, it can be difficult for people with chronic disease to access healthy food for a variety of reasons, including poverty and insufficient community resources (discussed below)Inadequate nutrition, as described in a 2006 report of the Association of Nutrition Services Agencies (ANSA), is a self-perpetuating problem because it can be "both a cause and consequence of poor health and poverty."[3] Breaking this cycle (displayed in Figure 1) requires innovative approaches to make medically appropriate food accessible to people facing critical and chronic disease. The Community Servings meals program is one such innovative approach.

FIGURE 1. The Cycle Of Poor Nutrition and Health[3]



COMMUNITY SERVINGS + ITS CLIENTS

Community Servings is a not-for-profit food and nutrition program that seeks to break the cycle of poor nutrition and health by providing nutrition services throughout Massachusetts to individuals and families living with critical and chronic illnesses. The nutrition program aims to help clients maintain their health and dignity and preserve the integrity of their families through free, culturally appropriate, home-delivered meals, nutrition education, and other community programs. Community Servings delivers 395,000 meals to 1,300 people per year, who are too sick to shop or prepare food for themselves or their families. Customized for clients with any type of acute, life-threatening illnesses, the service includes a nutritional lunch, dinner, and snack for sick clients, their dependent children, and up to one adult caregiver. Community Servings offers 17 different medically tailored menus designed by a registered dietitian (see Table 1), and the geographic service area includes 215 square miles across eastern Massachusetts.

People may be eligible for Community Servings' meals program by referral from a healthcare worker such as a physician, nurse practitioner, or social worker. Only people diagnosed with critical or chronic diseases are eligible. Several other criteria are taken into consideration upon application to the program. Evaluated on a case-by-case basis, these criteria include: medical complications related to illness; mobility; weight stability; mental health; housing; income; access to social support; and special dietary needs.

Meal deliveries are made on a weekly basis, and each recipient is provided five prepared dinners, which include a nutritionally balanced entrée and vegetable side dish, as well as three salads, three servings of soup, two servings of yogurt, two servings of fruit, five small desserts, one quart of milk, and one loaf of bread. Also included in meal deliveries are nutritional supplements such as Ensure® Nutrition Shake, Ensure Plus®, or Glucerna® Shakes under the guidance of Community Servings' staff dietitian. Together, these items provide five days of lunch, dinner, and snack for each recipient. Community Servings' daily food costs per client are estimated at $4.56. When multiplied by five days of service and 52 weeks, this translates to about $1,186 per client per year. Total costs per client per day (including delivery and program) are estimated at $17.37, or about $4,156 per client per year.

TABLE 1. Meal Service Plans Available to Community Servings Clients

• Bland	• Low fiber	• No fish/shellfish	• Renal
• Children's menu	• Low vitamin K	• No nuts	• Vegetarian
• Chopped/Soft	• No citrus	• No poultry	• Other
• Diabetic	• No dairy	• No red meat	• Low fat/ Low cholesterol
	• No eggs	• Regular	

Community Servings' clients face countless barriers to accessing the type of nutrition that is necessary to prevent disease complication and progression. For people with critical and chronic disease, the physical effects of illness—including nausea, chronic pain, fatigue, and immobility—can make it impossible to access nutritious food. In fact, an estimated 60 percent of Community Servings clients face mobility limitations as a result of their diagnoses. These issues manifest in difficulty shopping for groceries or preparing meals. In low-income communities, limited mobility is exacerbated by a lack of local food markets, especially those stocking nutritious food. Commonly referred to as food deserts,[18] these low-income communities are marked by the great distances residents must travel to access nutritious groceries. For the critically and chronically ill, such distance may be physically impossible. Without nutritional support, physical ailments can be made worse by psychological issues,[19] making the fight to get well even more difficult. Repeated examples from interview data collected from healthcare workers, as discussed in the Results section of this report, illustrate the ways in which psychological symptoms associated with critical disease can inhibit clients' access to nutritious meals, and therefore inhibit their ability to get well.

Lack of access to healthy food, for many, is rooted in a lack of financial resources. Ninety-two percent of Community Servings' clients live at or below 200 percent of the Federal Poverty Line, (that is, $22,340 for a one-person household or $46,100 for a four-person household[20]). For them limited funds is a major obstacle in maintaining a healthy diet. Bearing the costs of expensive medical procedures and treatments often means resources are unavailable to shift toward nutritious food, which is frequently more expensive than low-quality food. As suggested by the ANSA study:

> *Social Security Disability Income, which falls just above the poverty line, and Supplemental Security Income, which falls well below the poverty level, are inadequate to purchase a medically appropriate diet, especially when large portions of a person's budget are allocated to health care expenses. Due to the stringent qualifications for Social Security, many individuals experiencing significant effects of illness may receive little or no government benefit and may be without access to health insurance.*[3]

Further, many clients are unable to work as a result of their illnesses, and living alone reduces income and poses a barrier to accessing nutritious food. Some people have caregivers, but caring for sick loved ones often requires time away from work and a subsequent reduction in income. Even for those receiving Social Security Disability Insurance, fixed income may not be enough to offset the increasing costs of living. Nutritious food, then, can fall behind a long list of financial priorities including medical treatments, rent, and utilities. Altogether, the circumstances surrounding critical and chronic disease can force sick people to buy unhealthy food, perpetuating the cycle of frailty, which can prevent recovery.

There are currently insufficient community resources to ensure that people with critical and chronic disease have access to nutritious food. One such resource is Supplemental Nutrition Assistance Program (SNAP), a government-sponsored program for low-income people to help offset the cost of food. More than 884,000 Massachusetts resident, or 13 percent, participated in SNAP in September 2012.[21] More than 45 percent of the state's SNAP participants are in families with elderly or disabled members, far higher than the 27 percent of participants with elderly or disabled family members nationally.[22] SNAP covers some food costs and allows people to divert more funds toward other expenses. However, SNAP only provides approximately $1.00 per person per meal, which, for most recipients, runs out before the end of the month.[23] Special diets, like those prescribed to people with certain critical or chronic diseases, can be especially expensive,[24] making SNAP benefits even more unworkable. Some low-income people also rely on food banks for meals. Indeed, as many as 545,000 people in eastern Massachusetts alone were served by the Greater Boston Food Bank in 2009, a 23 percent increase from just four years prior.[25] Unfortunately, the food found at food banks may not be nutritionally-dense enough for people with special dietary needs as a result of the supply-controlled food bank market.[26] Moreover, even nutritious food at food banks can be physically inaccessible for those who struggle with the mobility limitations associated with critical or chronic disease. Other community programs may also be inaccessible because of eligibility restrictions. Meals on Wheels, for example, requires that clients be at least 60 years or older upon enrollment. [27] However, 904 of the 1,242 people served by the meals program in 2012 (or 73 percent) were under the age of 60. There are obviously, then, a substantial number of people who need support but who fall through the cracks of the system of community resources currently available.

SCOPE AND AIMS

Access to nutritious food among people with critical and chronic disease has importance beyond the bounds of Community Servings' clients. Statewide attention has recently focused on containing healthcare costs, and these efforts have found their way to the national stage with the implementation of the Affordable Care Act. The urgency of cost containment cannot be overstated; in 2010 alone, healthcare expenditures approached $2.6 trillion, a more than ten-fold increase since 1980 when expenditures totaled $256 billion.[28,29] Indeed, the rate of increased expenditures is expected to exceed the rate of increased national income throughout the foreseeable future.[27,30] Massachusetts has not escaped the rise in healthcare costs. Between 2009 and 2010, community health centers and safety net hospitals saw a 12 percent increase in patient volume.[31] In fact, per capita healthcare spending is 15 percent higher in the Commonwealth than the national average, and it lays claim to the highest market premiums in the country.[31]

With increased demand on the healthcare system, state and federal governments will have to seek cost-effective strategies to improve health at the population level. Just as health economists widely recognize the cost-effectiveness of investing in childhood obesity prevention and smoking cessation programs, so too, should there emerge critical discussion of the role of nutritious food in improving the health of people with critical and chronic disease. However, these discussions often remain unheard without a strong, unified voice from communities and the organizations that serve them. With this in mind, this white paper aims to raise awareness about the role of medically tailored, home-delivered meals on health outcomes for people with critical and chronic disease. It also adds to the public health literature, using a mixed-methods approach to understand "food as medicine." Ultimately, we seek to stimulate the conversation regarding the role of nutrition in promoting public health and curbing healthcare costs.

> "... Food is so important in taking medicine. When food helps people take medicine, it absolutely improves health outcomes."
>
> PHYSICIAN

METHODS

This report is based on a qualitative-quantitative research study. The mixed-methods approach is especially effective in health-related research because "neither quantitative nor qualitative methods are sufficient in themselves to capture the trends and details of the situation. When used in combination, both quantitative and qualitative data yield a more complete analysis, and they complement each other.[32] This project was not submitted to an Institutional Review Board for review.

INTERVIEWS

Efforts first focused on qualitative interviews, a type of research used to gain an in-depth, empathetic understanding of a situation from the point-of-view of stakeholders. Qualitative research uses open-ended, contextual data to describe relationships, individual experiences, and group norms. These methods are important because they provide detail-rich information to help answer "why?" and "how?" questions rather than simply "what?" This research differs from quantitative methods (such as surveys, described below), which focuses on numerical values to test hypotheses and predict causal relationships. Qualitative methods are especially helpful for laying a foundation for future research.

The qualitative interviews used in this study aimed to gain a better understanding of the role the Community Servings home-delivered meals program plays in the lives of clients from the perspective of the healthcare workers who referred them. We collected data through semi-structured phone interviews (for protocol, see Appendix A) with referral sources from the previous year. Healthcare workers were chosen for interviews on a volunteer basis via email invitation or as indicated on the survey tool. In total, 14 interviews were conducted between November 2012 and January 2013. Table 2 displays basic demographic characteristics of the interviewees. Interviews were transcribed using word processing software, and textual data were analyzed and sorted based on common themes arising from interviewees' responses. Throughout this report, these data (referred to as "interview data") are presented alongside survey and public health literature review data to paint a picture of the role nutritious food plays in the lives of critically and chronically ill people.

SURVEYS

The second part of the study employed a multiple-choice survey sent via email to healthcare workers who referred clients to Community Servings' home-delivered meals program in the past year. The survey sought to quantify referral sources' perceptions of the impact of the program on the health of clients they referred. The survey protocol, which was designed in consultation with a researcher at the Center for Survey Research, University of Massachusetts, can be found in Appendix B. Healthcare workers' email addresses were collected via telephone calls to their places of employment, as identified on client intake forms. In total, 276 places of employment were contacted. From these contacts, 125 healthcare workers' email addresses were collected. An initial invitation and two follow-up messages were sent to each email address, encouraging recipients to take the 11-question online survey. Sixty-nine surveys were completed between December 11, 2012 and January 7, 2013 and recorded via Google Forms. Table 3 displays basic demographic characteristics of survey respondents. Data were compiled in a Microsoft Excel spreadsheet, and descriptive statistics were calculated for presentation in this report. These data (referred to as "survey data" throughout this report) are analyzed alongside interview and public health literature review data.

