



# Produce Prescription Programs

Health Impacts of Fruit and Vegetable Consumption

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## Introduction

Despite growing evidence of the health benefits of fruit and vegetable consumption, only about 12 percent of adults in the United States consume the Centers for Disease Control and Prevention's (CDC) minimum recommended amount of fruits (one and a half to two cups per day), and only 9 percent consume the recommended amount of vegetables (two to three cups per day) (CDC Newsroom 2017). Produce Prescription Programs are one potential solution to increase fruit and vegetable consumption, especially among low-income populations suffering from chronic health conditions.

The Michigan Farmers Market Association partnered with Public Sector Consultants to identify the potential health impacts and healthcare cost savings of Produce Prescription Programs in Michigan. This paper is part of that research and examines the health impacts of fruit and vegetable consumption, potential healthcare cost savings from adequate consumption, the barriers to and possible cost benefits of increasing consumption, and the possible impact of Produce Prescription Programs on fruit and vegetable consumption and overall health. A list of key terms and phrases used in conducting this research is included in Appendix A.

## Healthcare Costs of Chronic Diseases

Chronic diseases are among the most prevalent and costly in the United States, with the CDC reporting that 60 percent of adults in the U.S. have at least one chronic disease and 40 percent have two or more chronic diseases (CDC n.d.a). Among the costliest of these are cardiovascular disease, including heart disease and stroke; diabetes; cancer; and obesity (CDC n.d.a). All of these, with the exception of obesity, are also among the country's leading causes of death (CDC n.d.b). In addition, low-income individuals have a higher rate of chronic disease than those with higher income (HealthyPeople.gov n.d.; Oates et al. 2017; Shaw et. al. 2016). This may be caused by increased exposure to risk factors and limited access to quality food, housing, and healthcare (Cunningham 2018).

These often preventable or controllable chronic conditions cost billions of dollars annually to treat. For example:

- The estimated annual cost of cardio metabolic diseases associated with an unhealthy diet for adults age 35–85 in the U.S. is \$50.4 billion dollars (Jardim et al. 2019).
- Ninety percent of the U.S.'s \$3.5 trillion annual healthcare expenditures go to treat chronic diseases and mental health conditions (CDC n.d.b).
- Estimated annual healthcare costs to treat some of the costlier chronic conditions are:
  - Diabetes: \$237 billion
  - Heart disease and stroke: \$199 billion
  - Cancer: \$174 billion
  - Depressive disorders: \$71 billion (CDC n.d.b); (American Diabetes Association 2018; Winerman 2017).
- Obesity is estimated to cost U.S. healthcare systems \$147 billion a year (CDC n.d.b).

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**Ninety percent of the U.S.'s \$3.5 trillion annual healthcare expenditures go to treat chronic diseases and mental health conditions that can be prevented or improved by increased produce consumption.**

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Adequate or increased fruit and vegetable consumption has been shown to prevent or improve these conditions (CDC Newsroom 2017). Therefore, increasing consumption of fruits and vegetables among those with chronic disease could also lead to significant healthcare cost savings and should be prioritized among policymakers and healthcare payers.

## Protective Effects of Fruit and Vegetable Consumption



“Poor diet quality is a leading and preventable cause of adverse health globally, which includes both maternal and child health ... and non-communicable diseases” (Miller et al. 2020).

Adequate fruit and vegetable consumption has a wide range of health benefits. Research has shown that potential benefits include reducing the risk of many chronic diseases, reducing the severity of asthma and chronic obstructive pulmonary disease (COPD), improving gastrointestinal health, promoting healthy aging and contributing to higher bone density, and improving mental health and decreasing the risk of depression (Dreher 2018; Zhao et al. 2011; Hu et al. 2014; Saghafian et al. 2018).

## Obesity

Obesity is associated with many chronic diseases, including type 2 diabetes and hypertension, and with gastrointestinal disorders, joint and muscle disorders, respiratory problems, and psychological disorders (Dąbrowska et al. 2020). Studies have shown that increasing servings of certain types of fruits and vegetables can, over time, reduce the risk of obesity, promote modest weight loss, and help with weight loss management (Dreher 2018, Schwingshackl et al. 2015).

