True Cost of Food: Food is Medicine Case Study

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Foreword

Poor nutrition and food insecurity are major drivers of poor health outcomes and excess healthcare spending in the United States. Few strategies or programs have traditionally existed within the healthcare system to address these risks, however this is now rapidly changing due to the growing momentum of Food is Medicine. Food is Medicine (FIM) interventions, which are food-based nutritional interventions that aim to treat or prevent disease, show tremendous promise for improving nutrition, reducing food insecurity, improving health outcomes, and increasing health equity.

This report builds upon other true cost of food reports supported by The Rockefeller Foundation, this time offering a true cost analysis of implementing national Food is Medicine interventions and programs. To better understand the potential national impacts of key FIM strategies, researchers at the Food is Medicine Institute at the Friedman School of Nutrition Science and Policy at Tufts University, with support from The Rockefeller Foundation, have investigated the impact on overall health, healthcare, and the U.S. economy of scaling medically tailored meals (MTMs) and produce prescription programs nationally. The results are described in this report as two separate case studies.

The first case study, *Medically Tailored Meals: Hospitalizations and Health Care Expenditures*, is a health and economic evaluation of the true cost of expanding implementation of MTMs nationally. The second case study, *Produce Prescription Programs: Health and Economic Impacts*, is a health and economic evaluation of the true cost of expanding implementation of produce prescriptions nationally for adults with diabetes and food insecurity. The overall results show that 1) national implementation of MTMs in Medicare, Medicaid, and private insurance for patients with both a diet-related condition and instrumental activities of daily living (IADL) limitation could be associated with approximately 1.6 million averted hospitalizations and net cost savings of $13.6 billion in health care costs in the first year, and 2) national implementation of produce prescription programs for patients with diabetes and food insecurity could result in 292,000 averted cardiovascular events and 260,000 quality-adjusted life years gained, while being highly cost effective from a health perspective (based on an incremental cost-effectiveness ratio of $18,100/quality-adjusted life years) and cost saving from a societal perspective (based on a net savings of $-0.05 billion).

Foreword

These two case studies suggest that Food is Medicine interventions scaled to a national level in the United States would not only improve health and be highly cost-effective, but also serve as a cost saving intervention in the healthcare setting for addressing diet-related chronic illness and health inequities. This is a rare outcome in medical care as few, if any, other interventions in healthcare are both cost effective and cost saving. Despite these proven and estimated benefits to patients, healthcare systems, and the economy, FIM interventions are not universally available to health care providers as a prescribable intervention, nor to patients as a covered intervention. As a result, FIM is largely unavailable to individuals who might benefit.

This report highlights policy solutions needed to facilitate and leverage the potential of FIM interventions to improve health and health equity while achieving cost savings or high cost effectiveness for Americans across the nation. It is time to recognize the true cost of food and take action as a country by placing a stronger emphasis on providing healthy food as a tool for treating chronic disease and developing the infrastructure needed to support national scaling of Food is Medicine interventions.

Onward,

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Introduction

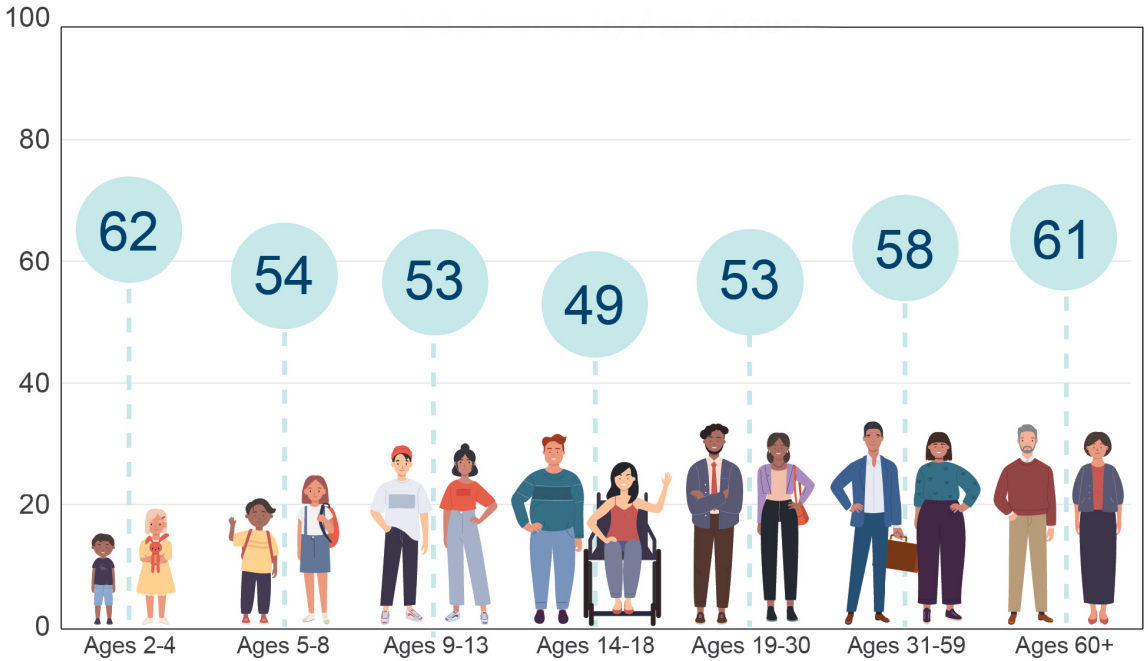
Burdens of Food and Nutrition Insecurity, Diet-Related Diseases, and Health Disparities in the United States

Most Americans have a failing score when it comes to consuming a healthy diet. Across the population ages 2 years and older, the average Healthy Eating Index (HEI) score — a measure of diet quality that assesses alignment with the *Dietary Guidelines for Americans* (DGA) — is 58 out of 100 [Figure 1].[1] Deficiencies include insufficient intake of fruits, vegetables, whole grains, nuts, and seafood, and excess intake of refined grains, added sugars, and sodium.[2]

Poor nutrition is the leading driver of death and disability in the United States, including from heart disease, stroke, type 2 diabetes, obesity, hypertension, and some cancers, and has staggering costs to society. The economic costs of suboptimal diets due to health care spending and lost productivity are estimated at $1.1 trillion each year — equaling the economic output of the entire food sector.[3]

In the United States, 42% of adults have obesity,[4] which is projected to increase to 58% by 2035. Changes in the prevalence of obesity are expected to rise even faster in children, by 2.4% per year.[5]

FIGURE 1: Healthy Eating Index Scores in the United States, by Age Group



Source: U.S. Department of Agriculture Food and Nutrition Service. How Healthy is the American Diet? Published October 2021. Accessed May 5, 2023. https://fns-prod.azureedge.us/sites/default/files/media/file/HEI-2015_Infographic_NHANES2017-2018.pdf

Today, 1 in 2 U.S. adults has diabetes or prediabetes,[6] 3 in 4 have overweight or obesity,[7] and 14 in 15 have suboptimal cardiometabolic health.[8] While rates of diet-related chronic disease in the United States as a whole are high, disparities exist by education, income, race/ethnicity, and geographic region. For U.S. adults, the prevalence of diabetes is highest among American Indians and Alaska Natives, those with less than a high-school education, those with a family income below the federal poverty level, and those living in the South and Southeast regions of the country.[9] Similarly, hypertension prevalence is highest among non-Hispanic Black adults and those with lower incomes and educational attainment.[4] These alarming statistics and projections are a matter of national security as 8 in 10 young Americans are ineligible for military service — with overweight and obesity being the top medical disqualifier. [10]

Millions of Americans also experience food insecurity, "a household-level economic and social condition of limited or uncertain access to adequate food."[11] During 2021, 10.2% of U.S. households (13.5 million) were food insecure at some point during the year.[12] Food insecurity is associated with worse nutrition, higher rates of diet-related diseases, and greater healthcare spending.[13,14] For example, it has been estimated that U.S. adults with food insecurity spend an extra $1,800 per year in healthcare expenditures compared to those who are food secure.[15] Food insecurity is also deeply intertwined with health disparities, with higher rates of food insecurity among households with lower income, Black non-Hispanic households, and Hispanic American households.[12]

