Denver Food Deserts and the Impact on Public Health
Review of Four Policy Options

Policy Memorandum
University of Denver
Institute for Public Policy Studies

Dustin C. Moyer
Faculty Advisor: Dr. Lapo Salucci
Spring Quarter, 2013
# Table of Contents

INTRODUCTION .................................................................................................................. 3

PROBLEM DEFINITION ...................................................................................................... 3

CONTEXT OF THE PROBLEM ............................................................................................. 3

RISING RATES OF OBESITY IN AMERICA, COLORADO, AND THE DENVER METRO AREA AND ASSOCIATED COSTS ......................................................... 3

DISPROPORTIONATE EFFECT ON LOW-INCOME INDIVIDUALS AND MINORITIES .................................................................................................................. 6

FOOD DESERT DEFINITION ............................................................................................... 8

ENVIRONMENT .................................................................................................................. 10

COST OF HEALTHY FOOD ................................................................................................. 11

DIET EFFECT ON OBESITY AND OBESITY RELATED ILLNESS ........................................... 14

FRUIT AND VEGETABLE AVAILABILITY ............................................................................. 18

AVAILABILITY OF FAST/PROCESSED FOOD ..................................................................... 20

FOOD INSECURITY AND HEALTH OUTCOMES ................................................................ 21

DENVER FOOD DESERTS .................................................................................................... 22

CURRENT POLICY INTERVENTIONS .................................................................................. 24

JUSTIFICATION FOR INTERVENTION AND OUTCOME MEASUREMENTS ......................... 27

POLICY OPTIONS .............................................................................................................. 28

EXPANDED EBT TERMINAL INFRASTRUCTURE AT FARMERS’ MARKETS ......................... 28

COMMUNITY AND URBAN GARDENS ................................................................................. 31

SUPERMARKET INCENTIVES .............................................................................................. 33

EXPANDED NUTRITION EDUCATION COURSES .............................................................. 34

COST BENEFIT ANALYSIS ................................................................................................ 37

STAKEHOLDERS .................................................................................................................. 37

WEAKNESSES AND LIMITATIONS .................................................................................... 48

CONCLUSION .................................................................................................................... 50

BIBLIOGRAPHY .................................................................................................................. 52

NOTES .................................................................................................................................. 61
**Introduction**

Health care costs continue to rise. Low-income individuals and families incur an un-proportionate share of these costs. A significant percentage of these costs can be traced to diet. Access to healthy food affects diet. Low-income people have less access to healthy food. These facts justify government intervention to remediate poor health outcomes and long-term costs.

Low-income neighborhoods are often located in ‘food deserts’. These geographic areas are characterized by a lack of full service grocery stores or supermarkets. Residents of these neighborhoods have limited access to fruits and vegetables and increased access to processed and fast foods. As a result, the individuals and families who reside in these areas suffer from higher rates of obesity, diabetes, and cardiovascular illness. Many low-income households rely on public health care (Medicaid, SCHIP, and Medicare) to treat these expensive conditions.

**Problem Definition**

The Denver metro area has a number of neighborhoods with limited access to full service grocery stores or supermarkets. This lack of access is likely to lead to long-term costs managing the chronic conditions associated with poor diet (obesity, diabetes, cardiovascular disease). This cost represents a societal loss.

**Context of the Problem**

**Rising Rates of obesity in America, Colorado, and the Denver Metro area and associated costs**

The United States of America has been gaining weight, a lot of it. Obesity is defined as an individual who has a body mass index (BMI) of 30 or higher (see notes for BMI definition). Overweight is defined as an individual having a BMI of 25 to 29.9. The percentage of Americans who fall into either of these categories has been steadily
increasing. In 2012 the percentage of Americans who met the clinical definition of obesity stood at 27.8%. This is over two times the 1990 rate, 11.6%. (United Health Foundation 2012)

The increases in overweight and obese Americans correspond with decreases in active lifestyles and quality of diet. The United Health Foundation reports the percentage of the population over the age of 18 who report doing no physical activity or exercise other than their regular job in the last 30 days is 23.9%. (United Health Foundation 2012)

While the rates of obesity in Colorado remain the lowest of any state in the nation, it is still alarmingly high, and rising. (United Health Foundation 2012) In 2012, the percentage of Colorado adults who met the criteria for obesity stood at 20.7%. This figure has been trending significantly upward over the past two decades. The obesity rate in Colorado in 1990 was only 6.9%. (United Health Foundation 2012)
Colorado also scores relatively well in adults living an active lifestyle. Colorado ranked first among all states (by having the lowest percentage) with only 16.5% of Coloradans living a sedentary lifestyle. (United Health Foundation 2012)

In the city and county of Denver, the percentage of residents meeting the qualifications for obesity in 2009 sat at 18.10%. Five and a half percent of adults were diagnosed with diabetes, a disease that often accompanies obesity. 26.8% of Denver adults failed to meet the minimum qualifications for physical activity in 2009. (USDA, Economic Research Service 2012)

While the prevalence of obesity in the adult population is relatively low, especially when compared to other states, the same cannot be said for Colorado’s children. The Colorado Health Foundation’s 2013 Colorado Health Report Card indicated that 14.2 percent of all Colorado children are obese. This figure ranks Colorado 23rd of all 50 states. (The Colorado Health Foundation 2013) There is also considerable disparity among the counties of Colorado. When measuring overweight and obese children the best performing county is Garfield at 17.1%. The worst performing are Logan and Morgan each at 40.1%. In the City and County of Denver 33.8% of children are classified as overweight or obese. (Colorado Children’s Campaign 2012)

The primary reason why this trend is significant is the sheer cost of treating obesity and obesity related illness. A 2002 study evaluated the cost of treating obesity compared to other unhealthy lifestyles (smokers and drinkers). This study found that obesity is associated with a 36% increase in inpatient and outpatient spending and a 77% increase in spending for medication. (Sturm 2002)

The Centers for Disease Control estimates the national cost of overweight and obesity, which takes into consideration direct costs such as medical expenditures and indirect costs such as lost productivity, to be $147 billion in 2008. (Centers for Disease Control and Prevention 2012) In Colorado alone, obesity related illnesses resulted in $874 million for medical expenditures in 2004. (Karpyn, Weidman and
The 2013 Colorado Health Report Card states that if ‘Colorado’s adult obesity rate returned to 1996 levels, Colorado employers and employees could save an estimated $228.9 annually in health care costs.’ (The Colorado Health Foundation 2013)