LITERATURE REVIEW

In addition to primary data collection, we reviewed the public health literature to provide information on disease characteristics and epidemiology, the role nutrition can play in improving health outcomes, and, when available, the healthcare expenditures and potential cost savings associated with improved nutrition. Three diseases common among Community Servings' clients were reviewed: HIV/AIDS, cancer, and diabetes. Literature was collected from the U.S. National Library of Medicine. Search keywords included: "home-delivered meals," "nutritious food," "medical nutrition therapy," "critical disease," "chronic disease," and "health outcomes."

TABLE 2. Characteristics of Healthcare Workers Who Completed Study Interview

	NUMBER	PERCENT OF TOTAL RESPONDENTS
PRIMARY PROFESSION		
Case Manager	4	28.6
Dietitian/Nutritionist	1	7.1
Physician	5	35.7
Social Worker	4	28.6
Total	**14**	**100.0**
Professional Specialization*		
Cancer	2	14.3
Diabetes	2	14.3
HIV/AIDS	7	50.0
Other	1	7.1
None	3	21.4
Missing	1	7.1
Number of Referrals to Community Servings		
1	2	14.3
2-3	1	7.1
4-5	3	21.4
6+	6	42.9
Missing	2	14.3
Primary Diagnoses of People Referred to Community Servings †		
Cancer	5	35.7
Cardiovascular Disease	2	14.3
Diabetes	2	14.3
HIV/AIDS	7	50.0
Lung Disease	2	14.3
Renal Disease	2	14.3
Other	1	7.1
TOTAL RESPONDENTS	**14**	**100.0**

*Some respondents identified multiple specializations

†Some respondents identified more than one primary diagnosis of people they referred to Community Servings

TABLE 3. Characteristics of Healthcare Workers Who Completed Study Survey

	NUMBER	PERCENT OF TOTAL RESPONDENTS
PRIMARY PROFESSION		
Case Manager	20	29.0
Dietitian/Nutritionist	4	5.8
Nurse Practitioner	1	1.4
Physician	5	7.2
Social Worker	31	44.9
Other	8	11.6
Total	69	100.0
Professional Specialization*		
Cancer	12	17.4
Cardiovascular Disease	1	1.4
Diabetes	3	4.3
HIV/AIDS	28	40.6
Lung Disease	1	1.4
Renal Disease	9	13.0
None	6	8.7
Other	8	11.6
Missing	1	1.4
Number of Referrals to Community Servings		
1	8	11.6
2-3	15	21.7
4-5	13	18.8
6+	32	46.4
Missing	1	1.4
Primary Diagnoses of People Referred to Community Servings †		
Cancer	30	43.5
Cardiovascular Disease	12	17.4
Diabetes	18	26.1
HIV/AIDS	34	49.3
Lung Disease	12	17.4
Renal Disease	21	30.4
Other	5	7.2
Missing	3	4.3
TOTAL RESPONDENTS	**69**	**100**

*Some respondents identified more than one professional specialization

†Some respondents identified more than one primary diagnosis of people they referred to Community Servings

RESULTS

INTERVIEWS

Interview data provided important context in analyzing the impact of the Community Servings home-delivered meals program on the critically and chronically ill. First, interview data emphasized some of the obstacles clients face in accessing nutritious food prior to enrolling in the program. One social worker, for example, explained how the physical effects of illness made it impossible for her patient, sick with cancer, to access nutritious food without the Community Servings meals program:

> *Community Servings comes to mind when a patient is underweight, tired, undergoing chemotherapy, radiation or both. The treatment knocks them out. They've got no energy. When energy is gone, meal preparation is not an option. I try giving them options that will make food more convenient, you know, like easy food ideas. But when that doesn't work, Community Servings really comes to mind to ensure they have access to food and an easy way to get it into their system.*

Another social worker explained how one person she referred only ate "pre-packaged doughnuts and coffee" before enrolling in the meals program. In the face of adversity, her patient resorted to food he felt he could rely on to make him "feel comfortable." A physician echoed the sentiments of choice constraints by stating, "Getting out is already challenging for people with chronic disease. It's hard to shop…And when they do shop, they're only buying things that are lightweight and that they can carry like pasta and potato chips. It's just not good for them."

As noted in the Background section of this report, physical ailments can be made worse by psychological issues. Repeated examples from the interviews illustrate the ways in which psychological symptoms associated with critical disease can inhibit clients' access to nutritious meals and therefore inhibit their ability to get well:

> *I have a patient who has a lot of chronic pain and issues with disability. She is socially isolated and depressed and was losing lots of weight. She lost 50 pounds, and I think it was related to her depression—she wasn't able to prioritize her own health. —Physician*
>
> *I think from my perspective, as social worker, I see the meals as a way to reduce anxiety…Generally speaking, my patients have been irrevocably altered by diagnoses with these illnesses, which happen without warning. Most of my patients are dying or going to be dying soon, and I think it means a lot to them to know there's a community organization like this. Something about it is very healing. —Social Worker*

These and countless other client stories indicate that the physical and psychological effects of critical and chronic illness can pose a significant threat to accessing nutritious food. By intervening to eliminate these barriers, organizations can provide community members access to the type of nourishment that would help combat disease.

Finally, interview data help contextualize the insufficiency of community resources available to chronically ill populations. Food pantries, for example, are not accessible because, as one social worker put it: "The pantry isn't something patients can utilize all the time because they have to come here, bring their bags, get the food, and bring it home. For people going through cancer treatment, this isn't really an option." Another social worker summarized the cumulative challenges of so many critically and chronically ill people across the country:

> *[My patient] was having difficulty finding a way to get food. She is low-income, and food pantries aren't an option because she has no car and lives on the third floor of her building. She couldn't carry food by herself from any pantry or grocery store. Plus, she's in a lot of pain, so food delivery seemed like a good option for her. She's too young for other meal delivery programs like Meals-On-Wheels, so the Community Servings program works out really well.*

In addition to contextualizing the obstacles Community Servings' clients face, four major themes emerged from the interview data regarding the impact of the meals program on clients' health. These themes include the provision of nutritious food as a means of: (1) improving psychosocial well being; (2) promoting healthy weight; (3) providing high-quality, holistic care; and (4) improving adherence to medications and treatments. Table 4 displays the most common words healthcare workers used to describe these themes and the role of healthy food for people facing illness.

TABLE 4. Terms and Phrases Healthcare Workers Used to Describe the Impact of Healthy Meals on the Health of People with Critical and Chronic Disease

Impact of Healthy Food Themes	Common Terms Used to Describe Themes
• Psychosocial well-being	• Relieves anxiety; One less worry;
• Healthy weight	• Makes patients happy
• High-quality, holistic care	• Gain weight; Stabilize weight
• Adherence to medications and treatments	• Care for whole patient; Humanistic care
	• Helps patients take medications; Reduces side effects of medications/treatments

As mentioned, several important themes emerged from interview data regarding the impact of medically tailored, home-delivered meals on clients' health. The first theme was the role of nutritious food in supporting psychosocial well-being, which in turn supports physical health. Eleven of the 14 interviewees (78.6 percent) cited the importance of nutritious meals in mitigating depression and anxiety, promoting emotional stability, and helping instill a sense of solace and relaxation. One social worker's words provide an example of improved psychosocial well-being resulting from the meals program:

> *Having adequate nutrition and stable weight gives everyone one less worry, and it actually helps treatment. For my patients, access to healthy food helps them cope with their treatment and focus on their whole health… Alleviating a major worry like this is supportive emotionally as well as physically.*

A physician provided another illustration of the connection between access to healthy food, improved psychosocial well-being, and improved physical health by explaining what happens to patients who struggle to access nutritious food. "You could see it in him," he said. "Signs of depression, withdrawing socially, not getting out of the apartment." When the patient lost a stable source of food, psychological symptoms worsened, "and then he lost weight."

A second important theme is the role of nutritious food in improving or maintaining clients' weights. More than half of the healthcare workers (n=8) suggested the promotion of healthy weight was a direct result of the Community Servings meals program. One dietitian identified the weight-related effects of nutritious meals quite clearly by recounting the story of a patient with chronic kidney disease who "lost 30 pounds before coming on the program. He came into it already malnourished. But after starting the meals program, he gained 10 pounds." A physician described the role of healthy weight for patients with critical and chronic disease by stating, "It's simple. The meals help stabilize weight, which makes bodies stronger to fight off disease."

Third, several healthcare workers (n=6), including four physicians, identified the provision of healthy food as an integral part of providing holistic care to patients. Two healthcare workers articulated the role of nutrition in holistic care most clearly:

> *Health and healing are beyond just prescriptions and medication. Providing someone with food is therapeutic, and it is important in terms of caring about the whole patient…A lot of times when people access medical care, it's our tendency to try to break things down into small aliquots, like you have a sick liver or cancer of the breast or some other disease. We get so distracted by the small pieces that make up disease that we forget about the whole person who experiences the illness. There are things that go into your quality of life and experience of illness that are bigger than the disease itself. We have to think about things like the social determinants of health, community violence, and access to social support if we are going to provide meaningful care to our patients. And being able to engage a community around eating and healthy eating is critical when we think about people who don't otherwise have access. That means a lot. —Physician*

> *The medical care system can have many dramatic and important effects for a person. We diagnose, give medications, we treat. But medical care doesn't always address those fundamental things like nutrition, or having a roof over your head, etc. Those are the basics that a patient needs, and they sometimes don't have them when they leave this office. Yet, they are all essential for a healthy life. The question is, where do these essentials come from? Where they come from – at least the nutrition aspect – is from Community Servings. It is absolutely essential. You know, we can't prescribe a nutritious meal for a client to pick up at the pharmacy, but it is so essential in caring for the whole patient. —Physician*

To healthcare workers, the provision of holistic care was imperative to the healing process. Without caring for the "whole patient," many argued, biomedical treatments could be inhibited.

The idea of holistic care was reinforced by the fourth major theme regarding the impact of nutritious food on people with critical and chronic disease: medication adherence (n=4). The public health literature largely supports the importance of healthy food in improving medication adherence and absorption, especially among patients with HIV/AIDS and cancer (discussed later). Not surprisingly, the four healthcare workers who described this theme had referred HIV/AIDS and cancer clients to Community Servings in the past year. One interview provided a clear example of healthcare workers' perceptions of the meals program:

> *The meals program helps people adhere to medications. Nausea is a major component of the disease and its treatment, and food is so important in taking medicine. When food helps people take medicine, it absolutely improves health outcomes. —Physician*

Whether it is the promotion of psychosocial well-being, weight maintenance, holistic care, or medication adherence, healthcare workers resoundingly believed the meals program played a substantial role in improving the health of Community Servings' clients.