Food is Medicine in Healthcare

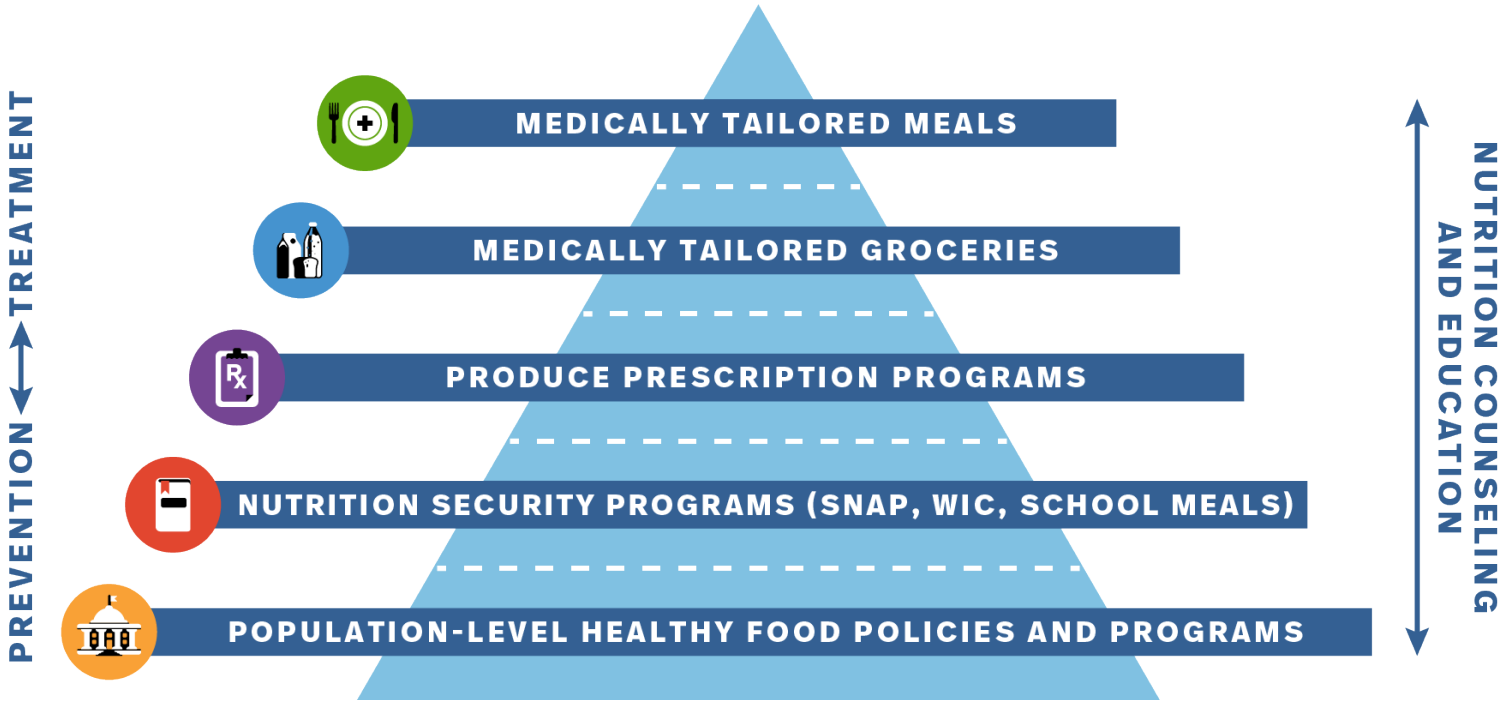
Remarkably, while poor nutrition and food insecurity are major drivers of poor health outcomes and excess healthcare spending, few strategies or programs have traditionally existed within the healthcare system to address these risks. This is now rapidly changing, however, based on a suite of food-based nutritional interventions that aim to treat or prevent disease. These "Food is Medicine" (FIM) interventions show tremendous promise for improving nutrition, reducing food insecurity, improving health outcomes, and increasing health equity.

Such FIM interventions are emerging as an important strategy for changing the status quo of U.S. healthcare by placing a stronger emphasis on providing healthy food as a tool for treating chronic disease. Importantly, the FIM framework extends beyond the concept of food security as a social determinant of health by recognizing that poor nutrition is a foundational determinant of health, one that must be directly addressed by the healthcare system through evidence-based, integrated interventions like any other disease risk factor.

Thus, FIM interventions provide a new critical link between nutrition and health, integrated into healthcare delivery. The FIM framework can be conceptualized as a pyramid of various programs and interventions in healthcare and population health that integrate food-based nutrition interventions to treat and prevent disease at multiple levels [Figure 2]. The top of the pyramid includes more intensive interventions for a smaller number of patients with more severe, complex medical conditions; the middle, other interventions with a larger number of patients with general diet-related illness; and the base, programs and interventions at the population-level that are more preventive in nature.[16]

All these interventions aim to support and promote healthy dietary habits to treat or prevent diet-related diseases. All also help to address the often intertwined challenge of food insecurity, helping to reduce health disparities. Table 1 provides specific examples of interventions that fit within the Food is Medicine pyramid [Table 1]. These include several types of programs that provide nourishing food, fully or partly supported by health insurance, to support disease management, disease prevention, or optimal health, and linked to the healthcare system as part of a patient's treatment plan.

FIGURE 2: The Food is Medicine Pyramid



Source: Figure updated and adapted with permission from Food is Medicine Massachusetts. Food is Medicine pyramid. Food is Medicine interventions. https://foodismedicinema.org/food-is-medicine-interventions

TABLE 1: Example Interventions from the Food is Medicine Pyramid

	Target population	Intervention	Examples of efficacy
Medically tailored meals	People with severe, complex chronic conditions that limit activities of daily living and cause high burdens of disability, illness, and health care utilization, such as poorly controlled diabetes, heart failure, cancer, kidney failure, and HIV.	Prepared, medically tailored meals delivered to individuals living with severe illness through a referral from a medical professional or health care plan. Meal plans are tailored to the medical needs of the recipient by a Registered Dietitian Nutritionist (RDN). Often provided as 10 (and up to 21) weekly meals, in combination with nutrition and culinary education.	Improved food security and disease management; lower hospital, emergency room, and nursing home admissions, and lower net health care costs.
Medically tailored groceries	People with one or more major diet-related health risks or conditions but who can still prepare and cook their own meals. Often, but not always, used for people on low-incomes and/or those with food insecurity.	Healthy food items that are pre-selected, often by an RDN or other qualified professional, and provided to eligible patients, in combination with nutrition and culinary education.	Improved food security and diet quality; inconsistent associations with health outcomes.
Produce prescriptions	People with at least one diet-sensitive health risk or chronic condition, such as diabetes, pre-diabetes, hypertension, obesity, or heart disease, as well as people with low incomes and/or who are food insecure.	Discounted or free produce such as fruits and vegetables (and sometimes also nuts, seeds, beans, whole grains, dairy, and eggs) are provided by electronic benefit cards or paper vouchers redeemable at grocery stores or farmers markets; picked up in the healthcare setting or by home delivery; in combination with nutrition and culinary education.	Improved food security and diet quality; lower hemoglobin A1c, blood pressure, and body mass index.
Government nutrition security programs	People from low-income or other marginalized households with food and/or nutrition insecurity. Children from households with lower incomes.	Community, public health, and healthcare system screening, connecting, and supporting enrollment of eligible individuals into government nutrition programs, like the U.S. Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), school breakfast and lunch programs, and nutrition programs for older adults.	SNAP: reduced poverty and improved food security; inconsistent associations with health outcomes. WIC: improved maternal and child diet quality, birth outcomes, and child preventative care and cognitive outcomes. School meals: improved diet quality, food security, and academic performance (lunch); less consistent findings for school breakfast.
Population-level healthy food programs and policies	Children and adults within the general population at risk for poor metabolic health.	Programs and policies to address systems and environmental barriers to equitable healthy food in communities. Examples include consumer education strategies like food package and restaurant menu labels, including warning labels; nutrition standards for institutional procurement including charitable food; employer-based wellness programs with education and incentives for healthier eating; fiscal approaches or incentives to support the affordability of healthful foods; taxes or other disincentives for unhealthful foods or beverages; and regulatory approaches to food additives.	Increased community availability of healthier foods and beverages, healthier industry reformulations of packaged foods and restaurant items, reduced sales of unhealthy items, and improved nutritional habits of consumers.

Note: For MTMs, medically tailored groceries, and produce prescriptions, clinicians or other health system staff including RDNs, social workers, and community health workers screen and refer eligible patients to appropriate services as part of their treatment plan.