## Cardiovascular Disease

Cardiovascular disease refers to a number of conditions, including heart disease and stroke. Hypertension (high blood pressure) and hypertriglyceridemia (elevated plasma triglyceride levels) are strong risk

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**Increasing produce consumption from less than 0.5 cup/day to greater than 1.5 cups/day could save \$1,568 per person per year in cardiovascular disease treatment costs (Zhang et al. 2017).**

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factors for cardiovascular disease. A diet high in fruit and vegetable consumption has been shown to lower the risk of coronary heart disease and stroke and reduce both blood pressure and blood triglyceride levels (Bhupathiraju and Tucker 2011; Houston et al. 2018; Zhao et al. 2011; Yuan et al. 2015; Hu et al. 2014; ). Additionally, a systemic review and dose-response meta-analysis of prospective cohort studies showed that a high consumption of fruits and vegetables lowered the risk of cardiovascular mortality (Wang et al. 2014).

## Diabetes

Millions of Americans have type 2 diabetes, which can lead to many complications, including heart disease, kidney disease, and blindness (CDC n.d.b). Diet plays an important role in reducing the risk of and the management of diabetes. Higher fruit or vegetable intake (particularly green leafy vegetables) and low glycemic index foods, such as fiber-containing whole fruit, can reduce the risk of and help with the management of type 2 diabetes (Li et al. 2014; Dreher 2018).

## Cancer

The American Cancer Society (ACS) recommends eating two and a half to three cups of vegetables and one and a half to two cups of fruit a day in order to reduce the risk of cancer (ACS n.d). Studies have shown that adequate fruit and vegetable intake can decrease the risk of certain types of cancer, including breast cancer and lung cancer (Li et al. 2017; Farvid et al. 2019; Wang et al. 2015). Additionally, a diet high in fruits and vegetables can play a role in lessening the effects of cancer and cancer treatment (Pekmezi and Demark-Wahnefried 2011).

## Depression

In addition to reducing the risk of many chronic diseases, adequate fruit and vegetable consumption has been shown to improve mental health, including depression. Major depression is one of the most common mental disorders in the U.S., affecting more than 17 million adult Americans in 2017, and studies have shown that fruit and vegetable intake is a protective factor against depression (National Institute of Mental Health n.d.; Saghafian et al. 2018).

## Increasing Fruit and Vegetable Consumption

Many Americans face numerous barriers to accessing high quality, affordable produce, which may limit their fruit and vegetable consumption. Research suggests that financial incentive programs are a cost-effective means to remove some of these barriers, potentially leading to increased produce consumption.

## Barriers to Adequate Fruit and Vegetable Consumption

Many vulnerable populations with chronic health conditions experience barriers when it comes to consuming an adequate amount of fruits and vegetables. According to one focus group study, these barriers include cost, transportation, lack of variety and/or quality of available fruits and vegetables, a changing food environment with decreasing access to farm-fresh produce and increasing fast-food restaurant availability, and changing societal norms that place less emphasis on cooking and more on convenience (Haynes-Maslow et al. 2013). The authors encouraged policymakers to support programs that address these barriers in low-income communities. One of the primary barriers is cost. “That healthier diets cost more than unhealthy diets is well-established in the literature” (Darmon and Drewnowski 2015, Rao et al. 2013). Poorer diets and health among low-income households is due, in part, to the higher per-calorie cost of nutrient-rich foods such as fruits and vegetables (Darmon and Drewnowski 2015). According to the U.S. Department of Agriculture Economic Research Service (USDA ERS), low-income American households spend a large proportion of their income on food. In 2018, those Americans with income in the lowest 20 percent spent 35.1 percent of their household income on food,

compared to only 8.2 percent of household income by those with income in the highest 20 percent (USDA ERS 2020). Nonetheless, lower-income households' food budgets are insufficient to ensure access to a healthy diet (Darmon and Drewnowski 2015).

## Financial Incentive Programs to Increase Fruit and Vegetable Consumption

Given the benefits of adequate fruit and vegetable consumption and the potential for significant healthcare cost savings, programs that strive to increase fruit and vegetable consumption for those with chronic conditions should be encouraged and supported. Several studies have shown that incentivizing the purchase of fruits and vegetables increases consumption (An 2013; Verghese, Raber, and Sharma 2019).

An example of a financial incentive program that significantly increased fruit and vegetable consumption among participants was the Philly Food Bucks program in Philadelphia, Pennsylvania. Between 2010 and 2011, two-dollar food coupons were distributed at farmers markets when people used their Supplemental Nutrition Assistance Program (SNAP) benefits and by community organizations that serve SNAP-eligible populations. These coupons were redeemable at farmers markets, which predominately offer healthy food and are increasingly located in low-income areas. Participants increased their fruit and vegetable consumption and were more likely than nonparticipants to try new fruits and vegetables (Young et al. 2013).