SURVEYS

Sixty-nine surveys were completed between December 11, 2012 and January 7, 2013 for a total response rate of 55.2 percent. Results from the survey of healthcare workers indicate clear consensus of the role nutritious meals play in improving the health of people with critical and chronic disease. In fact, 80.9 percent (n=55) of respondents believed nutritious meals in general have "a lot" of impact in improving the health of people with critical or chronic disease. The remaining 13 respondents (19.1 percent) believed nutritious food played "some" role in improving health. Nearly all respondents also noted the importance of medically tailored, home-delivered meals in promoting the health of their patients. Referring to Community Servings more specifically, 95.6 percent believed that the home-delivered meals program improved the health of clients "a lot" (n=36) or "some" (n=21).

Indirect markers of health improvement examined in the survey also indicated widespread acknowledgment of the role of home-delivered meals in improving health. For example, nearly two-thirds of healthcare workers (65 percent, n=37) indicated that the meals program resulted in decreased hospitalizations for the people they referred. Healthcare workers also suggested prevalent food insecurity among clients, which is widely recognized as a barrier to optimal health for people, including those with critical and chronic disease.[33,34] Nearly three-quarters of respondents (72 percent, n=42) believed inadequate access to healthy food was a substantial problem for the people they referred prior to enrollment in the meals program ("a lot," n=43, "some," n=23). Nearly all respondents (94.1 percent, n=64) believed the meals program improved access to healthy food "a lot" (n=45) or "some" (n=19). Importantly, among those who thought inadequate access to healthy food posed a major problem for their referral patients before enrolling in the program, 95.5 percent believed that access to healthy food improved "a lot" (n=32) or "some" (n=10) for their clients afterward.

Survey data also indicate that the meals program enables clients to make healthier food choices. Nearly three-quarters of respondents (71.6 percent) believed the meals program increased clients' knowledge about healthy food and good nutrition "a lot" (n=15) or "some" (n=33). And, overall, healthcare workers were satisfied with the program as evidenced by the 100.0 percent (n=68) who were "very likely" (n=62) or "fairly likely" (n=6) to refer clients to Community Servings in the future. The most pertinent results from the survey are displayed in Table 5. Throughout the remainder of the Results section, we present a review of the public health literature of "food as medicine" and contextualize this review with relevant survey and interview results.

TABLE 5. Results from Survey of Healthcare Workers' Perceptions of the Community Servings Home-Delivered Meals Program

	NUMBER	PERCENT OF TOTAL
In general, how much of a role do you think nutritious meals have in improving the health of people with critical or chronic disease?		
A lot	55	80.9
Some	13	19.1
A little	—	—
Not at all	—	—
Total	**68**	**100.0**
How much do you think the Community Servings home-delivered meals program has improved the health of the people you have referred?		
A lot	43	62.3
Some	23	33.3
A little	2	2.9
Not at all	—	—
Total	**69**	**100.0**
Do you believe the Community Servings home-delivered meals program has resulted in decreased hospitalizations for the people you have referred?		
Yes	40	60.6
No	26	39.4
Total	**66**	**100.0**
How much do you think Community Servings has increased knowledge about healthy food and good nutrition among people you have referred?		
A lot	15	22.4
Some	33	49.3
A little	17	25.4
Not at all	2	3.0
Total	**67**	**100.0**
From what you know, how much of a problem was inadequate access to healthy food before enrolling in the Community Servings home-delivered meals program?		
A lot	45	66.2
Some	22	32.4
A little	1	1.5
Not at all	—	—
Total	**68**	**100.0**
From what you know, how much has access to healthy food improved after enrolling in the Community Servings home-delivered meals program?		
A lot	45	66.2
Some	19	27.9
A little	3	4.4
Not at all	1	1.5
Total	**68**	**100.0**
How likely are you to make another referral to the Community Servings home-delivered meals program?		
Very likely	62	91.2
Fairly likely	6	8.8
Not very likely	—	—
Not at all likely	—	—
Total	**68**	**100.0**
TOTAL RESPONDENTS	**69**	**100.0**

HIV/AIDS: LITERATURE REVIEW

Epidemiology and Complications

Three hundred and thirty (or 39 percent) of Community Servings' clients have a primary diagnosis of HIV/AIDS. This number represents approximately 2 percent of the total 17,358 people living with HIV/AIDS (PLWHA) in Massachusetts in 2009.[35] Complications associated with HIV/AIDS are serious and varied: tuberculosis, meningitis, cancer, neurological dysfunction, kidney disease, and, most commonly, wasting syndrome.[36] Many of these complications are linked to malnutrition. In fact, an estimated 34 percent of AIDS patients can expect to experience wasting,[37] a syndrome characterized by a 10 percent loss of body weight accompanied by diarrhea, chronic weakness, and fever.[36] Malnutrition is also linked to increased susceptibility to opportunistic infections, immunologic decline, hastened progression of AIDS, and death.[39-44] Repeated studies, including one using a Massachusetts cohort, have found that loss of weight and lean body mass are significantly associated with mortality among PLWHA.[39] Additional complications, such as reduced effectiveness of and adherence to medication,[26] may have substantial public health implications, since reduced medication adherence can increase HIV viral load, the amount of virus in the bloodstream, and therefore increase risk of spreading disease.[45]

Nutritious Meals Can Improve Health Outcomes

Proper nutrition is integral for disease management for PLWHA, as it helps patients maintain a healthy body weight, helps them withstand the side effects of medications, improves immune system functioning, and enhances overall quality of life.[46]

Malnutrition is common among PLWHA, in part, because the disease causes an increase of 20-30 percent in energy expenditure.[47,48] However, comprehensive medical nutrition therapy can reduce the effects of increased energy expenditure and subsequent weight loss. One study found that a nutritionally tailored, home-delivered meals program allowed more than two-thirds of HIV/AIDS clients to maintain or increase body weight.[49] Interview data from the present study support public health literature regarding the role of medical nutrition therapy in helping PLWHA maintain a healthy weight. One case manager reported, "[The meals program] alleviates pressure so patients can just focus on eating and nourishing their bodies. And, ultimately, this definitely leads to improved weight in my patients." And a physician caring for PLWHA indicated, as noted previously, that the meals program "helps stabilize weight, and it makes bodies stronger to fight off disease."

In addition to maintaining weight, the provision of healthy food has also been connected with symptom management. Individually-tailored nutrition and education programs have been shown to reduce symptoms such as fever, anorexia, nausea, vomiting, diarrhea, and nutrient mal-absorption.[49] In one study researchers found that the incidence of diarrhea was reduced by about half after 6 months of nutrition counseling and dietary modification with normal food.[47] Reduced gastrointestinal side effects led not only to reduced nutritional imbalances but also to improved medication absorption and adherence.[26,47] Studies indicate that Atovaquone, a drug used to treat opportunistic infections, is up to three times more effective when taken with an appropriate diet. Other drugs, such as Glanciclover and Itraconazole are up to 30 percent more bioavailable when taken alongside a specified nutrition regimen[50] Further studies indicate that adequate diet can reduce gastrointestinal and other side effects, thereby making the drugs easier to tolerate.[51,52] Indeed, researchers, including those from Columbia University's Community Health Advisory and Information Network (CHAIN), widely accept that proper nutrition is required to increase the absorption of medication.[53]

> "You know, we can't prescribe a nutritious meal for a client to pick up at a pharmacy, but it is essential for caring for the whole patient."
>
> PHYSICIAN

Interview data also support the role of medically tailored, home-delivered meals in symptom management and medication adherence. A case manager, for example, described the meals program as something people can "count on." According to her, when

> *they have a hot meal for dinner they can choose to take their medications with that meal, and they won't get sick from the medications. One of my patients will absolutely take his medications with a hot meal because he knows it helps with the side effects. So, the meals help him adhere to medication so he doesn't get sicker…The program ensures [my patients] have a full meal, and it makes sure they will keep taking those medications, which then keeps them out of serious situations where they have to be admitted to the hospital.*

A physician echoed these sentiments by explaining, "Nausea is a major component of the disease and its treatment, so food is really important in taking medicine." Yet another healthcare worker "truly believe[s] it keeps them [my patients] from re-hospitalization. With nutrition, you have lower risk of things like dehydration, malnutrition, and negative side effects of medication." Providing PLWHA support in their homes, according to this social worker, helps them take the medication necessary to "lower the rates of re-hospitalization."

The literature also indicates that micronutrients, in particular vitamins C and E, N-acetylcysteine (NAC), alpha lipoic acid, selenium, and epigallocatechin gallate (EGCG), control HIV/AIDS by restoring immune response, reducing disease-related symptoms, and slowing the progression of AIDS.[54,55] In fact, studies have shown that micronutrients can block HIV multiplication and expression, enhance immune function, stabilize T cells, and elevate CD4 cell count.[38] Taken together, the literature indicates that reversing malnutrition can lead to improved functioning, clinical well-being, and longer-term survival among PLWHA.

Survey data also underscore the impact of medically tailored, home-delivered meals on the health of PLWHA. Among respondents who referred HIV/AIDS clients in the past year (N=34), 61.8 percent (n=21) believed the Community Servings meals program had improved clients' health "a lot." Nearly all the remaining respondents, or 35.9 percent (n=12) believed the program had improved clients' health "some." Also of import was the 62.5 percent (n=20, N=32) of healthcare workers who believed the program had resulted in decreased hospitalizations. Altogether, healthcare workers' perceptions support the public health literature, which indicates that medically tailored, home-delivered meals can improve health outcomes for PLWHA.

Improved Nutrition Could Reduce Healthcare Costs

HIV and its complications are associated with substantial healthcare expenditures. In 2006, annual medical costs for early-stage HIV/AIDS cost an average of $14,000 per patient. For those with late-stage disease, costs were estimated at $37,000 per year.[56] Hospital care and pharmaceuticals make up a large majority of these expenditures, 46 percent and 40 percent respectively.3 Average costs of anti-retroviral therapy (ART) in 2006 alone was estimated at $19,912 per year ($23,000 in 2010 dollars).[57] And these costs are not stable. Researchers have found an eight-fold cost increase associated with HIV/AIDS progression among non-ART-related costs and a six-fold increase in hospital expenditures.[58] Thus, interventions to prevent the progression of disease are important in reducing costs. Over a lifetime, HIV-related treatments lead to $379,668 on average spent on every infected patient in the country.[59] In Massachusetts, this translates to $178 million in total lifetime costs for all patients in 2009.[59] Clearly, HIV and its related complications represent a substantial financial burden. Fortunately, by preventing costly complications, we can reduce the overall expenditures associated with the disease.