Table adapted from Mozaffarian D, Blanck HM, Garfield, KM, et al. A Food is Medicine approach to achieve nutrition security and improve health. *Nat Med.* 2022;28(11):2238-2240; and Mozaffarian D. Measuring and addressing nutrition security to achieve health and health equity, *Health Affairs.* 2023; https://www.healthaffairs.org/do/10.1377/hpb20230216.926558/

Momentum is building for healthcare to add these strategies to its established armamentarium to increase health and well-being.[17,18,19] Nine states now have approved section 1115 waivers to deliver food-based nutritional interventions through Medicaid to patients with eligible medical conditions.[20] Private payers and health care providers are also investing in these interventions, identifying their potential to improve health and health equity at a similar or lower cost than many conventional medical interventions. The Biden-Harris Administration released a new National Strategy to end hunger, increase healthy eating, and reduce diet-related diseases by 2030, which includes several key FIM interventions in Medicare, Medicaid, the Veterans Affairs healthcare system, and the Indian Health Service.[21] In response to the White House National Strategy, a number of organizations made commitments to support FIM efforts, including the American Heart Association and Rockefeller Foundation commitment of $250 million to build a national Food is Medicine research initiative, a Kaiser Permanente commitment of $50 million for programs that increase food and nutrition security and improve health outcomes, a Blue Cross and Blue Shield of North Carolina Foundation commitment of $3.5 million to fund and evaluate FIM interventions in the state, a Community Servings commitment to provide 10 million medically tailored, home-delivered meals to individuals and families experiencing nutrition insecurity and chronic illness in Massachusetts and Rhode Island, and many more.[22,23] However, while the strong links between diet quality and chronic disease are well-established, these FIM interventions are not yet covered benefits nor considered a mainstream standard of care, limiting their access for the majority of Americans.

True Cost of Food is Medicine

The Rockefeller Foundation's July 2020 report, *Reset the Table: Meeting the Moment to Transform the U.S. Food System*, identified shifts required to make the U.S. food system more equitable, resilient, and nourishing. Several cross-cutting capabilities were identified as necessary for accomplishing these fundamental shifts, including to "relentlessly apply true cost accounting."[24] The Rockefeller Foundation has since published a true cost analysis of the U.S. food system, *True Cost of Food: Measuring What Matters to Transform the U.S. Food System*, and a true cost analysis of school meals, *True Cost of Food: School Meals Case Study*.

This report serves as an additional true cost of food report, this time offering a true cost analysis of implementing national Food is Medicine interventions and programs. To better understand the potential national impacts of key FIM strategies, researchers at the Food is Medicine Institute at the Friedman School of Nutrition Science and Policy at Tufts University, with support from The Rockefeller Foundation, have investigated the impact on overall health, healthcare, and the U.S. economy of scaling medically tailored meals (MTMs) and produce prescription programs nationally. The results are described in two case studies.

The first case study, *Medically Tailored Meals: Hospitalizations and Health Care Expenditures*, is a health and economic evaluation of the true cost of expanding implementation of MTMs nationally. MTMs are fully prepared, healthy meals for individuals living with advanced and costly diet-related conditions such as diabetes, heart failure, end-stage kidney disease, HIV infection, and cancer. Medically tailored meal programs are often designed to treat individuals with lower incomes, food insecurity, and/or limitations in instrumental activities of daily living, also known as IADLs (e.g., requiring help or supervision using the telephone, paying bills, taking medications, preparing light meals, or going shopping due to an impairment or health problem), that make it difficult to prepare healthy meals. Patients are identified and referred to an MTM program by a medical professional or health care plan based on meeting the preceding criteria. The meals are designed by a Registered Dietitian Nutritionist (RDN), tailored to the unique nutritional and medical needs of the patient, and typically delivered to the patient's home.

The second case study, *Produce Prescription Programs: Health and Economic Impacts*, is a health and economic evaluation of the true cost of expanding implementation of produce prescriptions nationally for adults with diabetes and food insecurity. In produce prescription programs, health care providers or payers identify at-risk patients with one or more diet-related health risks or conditions, often with additional criteria of food insecurity or other suboptimal access to nutritious foods, and then provide them with free or discounted healthy produce, most commonly fresh fruits and vegetables.[25]

The financial support can be implemented using a paper voucher or electronic cards redeemable at local farmers' markets or retail grocery stores, or with food packages picked up at a healthcare center or delivered to the home, with costs covered by healthcare payers. Programs typically include meaningful individual or group-based nutrition education and culinary guidance.[25,26]

The methods and findings from these two case studies are described in further detail in the ensuing sections as well as in Figures 3 and 4. The overall results show that 1) national implementation of MTMs in Medicare, Medicaid, and private insurance for patients with both a diet-related condition and an IADL limitation could be associated with approximately 1.6 million averted hospitalizations and net cost savings of $13.6 billion in health care costs in the first year,[27] and 2) national implementation of produce prescription programs for patients with diabetes and food insecurity could result in 292,000 averted cardiovascular events, 260,000 quality-adjusted life years gained, cost $44.3 billion in program costs, and save an estimated $39.6 billion in healthcare costs and $4.77 billion in productivity costs over a lifetime. The program was highly cost effective from a health care perspective and cost saving from a societal perspective.[28]

FIGURE 3: Key Details of the Two Case Studies

	CASE STUDY 1 Medically Tailored Meals: Hospitalizations & Health Care Expenditures	CASE STUDY 2 Produce Prescription Programs: Health & Economic Impacts
INTERVENTION	National coverage of Medically Tailored Meals (MTM)	National implementation of Produce Prescription Programs
KEY OUTCOMES	Hospitalizations Health care expenditures & net costs Cost-effectiveness of the MTM program *Changes in the above outcomes were estimated at 1 year & 10 years*	Cardiovascular Disease (CVD) Quality-Adjusted Life-Years (QALYs) Health-related cost Cost-effectiveness *Changes in the above outcomes were estimated at 5 years, 10 years, and over a lifetime*
POPULATION	U.S. adults 18 years & older with: At least one diet-related condition Limited instrumental activities of daily living (IADL) Coverage by Medicaid, Medicare, or private insurance (estimated separately)	U.S. adults aged 40–79 years with: Diabetes Food insecurity
COMPARISON GROUP	The identical population without receipt of MTM	The identical population without receipt of Produce Prescription
APPROACH	Population-level prospective cohort policy simulation model	Validated microsimulation modeling study (formal name: Diabetes, Obesity, Cardiovascular Disease Microsimulation Model)
DATA SOURCES	2019 Medical Expenditure Panel Survey	2013-2018 National Health and Nutrition Examination Survey 2014-2016 Medical Expenditure Panel Survey

FIGURE 4: Key Results From the Two Case Studies

CASE STUDY 1
Medically Tailored Meals: Hospitalizations & Health Care Expenditures

6.3 MILLION ELIGIBLE RECIPIENTS
with complex chronic disease plus limited instrumental activities of daily living

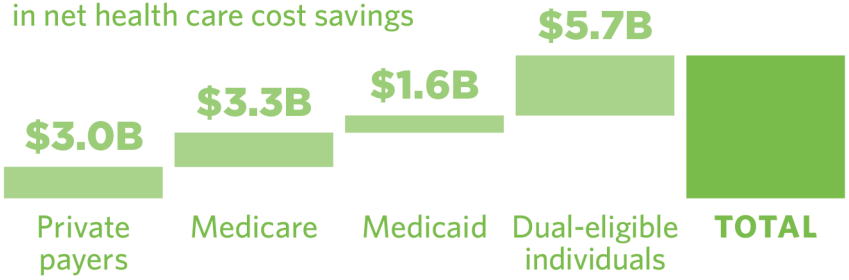
In one year of national MTM coverage:

1.6 Million fewer hospitalizations

$24.8 Billion in program costs

$38.7 Billion in health care cost savings

$13.6 Billion
in net health care cost savings



CASE STUDY 2
Produce Prescription Programs: Health & Economic Impacts

6.5 MILLION ELIGIBLE RECIPIENTS
with diabetes plus food insecurity

Over a lifetime:

292,000 CVD events prevented

260,000 QALYs generated

$44.3 Billion in program costs

$39.6 Billion in health care cost savings

$4.8 Billion in productivity savings

Highly cost-effective from a health care perspective (**$18,100/QALY**), cost-saving from societal perspective.