Another study provided low-income participants in Philadelphia a 50 percent rebate on purchases of fresh and frozen fruits and vegetables. Incentivized families purchased eight more servings of vegetables and two and a half more servings of fruits per week than the study's control group (Phipps et al. 2015). Another study found that SNAP households that received a 30 percent rebate on targeted fruit and vegetable purchases significantly increased their intake of both targeted and all fruits and vegetables by 0.24 cups and 0.32 cups per day respectively, closing around 20 percent of the gap between recommendations and increasing dietary quality (Olsho et al. 2016).

### Cost-benefit Analysis of Financial Incentive Programs

Although financial incentives have proven successful in increasing the consumption of fruits and vegetables among study participants, such incentives can be costly, making cost-effectiveness studies of these types of programs important. Studies have shown that programs designed to increase fruit and vegetable consumption can be cost effective because a healthier diet leads to less incidence of chronic disease and lower healthcare costs. Because type 2 diabetes and cardiovascular disease are among the costliest diseases in the U.S., several of these studies focus on these chronic diseases.

For example, one microsimulation study of current Medicare and Medicaid participants showed that over a lifetime, a 30 percent subsidy on fruits and vegetables would prevent 1.93 million cardiovascular disease events and 350,000 cardiovascular deaths, gain 4.64 million quality-adjusted life years (QALYs)—a generic measure of disease burden including both the quality and quantity of life—and save \$40 billion in formal healthcare costs, making financial incentive programs highly cost effective (Lee et al. 2019). Another microsimulation study of SNAP participants showed that a 30 percent incentive for fruits and vegetables over five years would prevent almost 39,000

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**Produce incentive programs offer significant health benefits for the millions of Michiganders participating in Medicaid and Medicare.**

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cardiovascular disease events, gain close to 19,000 QALYs, and save \$1.21 billion in healthcare costs. This program would achieve cost-effectiveness over the study cohort's lifetime (Mozaffarian et al. 2018). According to the Centers for Medicare & Medicaid Services (CMS), over 2.4 million people in Michigan are enrolled in Medicaid and more than 2 million additional people are enrolled in Medicare (CMS n.d.a; CMS n.d.b). Given these numbers, the potential for healthcare cost savings in the state could be substantial.

According to another cost-effect analysis, subsidizing fruit and vegetables purchases by 30 percent over an individual's lifetime would be expected to reduce incidence of type 2 diabetes by 1.7 percent, myocardial

## \$721.3 Million Saved

**Subsidizing Michigan SNAP participants' produce purchases by 30 percent would result in lifetime savings of \$721.3 million due to averted type 2 diabetes costs alone.**

Calculated based on \$952 saved per adult SNAP participant over a simulated life course from Choi, Seligman, and Basu's 2017 study and using data on adult SNAP participation from the Michigan Department of Health and Human Services October 2020 report.

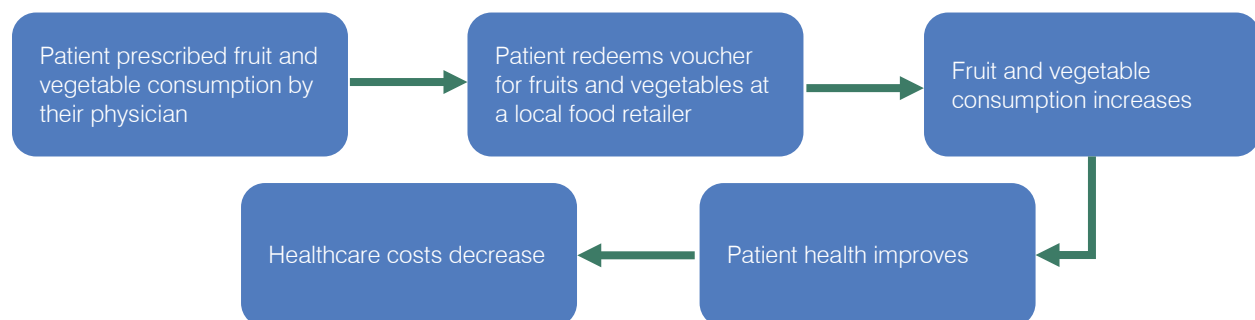
infarction by 1.4 percent, and stroke by 1.2 percent, leading to cost savings largely attributable to long-term reductions in these diseases—savings that may not be evident in short-term trials (Choi, Seligman, and Basu 2017). Moreover, a 2017 review of preventable medical costs of cardiovascular disease described a cohort study that showed increasing the consumption of fruits and vegetables from less than half a cup to more than one and a half cups per day could save nearly \$1,600 per person per year in treatment costs (Zhang et al. 2017).