Evidence is mounting to support the role of medically tailored, home-delivered meals in reducing healthcare costs associated with HIV/AIDS. In a study executed by the Philadelphia-based nutrition service organization, MANNA, researchers found that medically tailored, home-delivered meals significantly reduced healthcare costs for PLWHA. Researchers found that HIV/AIDS-related healthcare expenditures averaged $50,000 per person per month in the six months prior to enrollment in the home-delivered meals program. In the six months after enrollment, healthcare costs for the same population averaged just $17,000 per person per month. The $33,000 average monthly savings was found to be statistically significant.[58] The same researchers examined the differences in healthcare expenditures over a six-month period between PLWHA enrolled in the home-delivered meals program and a matched-pair control group who had not enrolled. The control group spent an average of $37,000 per person per month on healthcare costs, while those in the enrolled group spent just $17,000. This difference of $20,000 per person per month was also found to be statistically significant.[58] Given that the total costs of Community Servings' meals program are just $4,156 per client per year, there is reason to believe the program may be cost-effective.

Other studies identify additional opportunities for substantial cost savings associated with the provision of nutrition services to PLWHA. In a report published by ANSA, estimates indicate that nutrition programs can reduce costs between $4,389 and $12,668 per person per year by increasing CD4+ T cell counts.[3] The report also estimates that the improved adherence to medication associated with nutrition programs could lead to annual cost savings of $5,196 per person and that reduced income-based health disparities could save $41,593 per person per year.[3]

Furthermore, evidence shows that improved ART adherence and absorption can bring about cost-effective improvements in the quality and quantity of life for PLWHA. Goldie et al., for example, found that certain absorption-improving interventions increased quality-adjusted life years by 2.9 years. For each patient receiving absorption-improving interventions, cost savings ranged from an estimated $50,000 to $145,000.60 When these data are considered alongside other research indicating nutritious food can improve the absorption of medication, there is good reason to believe the Community Servings meals program is indeed cost-effective.

CANCER: LITERATURE REVIEW

Epidemiology and Complications

Twenty-one percent of Community Servings' clients were referred primarily for a diagnosis of malignant neoplasm, or cancer. The most common diagnoses include breast and lung cancers, though Community Servings provides meals to clients afflicted with more than twenty different cancers. Cancer survivors currently comprise 3 to 4 percent of the U.S. population, and their numbers are steadily rising.[61] Between 2004 and 2008, there were over 180,000 newly diagnosed cases of cancer in Massachusetts alone, averaging 36,280 diagnoses per year.[62] During this same period, there were 65,802 deaths due to cancer, averaging 13,160 per year.[62] This translates to 24 percent of all deaths,[63] making cancer the second-leading cause of death in the Commonwealth.[64] Although state-level cancer mortality rates are similar to national rates, cancer incidence in Massachusetts is substantially higher than the national average. The incidence rate for Massachusetts males was 590.9 per 100,000 between 2004 and 2008 compared to just 553.0 nationally between 2003 and 2007. For females, the incidence rate was 460.6 per 100,000 in Massachusetts and 416.5 nationally.[62] Certainly, cancer is a substantial public health problem, and its burden can be mitigated only through a strategic community response.

Nutritious Meals Can Improve Health Outcomes

Nutrition-related complications among cancer patients are numerous and costly.[65] Malnutrition is widespread among people living with cancer, ranging from 9 percent of those with urologic cancer to 85 percent of those with pancreatic cancer,[66] and it has been recognized as an important component of adverse outcomes, including increased morbidity and mortality and decreased quality of life.[67] Researchers in 2010 found that nearly half (49 percent) of the 191 medical oncology patients in one study were malnourished.[68,69] Other studies indicate that protein-calorie malnutrition (PCM) is the most common co-morbidity among people with cancer,[67] and an estimated 20 percent of patients die each year as a result of malnutrition, rather than from the cancer itself.[68,70] A key factor impacting malnutrition is increased energy requirements resulting from tumor growth, infection, inflammation, surgery, and treatments.[71] Given the striking prevalence and related mortality associated with malnutrition, its prevention is important to promote the health of people with cancer.

The causes of cancer-related malnutrition are varied and complex. Individuals with cancer often experience an increase in resting energy expenditure and require extra calories and nutrients to maintain a healthy weight.[67] Up to 25 percent of all newly-diagnosed cancer patients experience anorexia, the loss of appetite or desire to eat. Nearly universal among those with metastatic disease,[67,72,73] anorexia can hasten the course of cachexia, a progressive cancer-related wasting syndrome. Occurring in about 33 percent of newly diagnosed patients, cachexia may lead to delayed, missed, or decreased treatments[74] and is estimated to be the immediate cause of death for up to 40 percent of cancer patients.[15]

Complications related to malnutrition include increased toxicity of chemotherapy, limited immunologic competence, increased infection and co-morbidities, increased hospital length of stay, decreased quality of life, and increased mortality.[65,66,75] Cancer patients whose body mass index (BMI) falls below 20 have higher rates of consultation with a general practitioner, medication use, and death rates, compared with those who have higher BMI.[76]

Wasting is observed in many cancer patients and is a direct result of poor dietary intake that results in weight loss.[13] DeWys et al. found that a mere 5 percent weight loss in cancer patients led to decreased response to therapy. Researchers have also found that survival rates, performance status, productivity, and quality of life decline alongside weight loss.[76] Those with weight loss or malnutrition also experience increased risk of complications, decreased treatment tolerance, and increased mortality.[68]

Improved nutrition is associated with lower rates of physician consultation, rates of medication, and rates of death.[65] Repeated studies indicate the importance of early nutrition screening and follow-up in providing quality care to oncology patients.[65,67,78] In 2012 Baldwin et al. conducted a meta-analysis of 13 studies and showed that oral nutrition interventions such as Ensure were associated with significant improvements in weight and energy intake as well as quality of life compared with routine care.[68,79] On average, oral nutrition interventions improved patients' weights by 4.1 pounds and improved energy intake by 432 kcal/d.[79] Another randomized-controlled study of 60 patients found that nutritional intervention reduced nutritional deterioration, helped maintain patients' body weight, and led to faster recovery of quality of life and physical functioning.[80] Another study by Nayel et al. found that all 11 patients who received nutritional intervention for 10-15 days after treatment gained weight, while 58.3 percent of those without nutritional supplementation lost weight (n=7, N=12).[68,81] In fact, 41.7 percent of study participants (n=5) who received no nutritional support were forced to discontinue radiotherapy due to uncontrolled side effects or poor performance status, whereas all 11 patients receiving supplementation received a course of radiation without interruption.[81] Thus, the health benefits of improved nutrition status and weight maintenance were shown to be clinically significant.

One way the Community Servings meals program could improve health outcomes is through individualized nutrition assessment and counseling. In a recent randomized-controlled clinical trial of 271 oncology patients, Ravasco et al. observed that only 20 percent of those receiving individualized dietary counseling experienced nutritional deterioration compared to 96 percent of the control group who received standard services. Thus, according to researchers, "individualized dietary counseling during radiotherapy…assure[d] a sustained and adequate diet, which was able to overcome predictable deterioration."[65] In the same study, dietary counseling and improved dietary intake were associated with significant improvements in quality of life and could be extrapolated to improved physiological function and overall clinical outcomes.[65]

Maintaining health during cancer treatment requires a consumption of a variety of nutritionally-dense foods each day.[67] Since nutritious food is a major source of energy, access to healthy meals is required to mitigate cancer-related malnutrition. Thus, medically tailored, home-delivered meals can also support improved health outcomes by helping cancer patients maintain healthy weight. As mentioned previously, early nutrition intervention can help patients maintain lean body mass, better tolerate treatment, and improve quality of life.[68] The interview data collected for the present study supports the role of home-delivered meals in improving the weight of cancer patients. One social worker explained it this way:

> *We have had patients that are underweight at baseline, having just been diagnosed with something like cancer. A recent patient came in with lung cancer. He had lost 30 or 40 pounds prior to starting treatment. Like so many others, he was already starting off with a deficit. A lot of circumstances contribute to the deficit—maybe they don't have access to food or don't have a great understanding of what to eat during treatment. Even if they do know what they should be eating, they don't have the resources to get the food they need…Once we add the Community Servings meals, it gives patients a good guideline of what kinds of food to eat, and it lets them know they should be eating…Ultimately, this has definitely led to improved weight in the patients I see.*

A physician who had referred several cancer patients to Community Servings also indicated improved weight management as a result of the meals program:

> *I have a patient who has a lot of chronic pain and issues with disability. She is very socially isolated and depressed and was losing lots of weight. She lost 50 pounds, and I think it was related to her depression—she wasn't able to prioritize her own health. I referred her to Community Servings for a year, and it was tremendous to see her gaining weight, but it was also important that someone was coming regularly and asking how she was doing and seeing how she was. It was something that gave her real joy. The meals program helped her feel cared for; it helped her humanity. She needed to feel like someone cared that she deserved these meals after everything she had been going through. That provision of service itself is therapeutic.*

Not only does the physician indicate the meals program helped her patient maintain a healthy weight, but she also suggests that meal delivery helps mitigate depression, which has been identified as a major cause of anorexia.[82] These data were supported by several other respondents, one of whom suggested,

> *Having adequate nutrition and stable weight gives everyone one less worry, and it actually helps treatment. For my patients, access to healthy food helps them cope with their treatment and focus on their whole health. Nutrition is a big part of treating the person as a whole. Community Servings is a big supporter of patients who live alone. I truly believe it keeps them from re-hospitalization. With nutrition, you have lower risk of things like dehydration, malnutrition, and negative side effects of medication. The more support we get into these peoples' homes, the lower the rates of re-hospitalization I have seen, especially for people who have little access to other resources. —Social Worker*

Survey data also support the positive health impact of medically tailored, home-delivered meals on people experiencing cancer. Among healthcare worker respondents who referred cancer patients to Community Servings in the past year (N=29), 70.0 percent (n=21) believed the meals program had improved clients' health "a lot." Nearly all the remaining respondents (26.7 percent, n=8) believed the program had improved clients' health "some." These figures mirror the 62.1 percent (n=18) of healthcare workers who believed the program had resulted in decreased hospitalizations. Altogether, healthcare workers' perceptions support the public health literature, which indicates that medically tailored, home-delivered meals can improve health outcomes for people with cancer.