While the rising rates of obesity and obesity related illness is cause enough for alarm there is an added factor that make this especially relevant for policy makers. Taxpayers, through Medicaid and Medicare, foot a significant percentage of the medical expenditures attributed to obesity. A 2004 study estimated that Medicaid and Medicare paid for about half of the $75 billion (2003) dollars spent on treating obesity nationwide. (Finkelstein, Fiebelkorn and Wang 2004) In Colorado, of the $874 million in medical expenditures attributable to obesity, Medicare and Medicaid covered $139 million and $158 million, respectively. (Ibid)

**Disproportionate effect on low-income individuals and minorities**

Obesity and overweight, and their accompanying illness disproportionately affect individuals and families living in poverty. Drewnowski and Specter report that health disparities in the United States are linked to inequalities in education and income. This report also provides evidence indicating the highest rates of obesity occur among population groups with the highest poverty rates and the least education. (Drewnowski and Specter 2004)

Alaimo et al. reported that among older non-Hispanic white children, children in families with low income were significantly more likely to be overweight than children in families with high income. The same study indicates a clear relationship between obesity and socioeconomic status in women in the United States; poorer women are more likely to be overweight. (Alaimo, Olson and Frongillo Jr., Low Family Income and Food Insufficiency in Relation to Overweight in US Children 2001) The same pattern is evident for Medicaid eligible households. There is significantly higher percentage of Medicaid enrollees who meet the qualifications...
for obesity (30%) when compared to their non-Medicaid enrolled peers.

(Finkelstein, Fiebelkorn and Wang 2004)

**Obesity and Income/Education**

![Bar chart showing obesity rates by income and education levels.](chart)

(Drewnowski and Specter 2004)

There is a large body of research indicating that obesity and overweight also disproportionately effect minorities. This is even after controlling for other relevant factors including socioeconomic status, income, and neighborhood of residence. (Powell, et al. 2007) (Ogden, et al. 2006) (Drewnowski and Specter 2004)

A potential reason for these disparities is that low-income families and minorities have less access to healthy foods than their high income and white counterparts. This has been documented in various articles that indicate a lower prevalence of supermarkets and large-scale grocery stores in low-income and minority neighborhoods.¹ Powell notes that the lack of super-market access not only disproportionately affects low-income neighborhoods it also disproportionately affects neighborhoods in which the majority of its residents are minorities, even

---

¹ (Drewnowski and Specter 2004) (Alaimo, Olson and Frongillo Jr., Low Family
after adjusting for income. Hispanic neighborhoods have only 32% as many chain supermarkets when compared to non-Hispanic neighborhoods. African-Americans aren’t served much better with only 52% as many chain supermarkets as white neighborhoods. (Powell, et al. 2007)

A 2002 study evaluated the correlation between the food environment of a neighborhood and the associated health outcomes, especially those effecting neighborhoods largely populated by minorities. This study found that five times as many supermarkets were located in census tracts where White Americans resided. (Morland, Wing and Roux 2002) Additionally, only 8% of Black Americans lived in a census tract with at least one supermarket. (Ibid)

Beaulac et al, reports that low-income or African American residents are ‘underserved by food retailers compared with more advantaged areas.’ (Beaulac, Kristjansson and Cummins 2009) The same report suggests that low-income areas and areas with a high proportion of African Americans have fewer supermarkets or chain stores per capita than more advantaged areas, and the geographic distance to supermarkets for this segment of the population was significantly further. (Ibid)

**Food desert definition**

‘Food Desert’ has become a common term in public health and academic research to describe an instance of food insecurity in which there is low access to healthy food within a geographical area. There are a number of useful definitions for this term. Beaulac and colleagues state food deserts are “areas characterized by poor access to healthy and affordable food” and “may contribute to social and spatial disparities in diet and diet-related health outcomes, such as cardiovascular disease and obesity.” (Beaulac, Kristjansson and Cummins 2009) Many of the definitions disagree on fundamental points and remain difficult to quantify.
The United States Department of Agriculture’s Food and Nutrition Service has provided a tremendous service in quantifying and locating food deserts in America. Since this paper focuses on food security in the United States, Denver specifically, and will rely on United States Department of Agriculture (USDA) data it will use USDA’s definition of a food desert.

A food desert, as defined by the USDA, is a low-income census tract where a substantial number or share of residents has low-access to a super-market or grocery store. (United States Department of Agriculture 2012) Low-income meaning that it fits the Treasury Department’s New Market Tax Credit program eligibility criteria. A census tract is a small, relatively permanent statistical subdivision of a county. Census tracts’ population ranges between 1,500 and 8,000 with an average population of 4,000. (United States Census Bureau 2000) Low-access means it is greater than one mile from a supermarket or large grocery store in urban areas or more than 10 miles in rural areas.

This is not to say USDA’s definition is perfect. This formal definition has been met with criticism. The Atlantic published a story in February 2013 stating the USDA did not take into consideration transportation. The complaint levied against this definition is that it does not take into account car ownership or public transportation. (Badger 2013) However, this complaint ignores the fact that many low-income people lack car ownership and public transportation is often cumbersome for the specific task of grocery shopping.

The Economist has also levied its own complaints stating that the viability of local bodegas or corner shops to fill the grocery store gap is not considered. (The Economist 2011) The article points to the fact that many Americans are able to rely on small-scale grocers and even roadside stands to supplement their diet with healthy food. This may be true for some areas but it fails to consider the abundance of convenience stores and gas stations that are ubiquitous in many low-income
neighborhoods. These stores routinely fail to provide healthy food. (Andreyeva, Long and Brownell 2010)

While these concerns are noteworthy and should be kept in mind when establishing policy, USDA’s data does provide the best starting point. Not only does it indicate when urban areas are, on average, over a mile away from the nearest grocery store it also provides terrific insight into the demographics of the residents in these areas.