Since obesity is a risk factor in many chronic diseases, reducing obesity could also have significant cost-savings benefits. One study found that obesity prevention interventions, including fiscal measures, could have had the potential to decrease healthcare expenditures by \$2 billion in 2010 (Cecchini and Sassi 2015).

## Produce Prescription Programs

Produce Prescription Programs are one type of financial incentive program that could help address barriers to accessing fruits and vegetables, increase fruit and vegetable consumption, and improve health. By doing so, Produce Prescription Programs could help avoid significant healthcare costs.

**EXHIBIT 1. Process Flow and Possible Benefits of a Produce Prescription Program**







The Produce Prescription is most often a voucher or coupon that can be redeemed at specified local retail locations, such as farmers markets. These programs differ from other fruit and vegetable incentive programs (e.g., SNAP incentive programs) because they involve a healthcare professional who identifies patients who would benefit from increased produce consumption (Hennessee 2020). This is significant because studies have shown that advice from healthcare providers can be motivation for sustained behavior change (Kreuter, Chheda, and Bull 2000).

## Existing Programs and Outcomes

The 2018 Farm Bill included funding for pilot Produce Prescription Programs, up to \$25 million over five years as a part of the \$250 million dedicated to the Gus Schumacher Nutrition Incentives Program (Hennessee 2020). Many communities across the U.S. had already established Produce Prescription Programs prior to that funding becoming available. Below are examples of some of those programs and the impact they have had on their communities.

### **Capital Roots and the Whitney M. Young, Jr. Health Center, Albany, New York**

The Veggie Rx program began issuing weekly seven-dollar produce coupons in December 2011 to patients who were obese, hypertensive, and/or diabetic. A retrospective case-controlled study design was used to evaluate the program and statistically significant pre- and postintervention differences in BMI were observed for program participants (Cavanagh et al. 2017).

## **PRxHTN, Cuyahoga County, Ohio**

In 2015, Health Improvement Partnership-Cuyahoga (HIP-Cuyahoga) implemented the Produce Prescription for Hypertension Program (PRxHTN) in the county to evaluate the impact of Produce Prescriptions on hypertension. Participation in the program included three monthly nonphysician provider visits to measure blood pressure, provide nutrition counseling, and provide four ten-dollar farmers market produce vouchers to hypertensive adult patients screening positive for food insecurity. A subset of participants completed a follow-up survey, which showed significant improvement in fruit and vegetable consumption after program participation (Trapl et al. 2018). In 2017, more than 550 residents with high blood pressure received chronic disease management education and vouchers for no-cost fruits and vegetables through the PRxHTN program (HIP-Chuyahoga n.d).

## **RP Rx, North Carolina**

Reinvestment Partners (RP) developed a Produce Prescription Program called RP Rx that has streamlined the prescribing process for providers and made access to shopping for produce easy for participants. Established in 2018, RP Rx has an online enrollment portal where providers can easily enter patient information so that patients can receive \$40 each month to purchase Woman, Infants, and Children nutrition program–approved fruits and vegetables at over 500 Food Lion stores across North Carolina. As of January 2020, RP Rx has worked with providers at 17 clinics in 38 counties, serving 1,350 patients (RP n.d).

## **Wholesome Wave**

Wholesome Wave initiated Produce Prescription Programs in ten states between 2011 and 2015. In 2014 an evaluation of the New York City program showed a 70 percent increase in fruit and vegetable consumption during program participation in New York City alone. Of the 94 patients who completed the initiative, over 40 percent decreased their BMI (Chimbetete et al. 2016). In 2018, 653 people participated in Georgia and were provided with \$58,400 in produce vouchers. Program participation led to an increase in fruit and vegetable consumption and was associated with statistically significant reductions in BMI and diastolic blood pressure (Hennessee 2020).

## **Michigan Programs**

Michigan has at least sixteen known Produce Prescription Programs. Of these, the Fresh Prescription Program in Detroit has been operating for several years and has conducted evaluations that have shown positive impacts.