Maintaining a healthy weight has widely recognized health benefits, and, although expenditure-related data are not presently available, these benefits are likely cost-effective. In 2010, the total cost of cancer care in the U.S. was $263.8 billion: $102.8 billion for direct costs (i.e., inpatient and outpatient services, medications, and devices) and $161.0 billion for indirect costs (i.e., lost productivity due to morbidity and mortality).[83,84] Cancer spending is expected to accelerate as a result of costly new treatments and the increased number of cancer patients as the population ages.[85] Although Massachusetts-specific expenditure data were not accessible for this report, the high incidence of cancer suggest that cancer costs in the Commonwealth may be even higher than national figures. Since access to nutritious food is necessary for the maintenance of healthy weight and can reduce depressive symptoms, strategies to improve such access likely carry substantial benefit. In all, the public health literature supports the role of home-delivered, medically tailored meals in improving health outcomes. And, given the cost of cancer treatment, there may be a cost-benefit to community-level support for medically tailored, home-delivered meals programs.

"I truly believe it keeps them from rehospitalization. With nutrition you have a lower risk of things like dehydration, malnutrition and negative side effects of medication. The more support we get into these peoples' homes, the lower the rates of rehospitalization I have seen, especially for people who have little access to other resources."

SOCIAL WORKER

Epidemiology and Complications

More than 30 percent of Community Servings' clients have diabetes mellitus, a figure that far exceeds the estimated 9.6 percent of Massachusetts adults who had the disease in 2007.[86] In the same year, an additional 5.4 percent were diagnosed as pre-diabetic,[66] indicating elevated risk of developing type 2 diabetes.[87] Complications associated with diabetes are serious and potentially fatal including heart disease and stroke, hypertension, peripheral vascular disease, retinopathy, kidney disease, and neuropathy.[88,89] Diabetes can result in substantially reduced quality of life, and it is a leading cause of acquired blindness, kidney disease, and amputations in the U.S.[90] In each week of 2009 in the state of Massachusetts, 104 people with diabetes were discharged from the hospital, 38 received lower leg amputations, 13 were diagnosed with kidney failure, and five were blinded.[86] Diabetes remains a leading cause of death throughout the country; in fact, nearly 7 percent of all deaths in the state are related to diabetes.[86] Certainly, diabetes is a dynamic public health issue, and its burden can be mitigated only through an effective community response.

Nutritious Meals Can Improve Health Outcomes

Consensus in the medical community points to glycemic control, or improved control of patients' blood glucose (HbA1c) levels, as a means of reducing costly complications. Even small reductions in HbA1c levels can reduce risk. A recent study found that a 1 percent reduction in mean HbA1c was associated with a 21 percent decrease in death, a 14 percent decrease in heart attack, and a 37 percent decrease in heart disease risk.[91] Key to these risk reductions are dietary control, increased consumption of certain carbohydrates, reduced saturated fat intake, and increased monounsaturated fatty acids derived from plants.

Risk reduction can be supported through a balanced diet crafted by a registered dietitian. One randomized-controlled study found that the balanced diets delivered to diabetic patients significantly reduced average HbA1c levels from 8.2 to 7.4 after 12 months of service when compared with conventional, education-based dietary intervention.[92] Another randomized-controlled study involving more than 300 participants found that a pre-packaged, nutritionally complete, prepared meal plan (not unlike the program provided by Community Servings) significantly reduced HbA1c levels for diabetic participants.[93] Thus, home-delivered, medically tailored meals may be an effective strategy to improve glycemic control and reduce costly complications.

In addition to glycemic control, weight loss can be an important step toward reducing health risks for people with diabetes. Risk of complications increases for those who are overweight, and even slight weight loss can improve glycemic control, reduce blood pressure, and improve lipid profiles.[66] Unfortunately, more than 85 percent of people with type 2 diabetes are overweight or obese.[66] Intentional weight loss among people with diabetes is associated with a 25 percent reduction in total mortality and a 28 percent reduction in cardiovascular disease and mortality.[94]

Despite the risk reduction associated with weight loss, adherence to weight loss programs is poor.[66] However, researchers have found that medically tailored, home-delivered meals are associated with far higher rates of dietary adherence than traditionally prescribed diets.[93] For example, Gleason et al. found that home-shipped meals aimed at reducing cardiovascular risk had a 91 percent compliance rate four weeks after initiation and 88 percent compliance at eight weeks.[95] Not only do these programs improve diet adherence, but people lose weight more effectively when following a dietary program prescribed by a registered dietitian. This principle was illustrated in 2000, when Metz et al. found that a pre-packaged, medically-tailored meals program designed by a dietitian resulted in an average weight loss of 6.61 ffl 11.9 pounds over the course of a year. This weight loss was significantly greater than the control group, which lost an average of just 2.2 ffl 8.4 pounds. Weight loss among all participants, including the 119 who were diabetic upon initiation, was accompanied by improved blood pressure, LDL-cholesterol levels, glycosylated hemoglobin level, and quality of life.[93]

Survey data from the present study also suggest medically tailored, home-delivered meals can positively impact the health of people experiencing diabetes. Among healthcare worker respondents who referred diabetic clients to Community Servings in the past year (N=18), 66.7 percent (n=12) believed the meals program had improved clients' health "a lot." The remaining 33.3 percent (n=6) believed it had improved clients' health "some." A full 82.6 percent (n=14, N=17) believed the meals program resulted in decreased hospitalizations. Altogether, healthcare workers' perceptions support the public health literature, which clearly indicates that medically tailored, home-delivered meals can improve the health of diabetic patients.

Improved Nutrition Could Reduce Healthcare Costs

The burden of diabetes does not come without substantial financial costs. One out of every ten U.S. healthcare dollars is spent on diabetes and its complications. Of the $133 billion spent on diabetes, more than $92 billion is spent on direct healthcare, including inpatient and outpatient services, prescription medications, and other treatments.[66] Even more striking, nearly 34 percent of all Medicare dollars are spent on the 23.4 percent of patients with diabetes.[96] Massachusetts has not escaped the extraordinary financial burden of this disease. In 2007, diabetes cost the state $4.3 billion, and these costs are on the rise.[86] Diabetes-related hospitalizations alone cost nearly $23,500 per person per visit, nearly double the average cost of non-diabetes-related hospitalizations.[66] In order to reduce medical complications and costs associated with diabetes, many public health professionals agree that a substantial investment in preventive services is necessary.

The public health literature not only supports nutrition intervention as a means of improving health, but studies also show that these interventions reduce diabetes-related healthcare costs. A four-year longitudinal study of 4,744 patients with type 2 diabetes, for example, showed that even a slight reduction in HbA1c levels was associated with fewer primary care and hospital visits.[95] Lowering blood glucose levels by even 1 percent reduced healthcare costs by between $686 and $950 per patient per year.[96] Spread over the population, these data signal the potential for substantial cost savings. Yet another study also indicates potential cost savings associated with improved nutrition. Researchers followed 965 obese, diabetic patients for six years to monitor their medication use and healthcare costs. Among participants, the average annual cost for diabetes and cardiovascular disease medications decreased by an average of 8 percent for those who lost more than 15 percent of total body weight.[97]

It is clear that improving blood glucose levels and body weight can help reduce costs associated with diabetes care. Since access to nutritious food is necessary for both glycemic control and weight management, strategies to improve such access likely carry substantial cost-effective benefits. In all, the public health literature supports the role of home-delivered, medically tailored meals in improving health outcomes, and there is evidence that such programs may be cost-effective.

> " So, the meals help him adhere to medication so he doesn't get sicker ... The program ensures [my patients] have a full meal, and it makes sure they will keep taking those medications, which keeps them out of serious situations where they have to be admitted to a hospital."
>
> A CASE MANAGER

CONCLUSIONS

MEDICAL NUTRITION THERAPY AND HEALTH OUTCOMES

Survey, interview, and literature review data all support the notion of improved health outcomes associated with medical nutrition therapy and home-delivered meals. Interview data revealed that healthcare workers believe the Community Servings meals program is valuable for a variety of reasons. First, the meals program was believed to support the psychosocial well-being of the people they have referred. Healthcare workers believed the meals program "relieves anxiety" and gives everyone "one less worry" so that energy can be focused on treatment and getting well. Promoting psychosocial well-being is an important part of wellness because depression and anxiety are associated with poor health outcomes and unwanted weight loss among people with critical and chronic disease. Second, healthcare workers believed the meals program promoted healthy weight. For clients struggling with wasting syndromes, the meals helped them "gain weight," and for those with unpredictable weight issues, the meals helped "stabilize" weight. This, as the public health literature indicates, is especially important for those living with diabetes, HIV/AIDS, and cancer. Third, healthcare workers indicated the importance of nutrition as a way of providing high-quality, holistic care, which helped them "care for the whole patient," and take into account their patients' "humanity." Finally, adherence to medication and treatment was mentioned as especially important. For those on HIV/AIDS medications or cancer treatments, the meals program "helps them take medications" and "reduces the side effects" of treatment. Of course, any measures that promote adherence to treatment are likely to benefit a patients' health.

More than 8 in 10 healthcare worker respondents surveyed reported that nutritious meals play a major role in improving the health of people with critical and chronic disease. Almost all of the respondents believed the Community Servings meals program, in particular, improved health outcomes for the people they referred. And these health improvements may be cost-effective. Approximately two-thirds of respondents, for example, believed Community Servings meals results in reduced hospitalizations. And, as indicated in the Methods section of this report, these numbers may actually be a low estimate. Also important to note is the role of medical nutrition therapy in promoting food security. Nearly all respondents believed the meals program improved access to healthy food for their referrals, including almost all of those who indicated access to nutritious meals was a substantial problem prior to enrolling in the program.

The conversation has begun. Nutritious food can be an important part of treatment plans for people facing critical and chronic disease. For those who are low income or have other difficulties accessing healthy food, medically tailored, home-delivered meals may be an effective intervention. For the sake of our most vulnerable community members, and in the face of staggering healthcare costs, there must be a conversation regarding "food as medicine." It is a conversation that began thousands of years ago; indeed, it was Hippocrates who said, "Food be thy medicine, and medicine be thy food." Now, it is time to turn that conversation into action. Included here are several recommendations stemming from the findings of this report. They include stakeholders at the local, state, and national level and focus on steps toward evidence-based practice in the care of people with critical and chronic disease.