**Environment**

Fitting with USDA’s food desert definition, studies show that low-income neighborhoods have 75% of the supermarkets of their middle to high-income counterparts. (Powell, et al. 2007) This same study finds that low- versus high-income neighborhoods and predominantly black versus white neighborhoods have fewer numbers of available supermarkets but significantly more grocery stores (Ibid) (Morland, Wing and Roux 2002) (Moore and Diez Roux 2006)

Compounding the problem of limited full-service grocery stores is the fact that many living in food deserts do not have access to reliable transportation. (Romero 2005) Beaulac et al, citing Pulcher, state that in 2001, 26.5% of Americans with incomes below $20,000 did not own a car. (Beaulac, Kristjansson and Cummins 2009) (Pulcher 2003) This reality exacerbates the difficulty of obtaining healthy food in a low-income neighborhood. In the City and County of Denver there are over 4,000 households that both do not have a car and experience low-access to supermarkets, this represents 1.5 percent of the total population. (USDA, Economic Research Service 2012) (See notes for surrounding counties access to vehicle statistics.)² While 1.5 percent is a relatively low figure these are the individuals who are most likely to use government services including Medicaid.

Low access to supermarkets and decreased mobility mean that residents of food deserts are often forced to rely upon the food readily available to them. Convenience
stores and small-scale grocers that are less likely to carry fresh fruits and vegetables often serve these neighborhoods. Even when fruits and vegetables are available they are often in worse condition, than those in higher income neighborhoods, making them less appealing for purchase and consumption. (Andreyeva, Long and Brownell 2010)

**Cost of Healthy Food**
Access and limited income are significant factors when evaluating diet’s impact on health. Quoting Drewnoski and Specter, ‘income disparities had more of an effect on diet quality than on total energy intakes’. These authors suggest that a healthy diet costs more and are beyond the reach of many low-income families. (Drewnowski and Specter 2004)

In terms of economics, the purchase of food is very inelastic. Engel’s law, named after Ernest Engel who advanced this theory, states: that (1) the higher the family money income, the less the percentage of that income spent on food and more on education, automobiles, and saving; and (2) the proportion of a nation's income spent on food is a good index of its welfare – that is, the lower the proportion, the higher the welfare of the nation. (Wiley 1995)

An example of the increased cost burden for low-income families is USDA’s SNAP benefit formula. The Thrifty Food Plan, which is defined in the notes, is the formula USDA utilizes to set benefit levels for SNAP recipients. This plan implies that low-income individuals who rely on SNAP should spend 30% of their income on food. (Center on Budget and Policy Priorities 2012) Compare this to the 9.5% that the average urban American spent on food in 2004. (USDA ERS 2007) This highlights that low-income families are expected to spend a larger percentage of their income on food, given this, it makes sense that families will rely on cheaper food when economic necessity requires it.
A 2006 Forbes article looked at the differences in spending among low, middle, and high-income earners. Housing represented the biggest expense for all three groups. However, for the top quintile of all earners the second biggest expense is transportation and for the lowest fifth the second biggest expense is food. (Holland and Ewalt 2006)

The cost of food when coupled with low-access has serious implications. A 2005 USDA report states that 88 percent of American households were food secure throughout all of 2004. (Nord, Andrews and Carlson 2005) Their report defined food secure as a house having “access, at all times, to enough food for an active, healthy, life for all household members” This leaves about 12 percent of the United States population food insecure for at least some portion of 2004.

Low-income households are faced with the challenge of providing the most calories for their family on limited resources. An evaluation of food types and the calories provided per dollar make it clear that fast and processed food offer more bang for the caloric buck. Fresh fruits and vegetables, while healthier, do not provide a substantial amount of calories per dollar spent. For low-income families it does not
make economic sense to spend limited resources on foods that fail to provide the highest amount of energy. (Drewnowski and Specter 2004)

**Energy Density and Cost of Various Foods**

(Drewnowski and Specter 2004)

This paradox has another interesting element with government dietary recommendations. The USDA periodically releases dietary guidelines and urges Americans to follow them to realize positive health outcomes. The paradox lies within the expense of these recommendations, which are greater than un-healthy foods. This increased cost prices healthy eating out of reach for many low-income families.

USDA updates these dietary guidelines every five years (USDA 2012), and the most recent update in 2010 caught some media attention. This attention focused on the cost of a healthy diet. Reuters, in August 2011, reported that eating healthy, by
following the guidelines, could add as much as 10% to the average American’s food bill. (Yukhananov 2011)

This concern is backed up in academic journals as well. A 2011 article in Health Affairs confirmed that increasing the consumption of just one of the recommended nutrients, potassium, to recommended levels would add $380 to the average American grocery bill annually. (Monsivais, Aggarwal and Drewnowski 2011)

**Diet effect on obesity and obesity related illness**

The food system in the United States, as opposed to poorer countries, is extremely effective at providing an adequate number of calories. Many factors contribute to this fact including commodity subsidies and increased efficiency of the farming sector. Per person calorie production has increased in the United States from about 3,000 in 1957 to over 3,800 in 2000, although about 1,100 of these is lost to spoilage. This increase corresponds with American’s increased consumption and in turn increased weight. (United States Department of Agriculture 2002)
The number of calories consumed per American has steadily increased since the late 1950’s. The United States Department of Agriculture’s Economic Research Service estimates that recent consumption per American is just less than 2,700 calories. This figure represents a 24.5 percent or 530-calorie increase since 1970. (United States Department of Agriculture 2002)

While the increase in available calories and total caloric consumption obviously plays a significant role in the increase of American obesity, another important factor is the type of calories consumed. USDA estimates that over two thirds of the increase in calories consumed since the 1950’s to today comes from refined grains and added fats and oils. (United States Department of Agriculture 2002)

Americans are consuming record amounts of caloric sweeteners, usually in the form of sucrose (table sugar made from cane and beets) and corn sweeteners (notably high-fructose corn syrup, or HFCS). The amount of these substances consumed by
Americans increased by 43 pounds (39%) from the 1950’s to 2000. (United States Department of Agriculture 2002) These “foods” are often cheap and extremely calorie dense.