Food is Medicine Case Studies

CASE STUDY 1

Medically Tailored Meals: Hospitalizations and Health Care Expenditures

BACKGROUND

Medically Tailored meals (MTMs) have been suggested to effectively improve disease management, and reduce healthcare utilization (e.g. hospitalizations, emergency department admissions, nursing home visits) and health care expenditures based on evidence from observational studies and pilot randomized clinical trials.[29,30,31,32,33,34] To date, MTMs have generally been provided by community-based organizations supported by grants, donations, and additional ad hoc restricted funding from home health care services benefits, Medicare Advantage programs, or state Section 1115 waivers allowing coverage of MTMs, with limited coverage nationally. The potential changes in health care expenditure and hospitalization if MTMs were covered nationally by health insurance for an entire eligible population have not been quantified. The objective of this case study was to estimate the 1-year and 10-year potential changes in annual hospitalizations, health care expenditures and net costs, and cost effectiveness associated with national MTM coverage for U.S. patients with at least one diet-related health condition and limited instrumental activities of daily living (IADLs) who are covered by Medicaid, Medicare, or private insurance.

The MTM intervention evaluated in the study was meals that were medically tailored and provided only for the patient (i.e., no meals were provided for other household members). In practice, MTM organizations often have available 10 to 15 different daily medically tailored meal plans for different patients. Programs generally provide between 10–21 meals per week to each patient (such as lunch and dinner for all weekdays) based on disease diagnosis and nutritional assessment.[35] Meals are developed by Registered Dietitian Nutritionists (RDN) who tailor ratios of macronutrients and micronutrients for specific diagnoses, incorporate optimal quantities of healthy food groups such as fruits and vegetables, account for dietary preferences such as vegetarian options, and provide options for individuals who have challenges chewing solid foods. MTM dietary guidelines for common diagnoses can be found on the Food is Medicine Coalition website.[36]

For this case study, a population-level, cohort policy simulation model was created based on nationally representative samples from the 2019 Medical Expenditure Panel Survey (MEPS). The model estimated 1- and 10-year potential changes in annual hospitalizations, potential changes in annual health care expenditures, and overall policy cost effectiveness associated with national MTM coverage, compared with no new MTM policy. The model further incorporated evidence on annual hospitalizations and expenditures from MEPS, relative risks of hospitalizations and the percentage change in health care expenditures associated with MTM receipt, and MTM program costs. Participants were U.S. adults aged 18 years or older who had Medicare, Medicaid, or private payer insurance and at least one diet-related condition (diabetes, congestive heart failure, myocardial infarction, other heart disease, emphysema, stroke, nonmelanoma cancer, chronic kidney disease, and HIV infection) and one IADL limitation (i.e., a positive survey response to receiving help or supervision using the telephone, paying bills, taking medications, preparing light meals, doing laundry, or going shopping, due to an impairment or health problem).

The model outputs included changes in annual inpatient hospitalizations and health care expenditures, MTM program costs, and net policy costs from the health care perspective, separately analyzed among Medicaid, Medicare, dual-eligible, and privately insured patients, for both a 1-year (2019) and a 10-year (2019-2028) time horizon.

Who was eligible to participate in the program?

It was estimated that 6.3 million U.S. adults with Medicare, Medicaid, or private insurance would have been eligible to receive MTMs based on having at least one diet-related disease and IADL limitation.

The average patient age was 68.1 years; 63.4% were female, 36.6% were male, 11.3% were Hispanic, 3.1% were non-Hispanic Asian, 14.2% were non-Hispanic Black, 66.7% were non-Hispanic White, and 4.7% were other or multiple races and ethnicities. About three-quarters (76.5%) of patients were covered by Medicare and/or Medicaid.

The most common eligibility diagnosis was cardiovascular diseases (70.6%), followed by diabetes (44.9%) and cancer (37.2%) (values sum to greater to 100% due to the presence of more than one eligible condition in most patients).

The average annual health care expenditures in 2019 were about $31,000 per person, including an average of 0.98 emergency department visits and 0.54 hospitalizations per person per year, consistent with the expected high severity of illness and health care utilization in this patient population.

What was the intervention?

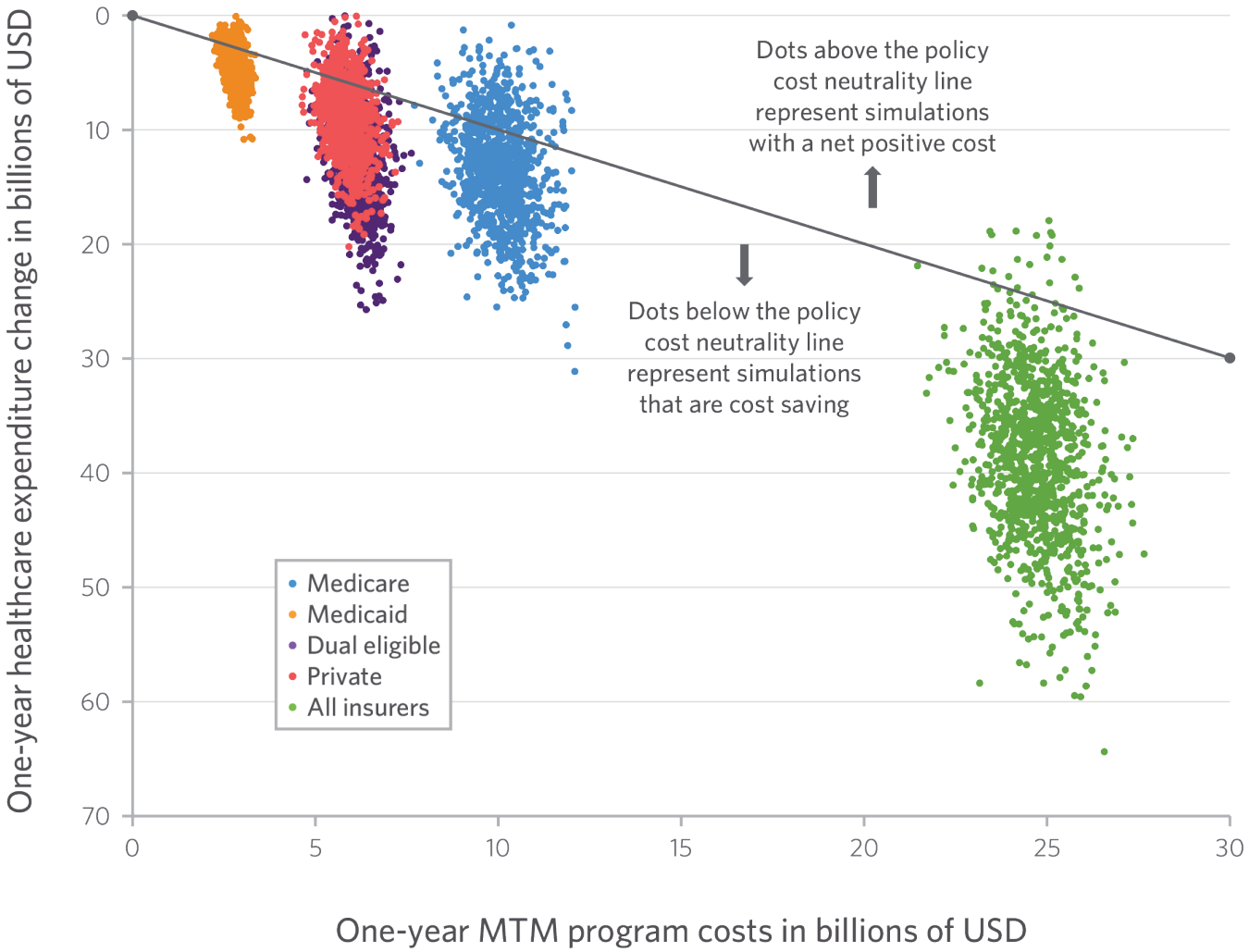
Eligible patients received 10 weekly meals (typically lunch and dinner on weekdays) for an average of 8 months each year. The meals were medically tailored by an RDN, considering macronutrients and micronutrients, incorporating optimal quantities of healthy food groups such as fruits and vegetables, accounting for dietary preferences such as vegetarian meals, and providing options for individuals who have challenges chewing solid foods. Meals were provided only for the index patient (i.e., not for other household members, as is common in most MTM insurance contracts). It was conservatively assumed that health benefits of MTMs would occur only in the year of their provision, with no sustained or carry-over benefits into the following year. Screening included an initial medical nutrition therapy (MNT) visit with an RDN. Program costs were based on 2019 insurance contracts from 10 major MTM organizations and included nutritional tailoring, ingredients, labor, administrative, and delivery costs, which yielded a pooled mean (SD) per meal cost of $9.30 (0.64).