RECOMMENDATIONS

1. Research—Community-based, food and nutrition organizations should consider seeking partnerships with institutions of higher education and other stakeholders to conduct evidence-based research regarding the impact of nutritious food provision on health outcomes for those with critical and chronic disease. Research should also include non-partisan cost-effectiveness analyses, perhaps executed by state and national legislatures.
2. Expansion of Services—State and national legislatures should consider expanding Medicare Part B coverage of medical nutrition therapy and the provision of food beyond diabetes and renal disease. Coverage could include services provided to people with HIV/AIDS, cancer (both described in this report), renal disorders, and other critical and chronic diseases. Legislatures should also consider expanding Medicaid to cover medical nutrition therapy including the provision of food.
3. Consensus—Research, advocacy, and government agencies should consider coming to consensus regarding the definition of medical nutrition therapy. At present, HRSA defines medical nutrition therapy to include the provision of food to PLWHA when provided through a licensed, registered dietitian.[5] However, the definition of MNT within Medicare Part B does not include the provision of food. MNT is also inconsistently defined across the medical and public health literature. Therefore, efforts should be made to standardize the definition of MNT to include the provision of food.
4. Collaboration—Community-based, food and nutrition organizations should consider collaborating to collect data shared across a network of service providers and researchers. Standardized data collection, which could include information on food security and hospitalization rates among clients, could be used for service provider-driven research. This type of collaboration could also help build mutually-beneficial research and advocacy capacity across the network.
5. Representation—Organizations should consider ensuring the voices of clients are fairly and accurately represented in further research and advocacy efforts. This can be accomplished through qualitative research aimed at better understanding the lives and circumstances of those with critical and chronic disease. Exemplary projects of this nature include Oregon Food Bank's Voices of Hunger project[99] or the ESCR Mobilization Project Human Rights Reports.[100]
6. Evaluation—Community Servings and other food and nutrition organizations should consider engaging in a systematic process and outcome evaluations of their respective meals programs. Future projects could assess process or outcome measures, and qualitative data from this and other studies could be used to inform quantitative research projects.

LIMITATIONS

The design for this project presents some notable limitations. First, survey data were limited by the healthcare workers whose email addresses could be collected from phone calls to their places of employment. In many cases, researchers were unable to obtain email addresses due to employment changes, absence from work, or other circumstances. Therefore, the number of surveys collected (n=69) represented just 25 percent of the healthcare workers who referred clients to Community Servings in the past year. However, while the number of surveys is not ideal, the proportion is high enough to provide a reasonable picture of healthcare workers' perceptions of the program. There is also a potential for bias within the survey data. Namely, healthcare workers who completed the surveys may have been more inclined to do so because of their favorable views of the program. However, survey invitations mentioned the survey was both brief and anonymous, so as to mitigate the potential self-selection bias.

Time constraints in data collection and analysis posed a second major limitation. Typically, quantitative measurements are taken after qualitative data has been collected and analyzed. This is because qualitative data often generates questions to be answered by quantitative research. However, this study collected qualitative and quantitative concurrently, so, the quantitative data may lack important foundational context. For example, survey data indicate that 39.4 percent of healthcare workers believed the Community Servings meals program did not result in decreased hospitalization for people with critical and chronic disease. However, we learned through several interviews conducted after survey administration that some healthcare workers responded to the question of reduced hospitalization in the negative because of specific circumstances of their patient population, not because of circumstances directly implicated by the meals program. One healthcare worker who answered "no" to the question of decreased hospitalization indicated that she works primarily with hospice care patients. So, while she thought the meals program improved the health and quality of life of the people she has referred, she could not say that it resulted in decreased hospitalization because her patients are rarely, if ever, hospitalized to begin with. Another healthcare worker who had just recently referred her first patient to Community Servings also noted that the meals program improved health but that it did not result in reduced hospitalization. This discrepancy, she explained in the interview, was not because the meals program could not reduce hospitalization. Instead, she indicated that her patient had been on the meals program for such a short time that it was too soon to tell whether or not it had resulted in reduced hospitalization. The respondent concluded by stating that the program has the potential to reduce the client's risk of hospitalization, but it is simply too soon to tell. Ultimately, these examples indicate weakness in the study design and reinforce the need for qualitative methods to inform quantitative data collection and analysis.

APPENDICES

APPENDIX A. INTERVIEW PROTOCOL

- Could you walk me through your thought process when you consider referring someone to Community Servings?
- How do you believe the Community Servings' meals program affects the people you've referred?
    - Do you believe the meals program has impacted the health of the people you've referred?
    - If so, can you tell me more about how the meals program impacted the health of the people you've referred? [If not, can you tell me more about this?]
    - Do you believe the Community Servings' meals program has resulted in decreased hospitalizations for the people you've referred?
    - If so, can you tell me more about this? [If not, can you tell me more about this?]
- Can you describe a recent experience in which you recognized the effects of the meals program on a person you've referred?
    - How did you know the meals program had an effect on that person?
- What words would you use to describe Community Servings and the meals program?

APPENDIX B. SURVEY TOOL

Which of the following best describes your primary profession?
Please select one.

- ☐ Case Manager
- ☐ Dietitian/Nutritionist
- ☐ Nurse
- ☐ Nurse Practitioner
- ☐ Physician
- ☐ Social Worker
- ☐ Other: _____

In which of the following areas do you specialize, if any?
Please select all that apply.

- ☐ Cancer
- ☐ Cardiovascular Disease
- ☐ Diabetes
- ☐ HIV/AIDS
- ☐ Lung Disease
- ☐ Renal Disease
- ☐ None
- ☐ Other: _____

About how many people have you referred to the Community Servings home-delivered meals program?
Please select one.

- ☐ 1
- ☐ 2-3
- ☐ 4-5
- ☐ 6+

For which primary diagnoses have you referred people to the Community Servings home-delivered meals program?
Please select all that apply.

- ☐ Cancer
- ☐ Cardiovascular Disease
- ☐ Diabetes
- ☐ HIV/AIDS
- ☐ Lung Disease
- ☐ Renal Disease
- ☐ Unsure
- ☐ Other: _____

In general, how much of a role do you think nutritious meals have in improving the health of people with critical or chronic disease?
Please select one.

- ☐ A lot
- ☐ Some
- ☐ A little
- ☐ Not at all

How much do you think the Community Servings home-delivered meals program has improved the health of the people you have referred?
Please select one.

- ☐ A lot
- ☐ Some
- ☐ A little
- ☐ Not at all

Do you believe the Community Servings home-delivered meals program has resulted in decreased hospitalizations for the people you have referred?
Please select one.

- ☐ Yes
- ☐ No

How much do you think Community Servings has increased knowledge about healthy food and good nutrition among people you have referred?
Please select one.

- ☐ A lot
- ☐ Some
- ☐ A little
- ☐ Not at all

Consider the people you have referred to Community Servings. From what you know, how much of a problem was inadequate access to healthy food before enrolling in the Community Servings home-delivered meals program?
Please select one.

- ☐ A lot
- ☐ Some
- ☐ A little
- ☐ Not at all

Consider the people you have referred to Community Servings. From what you know, how much has access to healthy food improved after enrolling in the Community Servings home-delivered meals program?
Please select one.

- ☐ A lot
- ☐ Some
- ☐ A little
- ☐ Not at all

How likely are you to make another referral to the Community Servings home-delivered meals program in the future?
Please select one.

- ☐ Very likely
- ☐ Fairly likely
- ☐ Not very likely
- ☐ Not at all likely

Would you be willing to participate in a 10-minute phone interview to discuss your views about the Community Servings home-delivered meals program? If yes, please include your email and phone contact information in the space provided.

NAME **EMAIL** **PHONE**

REFERENCES

1. **Centers for Disease Control and Prevention.** (2012). Chronic diseases and health promotion. Retrieved from http://www.cdc.gov/chronicdisease/overview/index.htm

2. **Anderson, G., Herbert, R., Zeffiro, T., & Johnson, N.** (2004). Chronic conditions: making the case for ongoing care. Baltimore, MD: John Hopkins University. Retrieved from http://www.partnershipforsolutions.org/DMS/files/chronicbook2004.pdf

3. **Association of Nutrition Services Agencies.** (2006). The power of nutrition. [White paper]. Retrieved from https://www.glwd.org/serve.do/content/press/publications/ANSA.pdf?property=Publication&aid=5949

4. **DeVol, R., Bedroussian, A., Charuworn, A., Chatterjee, A., Kim, I.K., et al.** (2007). An unhealthy America: The economic burden of chronic disease. Retrieved from http://www. milkeninstitute.org/healthreform/pdf/AnUnhealthyAmericaExecSumm.pdf

5. **United States Department of Health and Human Services, Health Resources and Services Administration.** (2010). Eligible individuals and allowable uses of fund for discretely defined categories of services. Retrieved from http://hab.hrsa. gov/manageyourgrant/pinspals/eligible1002.html

6. **Smith, R.E., Patrick, S., Michael, P., & Hager, M.** (2005). Medical nutrition therapy: The core of ADA's advocacy efforts (part 1). Journal of the American Dietetic Association, 105(5): 825–834.

7. **Thompson, T.** (2004). Report to Congress on medical nutrition therapy. Retrieved from http://www.cms.gov/Medicare/Coverage/InfoExchange/Downloads/Report-to-Congress-Medical-Nutrition-Therapy.pdf

8. **Krummel, D.A.** (2008). Medical nutrition therapy for cardiovascular disease. In L.K. Mahan & S. Escott-Stump (Eds.), Krause's Food & Nutrition Therapy (pp. 833–864). St. Louis: Elsevier, Inc.

9. **McCarron, D.A., Oparil, S., Chait, A., Haynes, R.B., Kris-Etherton, P., Stern, J.S., et al.** (1997). Nutritional management of cardiovascular risk factors: A randomized clinical trial. Archives of Internal Medicine, 157(2):169–177. doi:10.1001/archinte.1997.00440230041006

10. **Grant, B.** (2008). Medical nutrition therapy for cancer. In L.K. Mahan & S. Escott-Stump (Eds.), Krause's Food & Nutrition Therapy (pp. 959–990). St. Louis: Elsevier, Inc.

11. **Marín Caro, M.M., Laviano, A., & Pichard, C.** (2007). Nutrition intervention and quality of life in adult oncology patients. Clinical Nutrition, 26(3), 289–301.

12. **Franz, M.T. (2008).** Medical nutrition therapy for diabetes mellitus and hypoglycemia of nondiabetic origin. In L.K. Mahan & S. Escott-Stump (Eds.), Krause's Food & Nutrition Therapy (pp. 764–809). St. Louis: Elsevier, Inc.

13. **Pastors, J.G, Warshaw, H., Daly, A., Franz, M., & Kulkarni, K.** (2002). The evidence for the effectiveness of medical nutrition therapy in diabetes management. Diabetes Care, 25(3): 608–613. doi: 10.2337/diacare.25.3.608

14. **Fenton, M. & Silverman, E.C.** (2008). Medical nutrition therapy for human immunodeficiency virus (HIV) disease. In L.K. Mahan & S. Escott-Stump (Eds.), Krause's Food & Nutrition Therapy (pp. 991–1020). St. Louis: Elsevier, Inc.

15. **Keithley, J.K., Swanson, B., Murphy, M., & Levin, D.F.** (2000). HIV/AIDS and nutrition. Implications for disease management. Nursing Case Management, 5(2): 52–59.