Another contributing factor is the increased prevalence of meat in the American diet. In 2008, almost 200 pounds of meat per person was available for consumption; this represents a 50-pound increase from the 1950’s. (Subsidies are often pointed to for this increase, as 38% of grains grown are used to feed animals). (United States Department of Agriculture 2002) ³

A 2012 NPR story states this trend has declined in recent years but the United States is still among the top three meat-eating countries. This report indicates meat consumed per American annually has reached 270 pounds. The world average is only 102 pounds. (Barclay 2012)

America’s diet increasingly relies on processed food as a source of calories. Caloric sweeteners, as described above, and the shift from whole grains to highly refined
grains highlight this change. Americans now meet the recommended 9 daily servings of grains but fall well short of the recommended 3 servings of whole grains. (United States Department of Agriculture 2002)

Surprisingly, fruit and vegetable consumption also rose in the same time period (this trend is not experienced by low-income Americans, and overall fruit and vegetable consumption is still well short of recommended guidelines.) (United States Department of Agriculture 2002) While the slight increase in fruit and vegetable consumption is positive, it does not offset the additional caloric consumption, rather adds to the total.

A shift from highly processed grains to healthier fruits and vegetables might help the country realize lower weights and improved health outcomes. A 2002 study indicated individuals who consume more servings of fruit and vegetables had a lower body mass index than their peers who consumed less. (Lin and Morrison 2002) The correlation between individuals maintaining a healthy weight and the regular consumption of fruit was significant, although similar results were not discovered for vegetable consumption, with the exception of male children (this does not indicate vegetable consumption is not healthy in a multitude of other aspects). (Ibid)

The same study suggests that preparation of fruits and vegetables might be an important indicator of obesity. The reasoning is that vegetable and fruit juice, in which additional sugar is added, and vegetables consumed as desserts in sweet tarts or pies negate the positive impact of the raw fruit or vegetable. This report suggests that consuming raw, or minimally processed, varieties of these foods will lead to improved health outcomes. (Ibid)

Increased consumption of fruit and vegetables has a positive effect on many of the diseases associated with obesity, including cardiovascular disease. Hu and Willet find strong evidence to suggest that diets using ‘whole grains as the main form of
carbohydrates’ and containing ‘an abundance of fruits and vegetables’ can offer significant protection against coronary heart disease (CHD). (Hu and Willet 2002)

Anderson and Hanna find similar health outcomes with increased consumption of fruits and vegetables. Their study suggests that consumption of foods high in dietary fiber, such as vegetables, fruits, whole-grain cereals, and legumes are positively associated with lower incidences of CHD and atherosclerotic cardiovascular disease (ASCVD). (Anderson and Hanna 1999)

Ford and Mokdad found that ‘fruit and vegetable consumption intake may be inversely associated with diabetes incidence particularly among women.’ The authors also suggest that increased education might be a positive indicator of fruit and vegetable consumption and lower rates of diabetes. (Ford and Mokdad 2001)

Increased fruit and vegetable consumption has been shown to coincide with improved health outcomes primarily through decreases in obesity and cancer. (Steinmetz and Potter 1996) (Perez 2002) Given the positive health outcomes fruit and vegetable consumption provides, it remains an important goal to ensure all Americans have adequate access to these foods and the knowledge to make their consumption a priority.

While fruit and vegetable consumption is an important determinate in long-term health it is important to remember there are other dietary factors. The most important among these may be total caloric consumption. Increasing the availability of fruit and vegetables will not address this concern. However, one of the proposed policy interventions may prove effective at encouraging this behavior. Nutrition education is evaluated in the policy recommendation section.

**Fruit and vegetable availability**

The link between fruit and vegetable consumption and positive health outcomes has been clearly established. Unfortunately, in order to reap the benefits of a healthy...
diet one must have ready access to fruits and vegetables and the knowledge to prepare and consume them. Low-income households have less reliable access to fruit and vegetables.

The presence of fruits and vegetables is an important consideration because the availability of fruits and vegetables could be a moderating variable for their consumption. (Kratt, Reynolds and Shewchuck 2000)

Powell, citing Sallis and Horowitz state that larger sized food stores such as supermarkets, which many low-income neighborhoods lack, versus smaller stores and chain versus non-chain supermarkets are more likely to stock healthful foods. (Powell, et al. 2007) (Sallis, et al. 1986) (Horowitz, et al. 2004) Shopping at supermarkets, as opposed to small or independent grocery stores has been linked to more frequent fruit and vegetable consumption. (Powell, et al. 2007) (Zenk, et al. 2005)

Beaulac found that supermarkets in low-income areas had less selling space, resulting in fewer food options for those shopping in these stores. (Beaulac, Kristjansson and Cummins 2009)

Price, an already sensitive factor for low-income families, might be inflated in low-income neighborhoods. In two urban Minnesota neighborhoods a significant percentage of foods (26% and 52%) were significantly more expensive than the Thrifty Food Plan’s (SNAP guidelines which set benefit amount) market based price (MBP). (Hendrickson, Smith and Eikenberry 2006) (See notes for definition of the Thrifty Food Plan) 4

Even when fruits and vegetables are available for purchase their quality may be poorer than those available in more affluent neighborhoods. (Hendrickson, Smith and Eikenberry 2006)
In the City and County of Denver almost 4% of households disagree with the statement that ‘fresh fruits, vegetables, and other healthful foods are somewhat or very available in their neighborhood.’ (Colorado Department of Public Health and Environment 2009)

**Availability of fast/processed food**

The current American food system that favors grains and meat production to fruits and vegetables has produced similar patterns in American food consumption. This has increased demand and availability of fast and processed foods. These foods tend to be cheaper and more energy dense than their whole food counterparts.