What were the Year 1 outcomes (2019)?

If all eligible individuals (n=6.3 million) received MTMs, the estimated MTM program costs, including clinical screening and meals, would be $24.8 billion; and an estimated 1.6 million hospitalizations and $38.7 billion in health care expenditures would potentially be averted in one year. Most of the health care expenditure savings (77.0%) would occur in Medicare and Medicaid, totaling $29.8 billion. Summed across all health care payers, the policy was estimated to potentially be associated with net cost savings of $13.6 billion. By payer subsets, one-year possible policy cost savings were estimated at $3.0 billion for private payers, $3.3 billion for Medicare, $1.6 billion for Medicaid, and $5.7 billion for dual-eligible individuals (both Medicare and Medicaid). [Figure 5]

FIGURE 5: Model Simulations of One-Year Medically Tailored Meal (MTM) Policy Costs and Potential Change in Health Care Expenditures Associated with MTM Receipt, by Health Insurance Status

Each dot represents 1 of 1,000 simulations, stratified by insurance status. The diagonal line indicates policy cost neutrality. The policy simulation model ran 1,000 Monte Carlo simulations using inputs and their uncertainties from the 2019 Medical Expenditure Panel Survey, relative risks of annual hospitalizations, and annual percentage change in health care expenditures associated with MTM receipt, screening costs, and meal costs.



Even for the minority of simulation outcomes with a net positive cost, the value or cost effectiveness of the intervention was high, indicating this is a "best buy" in healthcare.

Source: Figure adapted with permission from Hager K, Cudhea FP, Wong JB, et al. Association of national expansion of insurance coverage of medically tailored meals with estimated hospitalizations and health care expenditures in the US. *JAMA Netw Open*. 2022;5(10):e2236898. doi:10.1001/jamanetworkopen.2022.36898

What if food insecurity were added as an eligibility criterion?

Eligibility decreased from 6.3 million to 1.9 million individuals when food insecurity was added as an additional criterion for receiving MTMs. Compared with the original population, this population was younger and more likely to be Hispanic or non-Hispanic Black, have lower household income, and be dual-eligible for Medicare and Medicaid. Baseline annual emergency department admissions, hospitalizations, and health care expenditures per person were slightly greater than for the base-case population, although these differences were not statistically significant. In this population, the model estimated that implementation of MTMs would potentially be associated with 506,000 averted hospitalizations and $13.0 billion averted health care expenditures in one year, with a net policy cost savings of $5.5 billion.

What were the Year 10 outcomes (2019–2028)?

Based on observed national trends with 2019 as the base, it was assumed that from 2020 to 2028, the eligible patient population would increase annually by 1.0% among privately insured individuals, 2.1% among those in Medicare, 3.0% among those in Medicaid, and 5.7% among dual-eligible individuals. It was also assumed that per-patient, inflation-adjusted health care expenditures would increase by 1.5% annually among privately insured individuals, 1.7% among those in Medicare, 3.5% among those in Medicaid, and 3.9% among dual-eligible individuals. In 2019 dollars, 10 years of the MTM intervention (in which the target population received MTMs for 8 months per year in each of the 10 years modeled) was estimated to cost $298.7 billion and to be associated with 18 million fewer hospitalizations and savings of $484.5 billion in health care expenditures. The net cost savings from an insurer perspective would be $185.1 billion.

What are the key takeaways from this case study of Medically Tailored Meals?

- → National coverage of MTMs (10 meals per week for an average of 8 months in each year of intervention) in Medicare, Medicaid, and private insurance for patients with both a diet-related condition and an IADL limitation was estimated to produce meaningful reductions in both annual hospitalizations and health care expenditures.
- → Among 6.3 million eligible recipients, provision of MTMs could lead to 1.6 million fewer hospitalizations annually.
- → After accounting for all costs of implementation, the policy was anticipated to be cost saving for the healthcare system, with estimated net savings of $13.6 billion over one year and $185.1 billion over 10 years.
- → By payer subsets, one-year possible policy cost savings were estimated at $3.0 billion for private payers, $3.3 billion for Medicare, $1.6 billion for Medicaid, and $5.7 billion for dual-eligible individuals (both Medicare and Medicaid).
- → Including the additional criterion of food insecurity, the number of eligible patients was reduced to 1.9 million, and net savings reduced to $5.5 billion.
- → Few — if any — other interventions in healthcare are both cost saving and cost effective. For example, vaccines[37] and contraception[38] are found to be cost saving, however, other such preventative interventions like blood pressure screening and control, cholesterol screening and control, and cancer screening do not save money despite being highly cost effective.[39] In contrast, MTMs are estimated to gain health and save money — a rare outcome in medical care.

The results of this case study suggest that national MTM coverage will both improve health and be net cost saving when appropriately targeted. These findings may inform state, federal, and private payers in implementing Food is Medicine interventions such as MTMs to address diet-related chronic illness and health inequities in the United States.

CASE STUDY 2

Produce Prescription Programs: Health and Economic Impacts

BACKGROUND

In quasi-experimental intervention studies, produce prescriptions have been shown to be effective in improving food security, nutritional quality, and health outcomes including blood sugar, body weight, and blood pressure.[26,40] The potential impact of implementing produce prescription programs on long-term health gains, costs, and cost effectiveness in the United States has not been established. The objective of this case study was to estimate the potential impacts on cardiovascular disease (CVD), quality-adjusted life-years (QALYs), health-related cost, and cost effectiveness of implementing healthcare produce prescription programs for U.S. adults with diabetes and food insecurity.

For this case study, a validated microsimulation model, the DOC-M (the Diabetes, Obesity, Cardiovascular Disease Microsimulation Model),[41] was used to estimate the long-term health and economic impacts and cost effectiveness of implementing produce prescriptions nationally for U.S. adults aged 40-79 years with diabetes and food insecurity. The model was populated with nationally representative eligible individuals from the National Health and Nutrition Examination Survey (NHANES) cycles 2013-2018, and further incorporated evidence on nationally representative demographics, health related risk factors, mortality, the effectiveness of produce prescription programs in improving diet, BMI, and hemoglobin A1c (HbA1c) estimated from meta-analysis, and the association of diet, BMI, and HbA1c with diet-related diseases risks and healthcare costs.[41] The included population represents 6.5 million non-institutionalized U.S. adults ages 40-79 years with diabetes (i.e., self-reported diabetes or any one of the following four clinical criteria: fasting glucose ≥126 mg/dL, 2-hour plasma glucose ≥200 mg/dL, HbA1c ≥6.5%, or using medication for diabetes) and food insecurity (self reported using the U.S. Food Security Survey Module collected in NHANES questionnaires).[42] By comparing the identical population with and without produce prescription receipt, the model calculates the incremental changes in health and costs of implementing the policy versus no policy over a lifetime horizon and at shorter-term horizons of 5 years and 10 years.

The model assumed continuing enrollment in the intervention each year, with stable intervention effects over time, and conservatively assumed that all health benefits would end (i.e., no persistent benefits) if an individual were to stop receiving produce prescriptions.

Model outputs include first and recurrent CVD events, QALYs, and healthcare expenditures and policy costs. To explore potential impacts on health equity, stratified analyses were performed by baseline age (40-64, 65+ years), sex as a biological variable, race/ethnicity (non-Hispanic White, non-Hispanic Black, Hispanic, other), education (less than high school, high school diploma/GED, some college or above), income (family income to poverty ratio <1.3, 1.3-2.99, 3.0+) and baseline insurance coverage status (Medicare, Medicaid, dual eligible, private insurance, or no insurance coverage).

The researchers estimated the potential impacts on CVD, QALYs, health-related cost, and cost effectiveness of implementing healthcare produce prescription programs. Produce prescription programs have emerged as a promising Food is Medicine health system strategy to improve nutrition, health outcomes, and health disparities in high-risk patients with nutrition-sensitive conditions, especially diabetes.[43] The model and findings described below suggest that implementing produce prescriptions among U.S. adults with diabetes and food insecurity would generate substantial health gains and be highly cost effective.