16. **Wilkens, K.G., & Tuneja, V.C.** (2008). Medical nutrition therapy for renal disorders. In L.K. Mahan & S. Escott-Stump (Eds.), Krause's Food & Nutrition Therapy (pp. 921–958). St. Louis: Elsevier, Inc.

17. **Pasticci, F., Fantuzzi, A.L., Pegoraro, M., McCann, M., & Bedogni, G.** (2012). Nutritional management of stage 5 chronic kidney disease. Journal of Renal Care, 38(1): 50–58. doi: 10.1111/j.1755-6686.2012.00266.x

18. **United States Department of Agriculture, Economic Research Service.** Access to affordable and nutritious food: measuring and understanding food deserts and their consequences. Report to Congress. Retrieved from http://www.ers.usda.gov/media/242675/ap036_1_.pdf

19. **World Federation for Mental Health.** (2010). Mental health and chronic illnesses: The need for continued and integrated care. Retrieved from http://www.wfmh.org/2010DOCS/ WMHDAY2010.pdf.

20. **United States Department of Health and Human Services.** (2012). 2012 HHS poverty guidelines. Retrieved from http://aspe.hhs.gov/poverty/12poverty.shtml

21. **United States Department of Agriculture.** (2013). Supplemental Nutrition Assistance Program: Number of person participating. Retrieved from http://www.fns.usda.gov/ pd/29snapcurrpp.htm

22. **Center on Budget and Policy Priorities.** (2012). Massachusetts Supplemental Nutrition Assistance Program. Retrieved from http://www.cbpp.org/files/1-14-13fa/MA.pdf

23. **Food Research and Action Center.** (2007, June). State of the States 2007. A profile of food and nutrition programs across the nation. Retrieved from http://frac.org/pdf/sos_2007_ report.pdf

24. **Ministry of Community and Social Services.** (2008, April). Special diets expert review committee: Final report. Retrieved from http://www.mcss.gov.on.ca/documents/en/ mcss/social/publications/special_diet_en.pdf

25. **Greater Boston Food Bank.** (2013). Our mission: Hunger. Hunger study. http://gbfb.org/ our-mission/hunger.php

26. **Woodruff, R.** (2009). Access Granted: Breaking Barriers to Optimal Health for Food Insecure People Living with Chronic Illnesses. Retrieved from http://hungercenter.wpengine.netdna-cdn.com/wp-content/uploads/2011/07/Access-Granted-Food-Insecure-People-Chronic-Illnesses-Woolford.pdf

27. **Community Resources Information, Inc.** (2013). Massachusetts food programs: Meals on Wheels and dining centers. Retrieved from http://www.massresources.org/meals-on-wheels.html

28. **Kaiser Family Foundation.** (2012) U.S. health care costs: background brief. Retrieved from http://www.kaiseredu.org/issue-modules/us-health-care-costs/background-brief.aspx

29. **Centers for Medicare and Medicaid Services, Office of the Actuary, National Health Statistics Group.** (January 2012). National health expenditures; Aggregate and per capita, annul percent change and percent distribution: Selected calendar years 1960-2011. Retrieved from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/downloads/tables.pdf

30. **Ginsburg, P.B.** (October 2008). High and rising health care costs: *Demystifying U.S. health care spending*. Retrieved from http://www.cbia.com/ieb/ag/CostOfCare/RisingCosts/ RobertWood_HighRisingHealthCareCost.pdf

31. **Kaiser Family Foundation.** (May 2012). Massachusetts health care reform: six years later. Focus on Health Reform. Retrieved from http://www.kff.org/healthreform/upload/ 8311.pdf

32. **Creswell, J.W., Fetters, M.D., and Ivonkova, N.V.** (2004). Designing a mixed methods study in primary care. Annals of Family Medicine, 2(1): 7-12. doi: 10.1370/afm.104

33. **Kregg-Byers, C.M. & Schlenk, E.A.** (2010). Implications of food insecurity on global health policy and nursing practice. Journal of Nursing Scholarship, 42(3): 278–285. doi: 10.1111/j.1547-5069.2010.01351.x

34. **Stuff, J.E., Casey, P.H., Szeto, K.L, Gossett, J.M, Robbins, J.M, Simpson, P.M., et al.** (2004). Household food insecurity is associated with adult health status. Journal of Nutrition, 134(9): 2330–2335.

35. **Massachusetts Department of Public Health, Bureau of Infectious Disease Prevention, Response and Services.** (2010). STD, HIV/AIDS and viral hepatitis surveillance report 2010. Retrieved from http://www.mass.gov/eohhs/docs/dph/cdc/aids/std-surveillance-2010. pdf

36. **Mayo Foundation for Medical Education and Research, Mayo Clinic Staff.** (2012, August 11). HIV/AIDS: Complications. Retrieved from http://www.mayoclinic.com/health/hiv-aids/DS00005/DSECTION=complications

37. **Smit, E., Skolasky, R.L., Dobs, A.S., Calhoun, B.C., Visscher, B.R., Palella, F.J., et al.** (2002). Changes in the Incidence and predictors of wasting syndrome related to human immunodeficiency virus infection, 1987-1999. American Journal of Epidemiolog, 156(3): 211–218.

38. **American Dietetic Association & Canadian Dietetic Association.** (1998). "AIDS should be treated with medical nutrition therapy." AIDS. In T.L. Roleff and C.P. Cozic (Eds.), Opposing Viewpoints. San Diego: Greenhaven Press.

39. **Weiser, S.D., Fernandes, K.A., Brandson, E.K., Lima, V.D., Anema, A., Bangsberg, D.R., et al.** (2009). The association between food insecurity and mortality among HIV-infected individuals on HAART. Journal of Acquired Immune Deficiency Syndrome, 52(3): 342–349.

40. **Wheeler, D.A., Gibert, C.L., Launer, C.A., Muurahainen, N., Elion, R.A., Abrams, D.I., et al.** (1998). Weight loss as a predictor of survival and disease progression in HIV infection: Terry Beirn Community Programs for Clinical Research on AIDS. Journal of Acquired Immune Deficiency Syndrome and Human Retrovirology, 18(1): 80–85.

41. **Guenter, P., Muurahainen, N., Simons, G., Kosok, A., Cohan, G.R., Rudenstein, R., et al.** (1993). Relationships among nutritional status, disease progression, and survival in HIV infection. Journal of Acquired Immune Deficiency Syndromes, 6(10): 1130–1138.

42. **Chlebowski, R.T., Grosvenor, M.B., Bernhard, N.H., Morales, L.S., & Bulcavage, L.M.** (1989). Nutritional status, gastrointestinal dysfunction, and survival in patients with AIDS. American Journal of Gastroenterology, 84(10): 1288–1293.

43. **Melchior, J.C., Niyongabo, T., Henzel, D., Durack-Bown, I., Henri, S.C., & Boulier, A.** (1999). Malnutrition and wasting, immunodepression, and chronic inflammation as independent predictors of survival in HIV-infected patients. Nutrition, 15(11-12): 865–869.

44. **Macallan, D.C., Noble, C., Baldwin, C., Jebb, S.A., Prentice, A.M., Coward, W.A., et al.** (1995). Energy expenditure and wasting in human immunodeficiency virus infection. New England Journal of Medicine, 333(2): 83–88.

45. **May, R.M. & Anderson, R.M.** (1987). Transmission dynamics of HIV infection. Nature, 326(6109): 137–42.

46. **Beisel, W.R.** (1996). Nutrition in pediatric HIV infection: Setting the research agenda. Journal of Nutrition, 126(10 Suppl): 2611S–2615S.

47. **Anastasi, J.K., Capili, B., Kim, G., McMahon, D., & Heitkemper, M.M.** (2006). Symptom management of HIV-related diarrhea by using normal foods: A randomized controlled clinical trial. Journal of the Association of Nurses in AIDS Care, 17(2): 47–57.

48. **World Health Organization.** (2003). Nutrition requirements for people living with HIV/AIDS: Report of a technical consultation. Geneva: World Health Organization. Retrieved from http://www.who.int/ nutrition/publications/Content_nutrient_requirements.pdf

49. **Topping, C.M., Humm, D.C., Fischer, R.B., & Brayer, K.M.** (1995). A community-based, interagency approached by dietitians to provide meals, medical nutrition therapy, and education to clients with HIV/AIDS. Journal of the American Dietetic Association. 95(6): 683–686.

50. **Centers for Disease Control and Prevention.** (2009, April 10). Guidelines for preventing opportunistic infections among HIV-infected persons. MMWR: Morbidity and Mortality Weekly Report, 58(RR-4). Retrieved from http://www.cdc.gov/mmwr/pdf/rr/rr5804.pdf

51. **McDermott, A.Y., Terrin, N., Wanke, C., Skinner, S., Tchetgen, E., & Schevitz, A.H.** (2005). CD4+ cell count, viral load, and highly active antiretroviral therapy use are independent predictors of body composition alterations in HIV-infected adults: a longitudinal study. Clinical Infectious Disease, 41(11): 1621–1670.

52. **Freedberg, K.A., Losina, E., Weisntein, M.C., Platiel, A.D., Cohen, C.J., Seage, G.R, et al.** (2001). The cost-effectiveness of combination antiretroviral therapy for HIV disease. New England Journal of Medicine, 344(11): 824–831.

53. **Community Health Advisory & Information Network.** (2011, October). HIV/AIDS, food, & nutrition service needs. Chain Brief Reports. Retrieved from http://www.nyhiv.com/pdfs/ chain/Food%20 Need%20Medical%20Care_factsheet%20v8.pdf

54. **Jariwalla, R.J., Niedzwiecki, A., & Rath, M.** (2011). Micronutrient synergy in the control of HIV infection and AIDS. In Yi-Wei Tang (Ed.), Recent Translational Research in HIV/AIDS (pp. 513–526).

55. **Jariwalla, R.J., Niedzwiecki, A., & Rath, M.** (2007). Role of micronutrients in the control of HIV and AIDS. The Commonwealth Health Ministers Reference Book. Retrieved from http://www4.dr-rath-foundation. org/nat_vit/PDF-Files/role_of_micronutrients_in_the_ control_of_hiv_and_aids.pdf

56. **Chen, R.Y., Accortt, N.A., Westfall, A.O., Mugavero, M.J., Raper, J.L., Cloud, G.A., et al.** (2006). Distribution of healthcare expenditures for HIV-infected patients. Clinical Infectious Diseases, 42(7): 1003–1010.

57. **Gebo, K.A., Fleishman, J.A., Conviser, R., Hellinger, J., Hellinger, F.J., Josephs, J.S., et al.** (2010). Contemporary costs of HIV healthcare in the HAART era. *AIDS,* 24(17): 2705–2715. doi: 10.1097/QAD.0b013e32833f3c14.