Drewnowski and Specter report that this reality is a factor taken into consideration by low-income households when deciding how to spend their limited food budget. (Drewnowski and Specter 2004)

Low-income neighborhoods have greater access to these options when compared to their more affluent peers. So, not only do these households often have less access to healthy food they also have greater access to unhealthy foods. A 2009 article reported that low-income neighborhoods tend to have a greater prevalence of fast-food restaurants, which serve inexpensive, nutrient deficient, calorie dense food. (Larsen and Gilliland 2009)

Reidpath et al. found a dose-response between socio-economic status and the density of fast-food restaurants. ‘People living in areas from the poorest SES category have 2.5 times the exposure to outlets than people in the wealthiest category. (Reidpath, et al. 2002) Gordon et al. identify a similar paradox for minorities living in New York City. Their 2011 paper creates a unique methodological ‘food desert score’ to measure healthy food availability and a food desert index. Their research indicates that black/African-American neighborhoods have a greater prevalence of fast food restaurants and decreased access to healthy foods through supermarkets. (Gordon, et al. 2011) Similar results were found in a study examining this issue in New Orleans. Block et al. found black neighborhoods
have approximately 2.4 fast food restaurants per square mile. This is compared to the 1.5 restaurants per square mile in white neighborhoods. (Block, Scribner and DeSalvo 2004)

In the City and County of Denver, there are 8.1 fast food restaurants per 10,000 residents. (Colorado Department of Public Health and Environment 2009) Given the population of Denver at just over 600,000 and square mileage of just over 153, these figures estimate just under 3.5 fast food restaurants per square mile in the City and County of Denver. (United States Census Bureau 2013)

Low-income neighborhoods also have a disproportionate share of convenience or corner stores. These stores often fill the void created by a lack of supermarkets and full-scale grocery stores. These stores are less likely to carry healthy food and more likely to carry processed food items. A report looking at corner stores in Philadelphia’s low-income communities found over 96% of the snack foods offered in these settings were highly processed. There were minimal offerings of fruits or vegetables. (Lucan, Karpyn and Sherman 2010)

While proximity to fast-food restaurants remains a promising theory when describing overweight, Burdette and Whitaker failed to find a correlation between the two factors in 3 and 4-year-old low-income children. This study did not report on prevalence, just proximity. The other two factors studied in this report were proximity to playgrounds and safety of the neighborhood in which the child lived, for which they did not find a correlation. (Burdette and Whitaker 2004)

**Food Insecurity and health outcomes**

Lack of access to healthy food, increased access to unhealthy food, and limited transportation is not just an inconvenience for residents in underserved communities it also translates into measurable adverse health-outcomes. Townsend, in a 2006 article, reports that it is ‘easier to be overweight if you have a small income or less education or are food insecure.’ (Townsend 2006) In a 2011
literature review Eisenmann et al report that studies examining this subject find that food insecurity and overweight co-exist. This trend is even more extreme for children. (Eisenmann, et al. 2011) Food insecurity has real costs evidenced by the disproportionate rise in obesity in low-income and minority neighborhoods.

Food insufficiency may also lead to other problems, especially for youth. Children who experience family-level food insecurity are more likely to demonstrate negative academic and psychosocial outcomes than their food secure peers. (Alaimo, Olson and Frongillo, Jr., Food Insufficiency and American School-Aged Children's Cognitive, Academic, and Psychosocial Development 2001)

**Denver Food deserts**

While Colorado remains one of the healthiest states in the nation, when using obesity as an indicator, its residents are experiencing the same weight-gain trends realized in the rest of the country. Nationally, this trend disproportionately affects low-income residents and minorities. Colorado sees the same results. (The Colorado Health Foundation 2009)

Food security in Colorado area has recently received much attention from non-profit organizations and government agencies as an area of concern. The Food Trust, in conjunction with the Colorado Health Foundation, has issued three reports in the past 3 years examining the prevalence of low-access areas in Colorado, Special Report: The Need for More Supermarkets in Colorado, Healthy Food for All: Encouraging Grocery Investment in Colorado, and Food Access in Colorado. (Karpyn, Weidman and Thomas 2009)(Lang and Kim 2011). (The Colorado Health Foundation 2009)

In the Special Report, the authors link food access and fruit and vegetable availability to rising rates of obesity and obesity related illness in Colorado.
The report states that these adverse health outcomes cost the state an estimated $874 million in treatment. This report also indicates that Colorado communities with poor supermarket access have higher incidences of diet-related deaths. (Karpyn, Weidman and Thomas 2009)

There is also indication that food insecurity is a big problem in Colorado. A significant percentage of urban neighborhoods and rural areas suffering from limited access. Similar to other studies, this report confirms that low-access to healthy food disproportionately affects low-income individuals and families in Colorado. (Karpyn, Weidman and Thomas 2009)

In the city and county of Denver, Colorado and the surrounding counties (Adams, Arapahoe, and Jefferson) there are 45 census tracts classified as a food desert (19 in Denver). There are 189,471 individuals residing in these neighborhoods. These areas meet the USDA guidelines for a food desert, requiring a census tract to be both low-income and low-access. 5
This data highlights the problem that is prevalent in much of the country: there is limited access to grocery stores and supermarkets. While the data shows that many of the metro area residents lack access to supermarkets there is an abundance of convenience stores and fast-food restaurants that, as we have seen, often compound the problem.\textsuperscript{6,7}

**Current Policy Interventions**

The federal and states’ governments have instituted a number of programs to alleviate the affects of food insecurity in the United States. Programs that are currently available to assist low-income individuals and families purchase food are: the Supplemental Nutrition Assistance Program (SNAP, formerly food stamps), WIC (Women, Infants and Children), Child & Adult Care Food Program (CAFP), Head Start, School Lunch and Breakfast Programs, Summer Food Service Program, Elderly
Nutrition Program, Emergency Food Assistance Program (TEFAP), Commodity Distribution Program, and Food Distribution on Indian Reservations (FDPIR). (United States Department of Agriculture 2012)

SNAP is the primary tool in the government’s tool belt to defend against hunger. SNAP is a means tested social safety net that provides money for food purchase to individuals and families and most categories of legal immigrants who are in need. SNAP is authorized through the Farm Bill. (United Stated Department of Agriculture 2012)

Eligibility guidelines for SNAP examine resources and income, allow deductions, and offer special considerations for homes with elderly or disabled individuals. As a general rule, eligibility for the SNAP program is set at 130 percent of the federal poverty level (FPL) before deductions are allowed. After deductions are factored, which include expenses for housing, childcare, medical expenses, etc., eligibility is set at 100 percent FPL. This allows a family of four to have a gross monthly income (before deductions) of $2,498 and a net monthly income (after deductions) of $1,921. (United Stated Department of Agriculture 2012) Benefits for SNAP, or allotments, equal the net monthly income of a household multiplied by .3, and the result subtracted from the maximum allotment. USDA states that SNAP households are expected to spend about 30 percent of their resources on food. The maximum monthly allotment for a household of four is $668. (United Stated Department of Agriculture 2012)

SNAP benefits are paid through an Electronic Benefits Transfer card (EBT). EBT cards are plastic cards that look like and operate much in the same way as credit or debit cards. Standard EBT terminals, used to accept SNAP benefits as payment, are provided to retailers, these terminals require an electrical plug-in and a phone line. There are wireless terminals available, typically used at farmers’ markets where electricity and phone lines aren’t readily available. Wireless terminals are not provided and retailers are responsible for their purchase. (United States
Department of Agriculture 2012) The federal government has indicated a shift in policy with the passage of the Consolidated and Further Continuing Appropriations Act. A provision in this legislation provides $4 million, to be split by the states, for purchase of electronic EBT machines to be used at farmers’ markets.