Who was eligible to participate in the program?

It was estimated, based on national data, that 6.5 million U.S. adults met eligibility criteria (ages 40-79 years at baseline and having both diabetes and food insecurity).

The average baseline age was 58.2 years, fewer than half (43.1%) were non-Hispanic White adults, nearly two-thirds (63.0%) had a high school education or less, and more than half (56.6%) had a family income to poverty ratio lower than 1.3. Most were covered by Medicare (39.4%) at the baseline, which include those on Medicare only (26.9%) and dual eligible (12.5%), followed by private payers (29.4%) and Medicaid (26.9%). About 16.5% had no insurance coverage at baseline. Nearly 1 in 3 (30.0%) had baseline prevalent CVD, average BMI was 33.6 kg/m^2, and average HbA1c was 7.3%. Baseline average daily consumption of fruits was 0.86 servings; and vegetables, 1.30 servings.

What was the intervention?

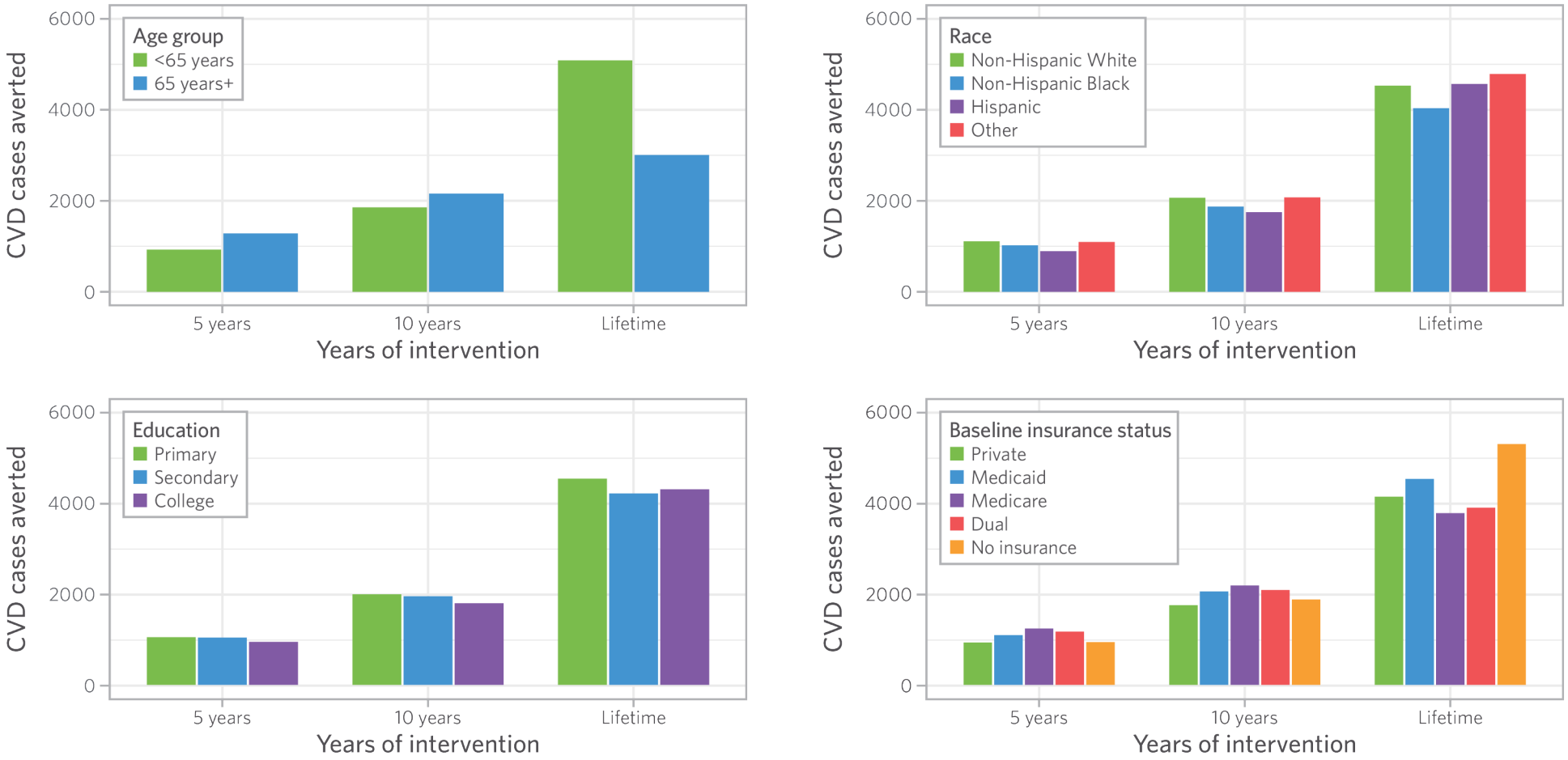
Eligible patients received a monthly electronic voucher (e.g., debit card) to purchase fruits and vegetables from major retail locations. Based on a pooled analysis of 20 produce prescription intervention studies, an average of $42/month was offered; after subtracting unused vouchers, patients redeemed an average of $32/month (adjusted to 2021 dollars). Based on random effects meta-analysis of the 20 intervention studies, the produce prescription programs increased average fruit and vegetable consumption by 0.80 servings/day (95% CI: 0.45 to 1.15), reduced BMI by 0.36 kg/m^2 (95% CI: 0.16 to 0.55), and reduced HbA1c by 0.63% (95% CI: 0.28 to 0.98). The modeled national intervention included similar educational and administrative components as other existing national programs like WIC and SNAP, including for personnel and training, eligibility certification, quality control, use of an electronic voucher system or food delivery, nutrition education, benefit and retailer redemption and monitoring, and program evaluation.

What was the impact on health outcomes?

The simulation model projected that national implementation of produce prescriptions would prevent 292,000 CVD events and generate 260,000 additional QALYs over a lifetime. At 5 years, the intervention would prevent 66,900 CVD events and at 10 years, 126,000 CVD events.

Over a lifetime, the national produce prescription program averted more CVD cases and saved more QALYs and healthcare costs per 100,000 patients among those who were younger (<65 years) at baseline compared with those who were older (65+ years); and among non-Hispanic Black and Hispanic patients compared with non-Hispanic White patients and other race/ethnicities [Figure 6].

FIGURE 6: Number of CVD Cases Averted per 100,000 Patients by Produce Prescriptions Nationally for Adults with Diabetes and Food Insecurity, by Population Subgroups at 5 years, 10 years, and Lifetime



Note: Vertical bars represent the mean number of CVD cases (or first-time CVD events) averted by produce prescriptions per 100,000 patients estimated from 1,000 Monte-Carlo simulations using the DOC-M model, by comparing the same population (diabetes patients with food insecurity) with and without implementation of produce prescriptions. Uncertainties around each estimate are presented in eTables F2-F5.

Abbreviations: CVD: cardiovascular disease; HIS: Hispanics; NHB: non-Hispanic Black; NHW: non-Hispanic Whites; Other includes all other racial/ethnic groups that are not HIS, NHB, NHW.

Figure adapted with permission from Wang L, Lauren BN, Hager K, et al. Health and economic impacts of implementing produce prescription programs for diabetes in the United States: A microsimulation study. *J Am Heart Assoc.* 2023;e029215. doi:10.1161/JAHA.122.029215

By payer, the most lifetime CVD cases per 100,000 were averted in patients with no insurance coverage at baseline, followed by those covered by Medicaid or private insurance at baseline. With shorter time horizons of 5 years and 10 years, more CVD cases were averted per 100,000 adults among those who were older (aged 65+ years) than younger, and among non-Hispanic Black and Hispanic patients than patients with non-Hispanic White and other racial/ethnic backgrounds. The program achieved similar health benefits per 100,000 patients among those with different education levels, at all time horizons.

What was the impact on cost/cost effectiveness over time?