### **Fresh Prescription Program: Recipe for a Healthy Detroit**

This program began in Detroit in 2013 and grew over the next several years to include an increasing number of sites and partners. In 2015, Fresh Prescription Program participants with uncontrolled type 2 diabetes took part in an evaluation to determine if participation in the program would improve their hemoglobin A1C—a measure of

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**As a result of the Fresh Prescription Program, 93 percent of participants reported better managing their chronic health conditions and 88 percent reported eating more fruits and vegetables each day (Fresh Prescription n.d).**

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**By expanding participation in Produce Prescription Programs among Michigan's 2.4 million Medicaid and additional 2 million Medicare participants, Michigan could realize considerable health benefits and cost savings.**

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average blood sugar levels over two to three months. Sixty-five eligible participants were given ten dollars per week for up to four weeks to purchase produce from a Federally Qualified Health Center (FQHC) at a specific farmers market. Hemoglobin A1C, blood pressure, and weight were collected from participants within three months of program start and within three months of program completion. The study found a statistically significant decrease in hemoglobin A1C pre- and poststudy (Bryce et al. 2107). Additionally, in 2016, participants in the Fresh Prescription Program reported

significant improvements in health status, with 93 percent reporting they better managed their chronic health conditions and 88 percent reporting that they ate more fruits and vegetables each day (Fresh Prescription n.d).

## Conclusion

Increased or adequate fruit and vegetable consumption has an abundance of health benefits, and financial incentive programs such as Produce Prescription Programs have been shown to increase fruit and vegetable consumption among participants across the U.S. Given Produce Prescription Programs' potential health benefits for patients with or at risk of many chronic diseases—leading to possible healthcare cost savings—healthcare payers, including Medicare and Medicaid and private insurers, could see significant long-term savings by funding these programs.



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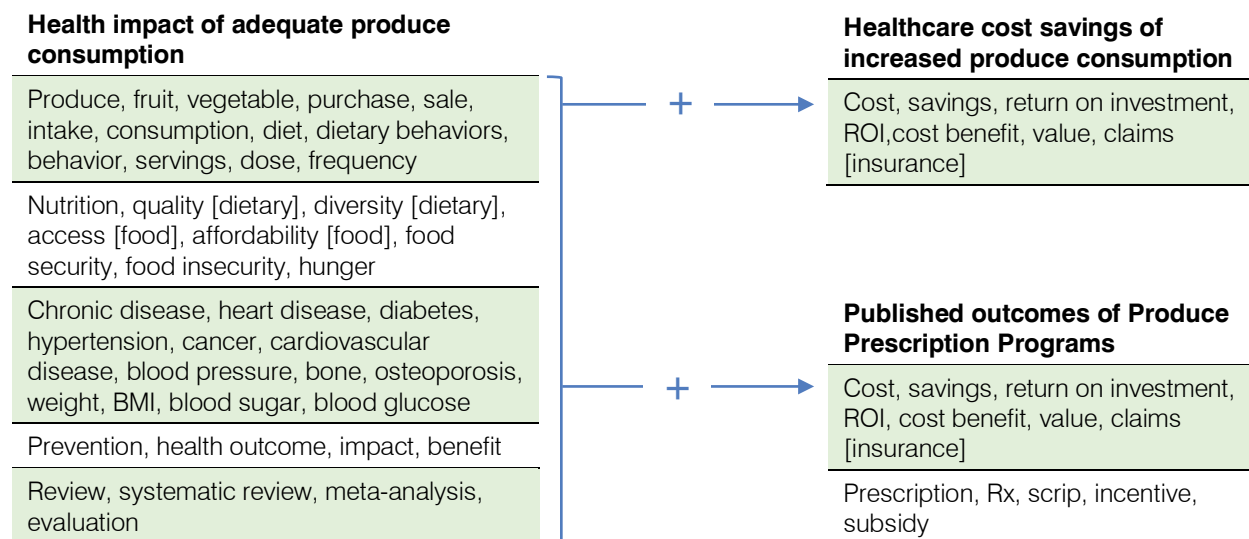
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## Appendix A: Key Search Terms and Phrases

This research had three main goals: to identify the impact of adequate fruit and vegetable consumption on health, the potential cost savings of increased produce consumption, and any published outcomes of Produce Prescription Programs. Peer-reviewed publications relevant to these three research questions were identified using combinations of the following search terms in online databases.







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