The transition to EBT cards from paper food stamps has a couple of advantages. State administrators are able to electronically “load” benefits onto an EBT card, reducing the need for recipients to travel to an office to receive benefits, often a difficult task for low-income individuals and families without reliable transportation. EBT cards have also been an effective tool in reducing the stigma associated with food stamps. Since EBT cards operate much in the same way as credit or debit cards, beneficiaries are able to use their SNAP benefits to purchase food discretely.

In 2011, SNAP served almost 45 million people (one in seven Americans). (United States Department of Agriculture 2011) USDA states that SNAP decreases food insecurity and helps to lift people out of poverty. SNAP is also viewed as an economic stimulus in its own right. SNAP allotments are spent on absolute necessities, food, within the community. This benefit also allows dollars previously spent on food to be spent on other items. USDA claims, through the economic multiplier effect, that every $1 in new benefits generates up to $1.80 in economic activity. (United States Department of Agriculture 2011)

SNAP participation tends to follow economic activity. The most recent downturn in the American economy has led to a sharp increase in enrollment. In 2000, SNAP participation was about 30 million individuals. This has increased to the current level of about 45 million in the latest reports. This increase has been linked to the economic recession of 2008. (United States Department of Agriculture 2011)

A primary goal of food assistance programs is to provide healthy foods for those that can’t afford it. By making healthy food more available for disadvantaged
populations the government hopes to realize improved health outcomes in this population. A current study evaluated the effectiveness of food subsidy programs, such as SNAP and WIC, in high-income countries and their impact on nutritional and health outcomes. Food subsidy program participants, mostly pregnant or postnatal women, were shown to have 10-20% increased intake of targeted foods or nutrients. (Black, et al. 2012)

In the City and County of Denver 8.86% of residents utilized SNAP benefits in 2011. Denver SNAP recipient’s received just over $70 per month, between 2008-2010.

There are also two nutrition education programs offered to low-income households. Snap-Education (Snap-Ed) is authorized by Title IV of the Farm bill and administered by USDA’s Food and Nutrition Service. (USDA, National Institute of Food and Agriculture March) The Expanded Food and Nutrition Education Program (EFNEP) is authorized by the Smith-Lever Act and administered by USDA’s National Institute of Food and Agriculture and the National Office for Co-Op Extension. (USDA, National Institute of Food and Agriculture 2013) A further evaluation of these programs will be offered in the Policy Option section under the heading Expanded Nutrition Education Courses.

**Justification for Intervention and Outcome Measurements**

Health care costs continue to rise. Low-income individuals and families incur an un-proportionate share of these costs. A significant percentage of these costs can be traced to diet. Access to healthy food affects diet. Low-income people have less access to healthy food. These facts justify government intervention to remediate the poor health outcomes and long-term costs.

The policy options in the proceeding section have both short-term and long-term outcome goals. The short-term goals are fairly straightforward: Improve the nutrition of individuals who reside in Denver’s food deserts. The long term goals
follow the same logic: Reduce long-term health costs by improving health outcomes for individuals residing in Denver’s food deserts, reduce Medicaid and Medicare expenditures on obesity and obesity related illness. Each of the policy options addresses both the short-term and long-term goals. Three of these options, Expanded EBT, Urban and Community Gardens, and Supermarket Incentives accomplish these goals by increasing access to healthy food. The fourth policy option, Expanded Nutrition Education, does not address the issue of access but instead relies on changing behavior of SNAP recipients. This option is ideally used in conjunction with an additional policy intervention.

While these interventions are likely to have intangible benefits this report is restricted to use of available data. Therefore the outcome measurements have been reduced to tangible and quantifiable outcomes.

**Policy options**

The goal of these policies is to help alleviate the ill effects of food deserts in Denver by improving the diet of its residents. The proposed solutions are: Expanded EBT terminal infrastructure at farmers’ markets, assistance establishing and building community or urban gardens, incentives or subsidies for investment in low-income neighborhoods for supermarkets and grocery stores, and assistance for nutrition education courses provided for at-risk populations.

**Expanded EBT Terminal Infrastructure at Farmers’ Markets**

This proposal calls for expanding the availability of Electronic Benefit Transfer wireless terminals to Farmers’ Markets operating in Denver’s 19 designated food desert census tracts.

There are three ways in which a Farmers’ Market may accept SNAP payments. Standard Electronic Benefit Transfer (EBT) Terminals, which are provided, wireless terminals, which must be purchased or rented (USDA states the cost to outfit a
A number of farmers' markets have moved to accept SNAP payments from consumers. The primary strategy to implement this capability has largely focused on a central EBT terminal station for an entire farmers' market. In this setting, a central location contains a wireless terminal. SNAP recipients who wish to use their benefits at the farmers' markets must first go to this location where their card is swiped for a specified amount of dollars. The SNAP recipient then receives that dollar amount in coins or tokens, which they are able to use as money at each vendor. The vendors are then required to bring each of these coins or tokens to the central station to be reimbursed for their SNAP sales that day.

There are a number of issues with this strategy. There is an inconvenience for both consumers and vendors. The extra step of having to visit a central location to receive tokens may dissuade many potential consumers. There is also an inconvenience to vendors who have to take extra time to receive reimbursement for the 'SNAP tokens'. There is also the issue of stigma. A benefit of moving towards EBT cards was that it is not only convenient, but allows the consumer to use the SNAP benefits discretely. By requiring the consumer to visit a central location and use a different currency the stigma may be reintroduced.