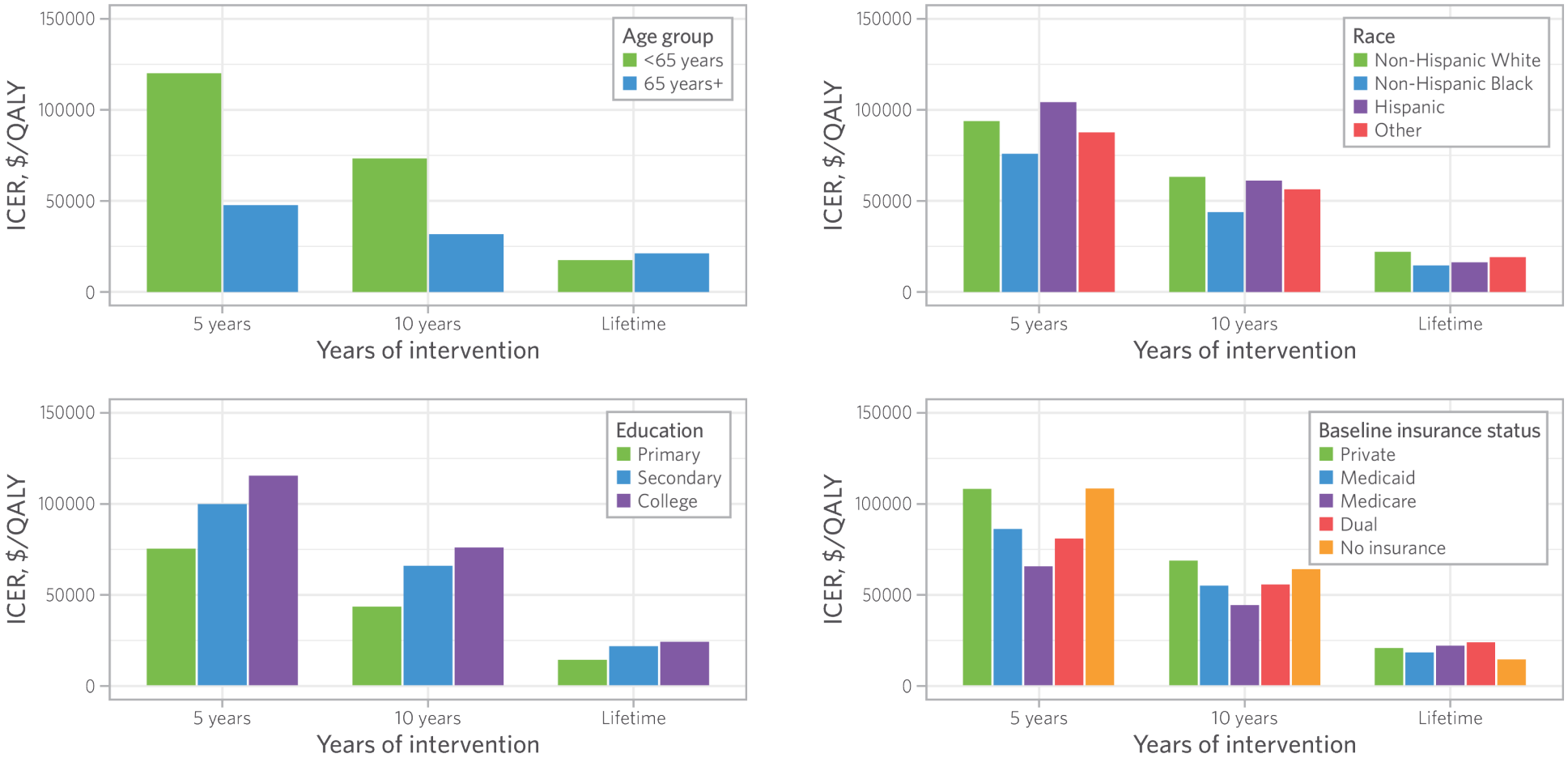
Over a lifetime, produce prescriptions were estimated to cost $37.3 billion in food costs and $6.99 billion in administrative costs. The intervention would save an estimated $39.6 billion in formal healthcare expenditures and $4.77 billion in productivity costs. The program was highly cost effective from a healthcare perspective with an incremental cost-effectiveness ratio (ICER) of $18,100/QALY, and cost saving from societal perspectives, with net savings of $0.05 billion. The probability of net cost effectiveness was 98.4% and 98.9% from a healthcare and societal perspective, respectively, when evaluated at a $150,000 willingness-to-pay threshold, and 74.4% and 84.6%, respectively, when evaluated at the $50,000 willingness-to-pay threshold. The intervention was also cost effective at shorter time horizons, with ICERs of $92,700/QALY at 5 years and $58,000/QALY at 10 years from the healthcare perspective; and corresponding ICERs of $66,100/QALY and $28,700/QALY from the societal perspective.

The program was cost effective over a lifetime of intervention among all population subgroups by age, race/ethnicity, education, and baseline insurance payer [Figure 7] with similar ICERs achieved.

With shorter time horizons of 5 years and 10 years, a lower ICER (i.e., greater cost effectiveness) was observed for older (65+ years) vs. younger patients, and among those covered by Medicare only or Medicaid only versus those covered by private payers or uninsured at the baseline.

The program was cost effective or cost saving over a lifetime when varying administrative costs to be a lower or higher percentage of the total program costs than the base case, or assuming a smaller percentage of eligible patients would participate in the program each year. Threshold analyses suggested that the program would be cost effective at lifetime until the per patient intervention cost exceeded $55.6 per month in total redemptions and administrative costs.

FIGURE 7: Estimated Cost Effectiveness of Produce Prescriptions Nationally for Adults with Diabetes and Food Insecurity, by Population Subgroups at 5 years, 10 years, and Lifetime



Note: Bars represent the ICER for implementing produce prescriptions among U.S. adults with diabetes and food insecurity, from a healthcare perspective, calculated as the estimated mean net change in costs (intervention costs minus health-related cost savings) divided by the mean net change in QALYs. The DOC-M model was used to project the health and economic outcomes for the same population with and without implementing produce prescriptions, based on 1,000 Monte-Carlo simulations.

Abbreviations: ICER: Incremental cost-effective ratio. HIS: Hispanics; NHB: non-Hispanic Blacks; NHW: non-Hispanic Whites; Other includes all other racial/ethnic groups that are not HIS, NHB, NHW.

Figure adapted with permission from Wang L, Lauren BN, Hager K, et al. Health and economic impacts of implementing produce prescription programs for diabetes in the United States: A microsimulation study. *J Am Heart Assoc.* 2023;e029215. doi:10.1161/JAHA.122.029215

What are the key takeaways from this case study of Produce Prescription Programs?

- → National coverage of produce prescriptions (average monthly voucher or food boxes of $42 per patient or $504/year) for patients with diabetes and food insecurity was estimated to produce meaningful reductions in CVD events and healthcare expenditures.
- → Among 6.5 million eligible recipients, provision of produce prescriptions over a lifetime would prevent 292,000 CVD events and generate 260,000 QALYs. By payer, the most lifetime CVD cases per 100,000 were averted in patients with no insurance coverage at baseline, followed by those covered by Medicaid or private insurance at baseline.
- → There was an estimated $44.3 billion in programs costs and an estimated savings of $39.6 billion in healthcare costs and $4.77 billion in productivity costs over a lifetime.
- → The program was highly cost effective from a healthcare perspective (incremental cost-effectiveness ratio: $18,100/QALY) and cost saving from a societal perspective (net savings: $0.05 billion). The intervention remained cost effective at shorter time horizons of 5 and 10 years. Results were similar in population subgroups by age, race/ethnicity, education, and baseline insurance status.
- → Compared to modern weight loss medications, produce prescriptions are much more cost effective. The estimated ICER for weight loss medications is about $200,000/QALY, which equates to more than ten times higher cost per health gained than produce prescriptions.

This case study suggests that implementing produce prescriptions nationally for patients with diabetes and food insecurity could improve health, reduce healthcare costs, and be highly cost effective in the United States. Findings support the testing, scaling, and evaluation of produce prescription programs for patients with diabetes and food insecurity for both public and private payers; with a focus on ensuring access to those with greatest need.

LOOKING AHEAD:

Implications for Policy and Future Research

Policy Relevance and Implications

These two case studies of medically tailored meals and produce prescriptions suggest that Food is Medicine interventions scaled to a national level in the United States would not only improve health and be highly cost effective, but also serve as a cost saving intervention in the healthcare setting for addressing diet-related chronic illness and health inequities.