58. **OMG Center for Collaborative Learning.** (May 2012). Food as medicine: Reducing health care costs with comprehensive medical nutrition therapy. Retrieved from http://www. mannapa.org/wp-content/ uploads/2012/11/MANNA-Final-Report-6-13-2012.pdf

59. **Schackman, B.R., Gebo, K.A., Walensky, R.P., Losina, E., Muccio, T., Sax, P.E., et al.** (2006). The lifetime cost of current human immunodeficiency virus care in the United States. *Medical Care*, 44(11): 990–997.

60. **Goldie, S.J., Paltiel, A.D., Weinstein, M.C., Losina, E., Seage, G.R. 3rd, Kimmel, A.D., et al.** (2003). Projecting the cost-effectiveness of adherence interventions in person with human immunodeficiency virus infection American Journal of Medicine, 115(8): 623–641.

61. **Toles, M. & Demark-Wahnefried, W.** Nutrition and the cancer survivor: Evidence to guide oncology nursing practice. Seminars in Oncology Nursing, 24(3): 171–179. doi: 10.1016/j.soncn.2008.05.005

62. **Massachusetts Department of Public Health, Bureau of Health Information, Statistics, Research, and Evaluation.** (2011, August). Cancer incidence and mortality in Massachusetts 2004–2008: Statewide report. Retrieved from http://www.mass.gov/eohhs/docs/dph/ cancer/registry-statewide-04-08-report.pdf

63. **Centers for Disease Control and Prevention.** (2008). Massachusetts: Burden of disease. Retrieved from http://www.cdc.gov/chronicdisease/states/pdf/massachusetts.pdf

64. **Centers for Disease Control and Prevention.** (2012). Massachusetts fact sheet. Retrieved from http://www.cdc.gov/nchs/pressroom/states/MA_2012.pdf

65. **Ravasco, P., Grillo, M.I., & Camilo, M.** (2007). Cancer wasting and quality of life react to early individualized nutrition counseling. Clinical Nutrition, 26(1): 7–15.

66. **Abbott Laboratories, Inc., Abbot Nutrition.** (2007, July). Improving outcomes in chronic diseases with specialized nutrition intervention. Retrieved from http://abbottnutrition. com/Downloads/ ResourceCenter/HCPLitReview_Final_20(printer_20friendly).pdf

67. **National Cancer Institute.** (n.d.). Nutrition care in cancer: Overview. Retrieved from http:// www.cancer.gov/cancertopics/pdq/supportivecare/nutrition/HealthProfessional/page1

68. **Abbott Laboratories, Inc.** (2012). Improving outcomes with nutrition in patients with cancer [White paper]. Retrieved from http://www.onsedge.com/wordpress/wp-content/uploads/ 2012/07/ Abbott-white-paper-final_Web.pdf

69. **Isenring, E., Cross, G., Kellett, E., Koczwara, B., & Daniels, L.** (2010). Nutritional status and information needs of medical oncology patients receiving treatment at an Australian public hospital. Nutrition and Cancer, 62(2):220–228. doi: 10.1080/01635580903305276

70. **Ottery, F.D.** (1994). Cancer cachexia: prevention, early diagnosis, and management. Cancer Practice. 2(2): 123–131.

71. **Argilés, J.M.** (2005). Cancer-associated malnutrition. European Journal of Oncology Nursing. 9(2 Suppl): S39–S50.

72. **Langstein, H.N. & Norton, J.A.** (1991). Mechanisms of cancer cachexia. Hematology/Oncology Clinics of North America, 5(1): 103–23.

73. **Tisdale, M.J.** (1993). Cancer cachexia. Anticancer Drugs, 4(2): 115–125.

74. **Granda-Cameron, C., DeMille, D., Lynch, M.P., Huntzinger, C., Alcorn, T., Levicoff, J., et al.** (2010). An interdisciplinary approach to manage cancer cachexia. Clinical Journal of Oncology Nursing, 14(1): 72–80. doi: 10.1188/10.CJON.72-80

75. **Hutton, J.L., Matin, L., Field, C., Wismer, W.V., Bruera, E.D., Watanabe, S.M., et al.** (2006). Dietary patterns in patients with advanced cancer: Implications for anorexia-cachexia therapy. American Journal of Clinical Nutrition, 84(5): 1163–1170.

76. **Edington, J., Winter, P.D., Coles, S.J., Gale, C.R., & Martyn, C.N.** (1999). Outcomes of undernutrition in patients in the community with cancer or cardiovascular disease. Proceedings of the Nutrition Society, 58(3): 655–661.

77. **Dewys, W.D., Begg, C., Lavin, P.T., Band, P.R., Bennett, J.M., Bertino, J.R., et al.** (1980). Prognostic effect of weight loss prior to chemotherapy in cancer patients: Eastern Cooperative Oncology Group. American Journal of Medicine, 69(4): 491–497

78. **Andreyev, J.H.N., Norman, A.R., Oates, J., & Cunningham, D.** (1998). Why do patients with weight loss have a worse outcome when undergoing chemotherapy for gastrointestinal malignancies? European Journal of Cancer, 34(4): 503–509

79. **Baldwin, C., Spiro, A., Ahern, R., & Emery, P.W.** (2012). Oral nutritional interventions in malnourished patients with cancer: a systematic review and meta-analysis. Journal of the National Cancer Institute, 104(5): 371–385. doi: 10.1093/jnci/djr556

80. **Bauer, J.D., Capra, S., Battistutta, D., Davidson, W., & Ash, S.** (2005). Compliance with nutrition prescription improves outcomes in patients with unresectable pancreatic cancer. Clinical Nutrition, 24(6): 998–1004.

81. **Nayel, H., El-Ghonelmy, E., & el-Haddad, S.** (1992). Impact of nutritional supplementation on treatment delay and morbidity in patients with head and neck tumors treated with irradiation. Nutrition, 8(1): 13–18.

82. **Bruera, E.** (1997). ABC of palliative care. Anorexia, cachexia, and nutrition. British Medical Journal, 315(7117): 1219–1222.

83. **Meropol, N.J., Schrag, D., Smith, T.J., Mulvey, T.M., Langdon, R.M. Jr., Blum, D., et al.** (2009). American Society of Clinical Oncology guidance statement: The cost of cancer care. Journal of Clinical Oncology, 27(23): 3868–3874. doi: 10.1200/JCO.2009.23.1183

84. **American Cancer Society.** (2010). Cancer facts & figures. Atlanta: American Cancer Society. Retrieved from http://www.cancer.org/acs/groups/content/@nho/documents/ document/acspc-024113.pdf

85. **Hoffman, J.M., Li, E., Doloresco, F., Matusiak, L., Hunkler, R.J., Shah, N.D., et al.** (2012). Projecting future health care expenditures—2012. American Journal of Health-System Pharmacy, 69(5): 405–421. doi: 10.2146/ajhp110697

86. **Massachusetts Department of Public Health** (n.d.). Diabetes Prevention and Control Program fact sheet. Retrieved from http://www.mass.gov/eohhs/docs/dph/com-health/diabetes/facts-in-mass.pdf

87. **Mayo Foundation for Medical Education and Research, Mayo Clinic Staff.** (2012, January 26). Prediabetes: Definition. Retrieved from http://www.mayoclinic.com/health/prediabetes/ DS00624

88. **Massachusetts Department of Public Health.** (2012, July 11). Massachusetts deaths 2009. Retrieved from http://www.mass.gov/eohhs/docs/dph/research-epi/death-full-09.pdf

89. **A.D.A.M., Inc.** (2012, June 27). Diabetes. A.D.A.M. Medical Encyclopedia. Retrieved from http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0002194/

90. **American Diabetes Association.** (2011, January 26). Diabetes basics: Diabetes statistics. Retrieved from http://www.diabetes.org/diabetes-basics/diabetes-statistics/

91. **Stratton, I.M., Adler, A.I., Neil, H.A., Matthews, D.R., Manley, S.E., Cull, C.A., et al.** (2000). Association of glycaemia with macrovascular and microvascular complication of type 2 diabetes (UKPDS 35): Prospective observational study. British Medical Journal. 321(7258): 405–412.

92. **Imai, S., Kozai, H., Matsuda, M., Hasegawa, G., Obayashi, H., Togawa, C., et al.** (2008). Intervention with delivery of diabetic meals improves glycemic control in patients with type 2 diabetes mellitus. Journal of Clinical Biochemistry and Nutrition, 42: 59–63. doi: 10.3164/jcbn.2008010

93. **Metz, J.A., Stern, J.S., Kris-Ehterton, P., Reusser, M.E., Morris, C.D., Hatton, D.C., et al.** (2000). A randomized trial of improved weight loss with a prepared meal plan in overweight and obese patients: Impact on cardiovascular risk reduction. Archives of Internal Medicine, 160(14): 2150–2158.

94. **Williamson, D.F., Thompson, T.J., Thun, M., et al.** (2000). Intentional weight loss and mortality among overweight individuals with diabetes. Diabetes Care, 23(10): 1499–1504.

95. **Gleason, J.A., Bourdet, K.L., Koehn, K., Holay, S., & Schaefer, E.J.** (2002). Cardiovascular risk reduction and dietary compliance with a home-delivered diet and lifestyle modification program. Journal of the American Dietetic Association, 102(10): 1445–1451.

96. **United States Renal Data System.** (2011). Costs of chronic kidney disease. 2011 Atlas of CKD. (pp. 91–100). Retrieved from http://www.usrds.org/2011/pdf/v1_ch06_11.pdf

97. **Wagner, E.H., Sandhu, N., Newton, K.M., McCulloch, D.K., Ramsey, S.D., & Gorthaus, L.C.** (2001). Effect of improved glycemic control on health care costs and utilization. JAMA, 285(2): 182–189.

98. **Agren, G., Narbro, K., Näslund, I., Sjöström, L., & Peltonen, M.** (2002). Long-term effects of weight loss on pharmaceutical costs in obese subjects: A report from the SOS intervention study. International Journal of Obesity and Related Metabolic Disorders, 26(2): 184–192.

99. **Oregon Food Bank.** (2012). Voices: Stories about hunger and its root causes from the Oregon Food Bank Network. http://www.oregonfoodbank.org/About-Us/~/media/CAB05CAD908D47368157106E22EE4F86.pdfh

100. **Center for Community Action and Environmental Justice & ENGAGE Economic, Social and Cultural Rights Mobilization Project.** (2011). Pollution in San Bernardino: The BNSF international rail yard. Retrieved from http://globalgrassroots.files.wordpress.com/2011/ 01/san-bernardino-1-24-small1.pdf

COMMUNITY SERVINGS

DELIVERING MEALS
DELIVERING HOPE

18 MARBURY TERRACE, BOSTON, MASSACHUSETTS 02130
TELEPHONE 617.522.7777 EMAIL info@servings.org

www.servings.org

DESIGN: WINSOR COBB DESIGN