One potential option to remedy this problem is instituting infrastructure for vendors at a farmers' market to have their own wireless EBT terminal. Buttenheim and colleagues examined this option at a Philadelphia farmers' market. (Buttenheim, et al. 2012) In their study they provided each vendor at the Clark Park farmers' market (at no cost to the vendor) an EBT point of sale (POS) terminal capable of accepting SNAP benefits. Their study ran for nine months from June 2008 to February 2009. This intervention led to an increase in sales, as they were able to attribute the expanded capability to a 38% increase. This study examined expanding infrastructure where it already existed whereas this policy proposal recommends...
installing infrastructure where it is not currently located. This figure remains important for future interventions. The results of this study would allow one to infer that the more available this particular piece of technology is, the more it will be used.

While this is certainly a positive aspect in expanding access for residents of low-income neighborhoods the authors also found that this expansion would not have been possible without the provision of free terminals. A subsidy to vendors would be required to purchase additional terminals for the merchants to break even. This is still a viable option for the future. EBT terminal expansion increases access to and consumption of healthy fruits and vegetables. In the future, through advances in technology, this will only become cheaper and allow more farmers’ market vendors to participate. In the mean time, interested non-profit organizations should examine the feasibility of providing these terminals.

**Specifics:**
Provide EBT Terminals for any farmer market that operates in a designated food desert census tract. The total cost will be the cost of the EBT terminal times the number of farmers markets taking advantage of this offer, this analysis estimates one per Denver census tract, 19. Terminals cost between $1,400 and $3,000. (Colorado Department of Human Services 2013) These terminals are available for lease though for $20, $15/month to lease and a $5/month communication fee. This proposal will recommend the lease of EBT terminals. (Ibid) Awardees will be required to report sales.

**Measured Outcomes:**
The outcome measurement will be increased purchase of fruits and vegetables. This will be by extrapolating results from a similar Denver Urban Garden initiative. Due to lack of data the CBA will not attempt to quantify the health outcomes of this proposal. Instead it will measure increased purchases as the sole benefit.
Additional Considerations:
Technology is becoming cheaper and more readily available. Smart phones are now able to accept credit card transactions. These innovations will likely extend to EBT terminals in the near future. While these innovations seem promising a February 2013 training seminar conducted by officials from USDA FNS and the Colorado Department of Human Services stated that they were still years away from realizing this potential. (Colorado Department of Human Services 2013)

Community and Urban Gardens
This proposal will offer one-time grants and long-term technical support for the purpose of establishing community gardens. The grants will be available for residents of food desert census tracts.

Urban and community gardens have increased in popularity in recent years. They are viewed as an effective tool to expand access to healthy food and as a means for community development.

Community gardens serve as a viable source of fresh produce for the neighborhoods they serve and greatly enhance the diets of those involved. Blair and colleagues found that community gardeners have higher consumption of fresh vegetables compared with non-gardeners, and lower consumption of sweet food and drinks. (Blair, Giesecke and Sherman 1991)

A 2000 study examining gardens in upstate New York found that those gardens serving and tended to by low-income communities provided a greater benefit to the community, perhaps due to the organizing efforts of establishing and maintaining a garden. (Armstrong 2000)

In Denver, a non-profit organization, Denver Urban Gardens (DUG), supports over 120 community gardens throughout the metro area. These include more than 30 school-based community gardens. (Denver Urban Gardens 2012) DUG cites both
nutritional and community benefits as a positive outcome. These benefits have the potential to be very real and measurable. While some of the community development impact might be difficult to quantify these gardens provide tangible monetary benefits to a community.

These benefits can be measured as the market price of each fruit or vegetable pulled from the garden. Other long-term benefits include improved long-term health outcomes for its members. This would be the natural result of an improved diet. DUG’s Best Practices quantifies the costs of establishing an urban garden. The total estimated cost for a typical DUG is just over $29,000. This might be overstating the cost as it assumes all labor will be contracted. In fact, members of the garden will volunteer much of the labor.

**Specifics:**
Grants are provided to develop urban/community gardens. Each grant will equal $15,000, this will cover the initial cost of materials, labor shall be provided by volunteers. This proposal also calls for the creation of 1.5 FTE to assist grantees with garden maintenance. Also, to better understand the positive impacts associated with community and urban gardens there will be strict reporting measures for each garden. These reports will provide information on participants, space, seeds planted, food harvested, etc.

**Measured Outcomes:**
The outcome measurement will be the market value of the fruits, vegetables, and other foods a garden produces. This will be estimated by using DUG data. Note that community and urban gardens provide a significant number of intangible items including community pride, increased exercise, and additional social interaction that will not be factored.

An additional item for consideration is local zoning and available green space. It may be necessary for community leaders to lobby for change in zoning codes to allow for
increased agricultural activities. Locating and acquiring the right to use available green space (open lots) may be an issue. This policy proposal does not address these considerations but rather relies on the grantees to assume this responsibility.

**Supermarket Incentives**

The opening of supermarkets in former food deserts has the potential to alleviate many of the health outcomes that are associated with low-access to healthy foods. The opening of a supermarket also represents an investment within a community and has the potential to address many of the social aspects that result in disparate consequences for these neighborhoods. (Wrigley, et al. 2002)

Incentivizing supermarkets to invest in low-income underserved neighborhoods is not a new idea. Philadelphia’s Food Trust created the $85 million public-private partnership *Fresh Food Financing Initiative* to provide grants and loans to grocery stores that invest in these communities. (The Food Trust 2013)

Realizing the need for action a Colorado collaborative headed by The Food Trust aimed to define the problem. A Special Report titled the Need for More Supermarkets in Colorado outlines the problem, ‘Colorado ranks in the bottom third of states for supermarket density per population, 37th among the 50 U.S. States. (Karpyn, Weidman and Thomas 2009) This lack of access leads to a host of health problems, which have been highlighted above.

Healthy Food for All: Encouraging Grocery Investment in Colorado, took the policy implications and potential solutions one step further and outlined a strategy to recruit supermarkets to underserved areas. (Lang and Kim 2011) This report convened stakeholders to a task force to examine strategies and make recommendations on how to recruit supermarket investment in low-income underserved communities.