This is a rare outcome in medical care as few — if any — other interventions in healthcare are both cost effective and cost saving. Based on this evidence, it is time to change the status quo of U.S. healthcare by placing a stronger emphasis on providing healthy food as a tool for treating chronic disease and adding Food is Medicine interventions to the toolbox for treating patients. Additionally, scaling Food is Medicine interventions is critical in achieving the Biden-Harris Administration's National Strategy on Hunger, Nutrition, and Health goal to reduce diet-related disease by 2030.

The case study findings show that national coverage of MTMs and produce prescriptions would result in improved health and have meaningful, positive economic impacts, which mirrors findings from previous studies. Prior observational studies and pilot randomized clinical trials of MTM interventions found that patients receiving MTMs experienced better disease management and had fewer hospitalizations, emergency department admissions, nursing home visits, and lower health care expenditures compared with similar control patients.[29,30,31,32,33,34] Further, compared with no receipt of MTMs, MTM receipt has been associated with a 37% to 52% lower risk of hospitalization, 16% to 31% reduction in monthly health care expenditures, and decreased net costs of approximately 2,500 per patient-year after paying for meal costs.[29,30,31,32]

A 2021 systematic review and meta-analysis of 13 predominantly U.S.-based produce prescription interventions found that fruit and vegetable consumption increased by 0.8 servings per day, BMI decreased by 0.6 kg/m^2, and HbA1c decreased by 0.8 points among patients with diabetes.[26] In comparison, a pooled, patient-level analysis of nine other produce prescription programs across 22 sites in 12 states demonstrated similar health gains among people with increased risk for cardiovascular disease.[40] A 2023 systematic review and meta-analysis evaluated FIM interventions in low-income or food-insecure populations with prediabetes or diabetes and concluded that FIM interventions effectively increase fruit and vegetable intake and reduce HbA1c.[44]

Despite these proven and estimated benefits to patients, healthcare systems, and the economy, FIM interventions are not universally available to health care providers as a prescribable intervention, nor to patients as a covered intervention. Given this, FIM is largely unavailable to those individuals who might benefit. For example, medically tailored meals are not currently a covered benefit in Medicaid or Medicare and the availability in federal programs is dependent on whether regulatory flexibility or other special circumstances permit their inclusion and, if permitted, whether participating private health care entities choose to cover them.[45,46] Access to FIM programs is generally provided by community-based organizations supported by grants, donations, and other funding from home health care services benefits, Medicare Advantage programs, or state Section 1115 waivers that allow coverage.[43] The Gus Schumacher Nutrition Incentive Program (GusNIP), a federally funded program established in 2019 that issues grants for conducting and evaluating programs that provide nutrition incentives and produce prescriptions, is one avenue for accessing produce prescriptions.[47]

Several policy solutions will facilitate and leverage the potential of FIM interventions to improve health and health equity while achieving cost savings or high cost effectiveness for Americans across the nation:

Develop Infrastructure

- The U.S. Department of Health and Human Services (HHS) Office of Inspector General (OIG) could establish a flexible anti-kickback statute safe harbor specifically for FIM initiatives or at a minimum clarify the circumstances in which OIG would not impose any sanctions on a FIM initiative.
- The National Institutes of Health (NIH) Office of Nutrition Research (ONR) could proceed to develop, with appropriate resources, a comprehensive set of Food is Medicine Networks or Centers of Excellence.
- The Centers for Medicare and Medicaid Services (CMS) and HHS could continue to support efforts to develop the data infrastructure needed for food and nutrition insecurity to be captured in electronic health records and ensure interoperable health information exchange and the collection of demographic information.
- Healthcare, advocacy, and policy stakeholders could ensure nutrition education for doctors and other providers throughout their training and practice, including through reform of accreditation requirements, medical licensing exams, specialty certification exams, continuing medical education requirements, and nutrition-focused research fellowships and postdoctoral programs.

Generate Opportunities and Funding

- Pilot programs could be conducted to provide eligible individuals with MTMs and produce prescriptions through Medicaid, Medicare, the Department of Veterans Affairs, the Department of Defense, and Indian Health Service.
- States could apply for and CMS could approve Section 1115 waivers that allow Medicaid programs to test and scale FIM initiatives.
- HHS and CMS could convene private health insurance payers and providers to collaborate on ways to include FIM programs within private health insurance plans.

Expand USDA Nutrition Programs

- The Supplemental Nutrition Assistance Program (SNAP) has been successful in reducing food insecurity, but must be leveraged more effectively to reduce nutrition insecurity. Effective interventions include regular analysis and reporting on SNAP purchasing nationally; expansion of the successful Gus Schumacher Nutrition Incentive Program (GusNIP), including in online retail; and encouragement of innovative state pilots to test new approaches to jointly advance food and nutrition security.
- The GusNIP nutrition incentive and produce prescription programs could be expanded to reach additional SNAP participants. For example, the non-federal matching requirement could be decreased or eliminated for grantees in lower-resourced communities to encourage additional participation. In addition, GusNIP's current $500,000 limit per grant award could be increased to at least $1 million in order to sustain larger-scale projects and robust evaluations.

Future Research Needs

Based on these case studies and existing evidence, continued research and evaluation on FIM interventions are needed to further clarify and identify optimal participant selection and intervention design. Examples include research and evaluation on:

- Specific implementation factors and patient characteristics that might influence efficacy and costs.
- Potential additional benefits on other outcomes such as patient-related quality of life, disease progression, caregiver well-being, and population-level health equity.
- Potential health and economic benefits for family members/households of enrolled patients.
- Potential economic benefits for local, regional, and national farms, retailers, and related supply chain stakeholders.
- Potential for integration of FIM programs with other procurement priorities, such as support for small and mid-sized farms, local and regional production, regenerative and organic agricultural practices, fair labor practices, and food sector ownership from traditionally marginalized populations.
- Process and engagement metrics critical for translating research results into policy and practice such as intensity, duration, access mechanism, and adherence and participation levels.[48]
- Datasets that could be made public by CMS on the utilization of Medicare Part C coverage of FIM programs under the Special Supplemental Benefits for the Chronically Ill, such as amounts spent on FIM treatments, types of treatments, geographic reach, and types and numbers of patients served.
- Payers' experiences in implementation, identification of barriers to expansion of these benefits, and patient experiences.

Conclusions

Food is Medicine interventions have emerged as a highly promising strategy for changing the status quo of U.S. healthcare by placing a stronger emphasis on providing nourishing food as a specific intervention for treating and preventing diet-related chronic disease. This report highlights the findings from two "True Cost of Food" case studies that evaluated the health and economic impacts of scaling medically tailored meals and produce prescriptions nationally.

The case study on medically tailored meals found that national implementation could result in 1.6 million averted hospitalizations and a net cost savings of $13.6 billion annually. The case study on produce prescriptions found that national implementation for patients with diabetes and food insecurity could result in 292,000 averted cardiovascular events, with high value cost effectiveness compared to other well-established medical interventions. These case studies support the need for additional investments in evaluation as well as policy solutions to implement and evaluate these FIM programs more broadly for all Americans.

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Case Study 1 – Medically Tailored Meals: Hospitalizations and Health Care Expenditures

This case study is based on findings from the paper, *Association of National Expansion of Insurance Coverage of Medically Tailored Meals With Estimated Hospitalizations and Health Care Expenditures in the US*, published in *JAMA Network Open* in October 2022. The research was supported by grant 2R01HL115189-06A1 from the National Heart, Lung, and Blood Institute, NIH (Dr Hager, Dr Cudhea, Dr Wong, Mrs Downer, Ms Lauren, and Dr Mozaffarian), by the Horowitz Foundation for Social Policy (Mr Hager), and by grant K23DK109200 from the National Institute of Diabetes and Digestive and Kidney Diseases, NIH (Dr Berkowitz). The funders had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Case Study 2 – Produce Prescription Programs: Health and Economic Impacts

This case study is based on findings from the paper, *Health and Economic Impacts of Implementing Produce Prescription Programs for Diabetes in the United States: A Microsimulation Study*, published in the *Journal of the American Heart Association* in July 2023. The research was supported by the National Institutes of Health and the National Heart, Lung, and Blood Institute (2R01HL115189-06A1; PI, Dariush Mozaffarian). The funding agency did not contribute to the design or conduct of the study; collection, management, analysis, or interpretation of the data; preparation, review, or approval of the manuscript; or the decision to submit the manuscript for publication.

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meats
HEALTHY FOOD
vegetables & flour
sweets
fruits
What share of each food group should I be eating for a healthy diet?
Protein
Dairy
THIS WEEK'S MEALS

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