**Specifics:**
A Denver task force recently announced the creation of a Fresh Food Financing Fund. This fund will provide incentives for grocery stores to build in underserved communities and will be modeled on Pennsylvania’s Food Trust. (Auge 2011) This memorandum’s policy proposal will build on the task force announcement and request $10 million for grants and low-interest loans. These funds will be distributed to supermarkets investing in any of the nineteen Denver food deserts.

**Measured Outcomes:**
The outcome measurement will be improved community impacts. This CBA will rely on an economic impact study examining Pennsylvania’s Fresh Food Financing Initiative that measures the three community benefits: Improved Real Estate, New Investment, and Lower Prices. Note that there will also be improved health outcomes due to improved diet. Due to available data these impacts are not considered and the CBA will only consider community benefit impacts.

**Expanded Nutrition Education Courses**
Often, the most impactful public policy is increased education. Providing information to a consumer or population has the potential to result in improved outcomes. Studies have shown education programs as effective tools in improving health related choices. (Zoller and Maymon 1986) (Allen, Taylor and Kuiper 2007) (Clark, Mitchell and Rand 2009) While this policy option does not address the issue of access it may lead to positive outcomes in conjunction with improved availability.

There are currently two nutrition education programs available for low-income households designed to improve the shopping and consumption patterns of its participants. These are EFNEP and SNAP-Ed. Both programs are funded and administered by the USDA. EFNEP has a standardized curriculum and reporting system. USDA’s extension offices administer these courses. In Colorado, Colorado State University’s Extension office is responsible for EFNEP. (Baker 2013)
For SNAP-Ed, USDA contracts with multiple organizations (public and private) to provide education courses. As a result of this, SNAP-Ed implementing agencies rely on a diversity of approaches and lack a uniform reporting system. The Colorado State University Extension office, Denver Urban Gardens, and Cooking Matters are implanting SNAP-Ed agencies in Colorado. (Ibid)

Colorado has a regional branch of the national non-profit organization, Share Our Strength, which focuses on food security and healthy food access. The Colorado chapter operates a program called Cooking Matters that provide educational courses focusing on nutrition and cooking. These courses largely serve low-income individuals and families.

Cooking Matters is a six-week course with weekly classes. Cooking Matters often conducts specialized classes for families with children who are or are at risk of childhood obesity. The classes teach the basics of preparing nutritional foods. These basics include what to look for in grocery stores, how to buy food on a budget, how to provide healthy alternatives, and how to cook nutritious meals. (Cooking Matters 2013) (Ramirez 2012)

Colorado State University’s extension office relies on the same curriculum for both its SNAP-Ed and EFNEP programs. This program titled, *Eating Smart-Being Active*, has been adopted nationwide as ‘an evidence based, nutrition education and obesity prevention curriculum.’ This program ‘is designed for paraprofessional nutrition educators to use when teaching low-income families with young children to learn healthy lifestyle choices. The curriculum consists of eight core lessons, each 60 to 90 minutes long. The teaching techniques in the lesson plans of *Eating Smart • Being Active* are based on the adult learning principle, dialogue-based learning or learner-centered education.’ (Colorado State University Extension 2013) (Baker 2013)

This proposal calls for an increase of EFNEP funds for use in Denver to equal 25% of state funding. While each of the nutrition education programs provides a benefit this
paper will focus on EFNEP as a model to expand. The primary reason for this is the consistency in which EFNEP is administered. This consistency provides more reliable data on the program, whose effectiveness has been studied. There have been a number of cost benefit analysis reports on the effectiveness of the EFNEP program at various locations throughout the nation. The results of these reports are the basis for estimating benefits of the program in the CBA.

Costs are estimated by using the current EFENP program in Colorado.

**Specíficos:**
In Federal Fiscal Year 2010 the State of Colorado, through the Colorado State University Extension Office, received $655,236 for EFNEP programs in the state. This proposal calls for the provision of annual funds to equal 25% of the state total. These funds will be used to fund additional courses providing EFNEP curriculum to Denver citizens residing in a USDA identified food desert. The additional funds equal $163,832 annually.

**Measured Outcomes:**
The measured outcome is changed behavior. This measurement will be improved health outcomes and shopping patterns. These outcomes will be estimated using similar cost benefit analyses conducted by EFNEP researchers.
Cost Benefit Analysis

Each of the policy proposals has been assigned a total cost based on the specifics of each option. This cost is calculated by adding up-front costs and out-year costs to the present value. The cost-benefit analysis put forward in this memo looks six years into the future.

Benefits calculations are less straightforward as each proposal offers unique advantages. While the final results may not be a perfect apples-to-apples comparison the analyses attempts to consider the significant variations of each option.

Stakeholders
There are many entities that have an interest or maintain standing in each of the proposed policies. The stakeholders are as follows:

- Residents of Food Deserts/SNAP Recipients
- Denver, Colorado Health care system
- Denver tax-payers
- Food vendors (grocers, farmers, farmer’s market vendors)

Each of these stakeholders stands to benefit from the various proposals. Benefits are measured for the various proposals as follows:

Expanded EBT:
This proposal calls for expanding the availability of farmers markets accepting SNAP as a form of payment. Those benefiting from this policy intervention and having primary standing are SNAP recipients and farmer’s market vendors. Secondary stakeholders are the healthcare system, the City and County of Denver, the local economy, and taxpayers. Benefits are measured as the projected market price of the estimated number of food sales due to the increased availability.
Denver Urban Gardens maintains produce stands for many of their gardens. These stands have the capability to accept SNAP payments. The experience of these stands, in terms of SNAP sales, has been used to project SNAP sales for an emerging farmers market or produce stand with the capability to accept SNAP.

Since this proposal calls for new farmers markets and produce stands one should expect low total sales during the first few seasons. However, if DUG’s experience is any indication as a vendor gains experience and becomes more of a presence in the community sales should be expected to rise in out years. The reason for this increase centers on awareness, as residents become more aware of this resource they are more likely to patronize it. Secondly, as SNAP recipients become more aware of their ability to use their benefits at farmers’ markets and fruit stands they will be encouraged to spend their benefits there. (Adelson 2013) Of all DUG farmers’ markets they experienced a 125% increase in SNAP sales from 2011 to 2012 and in the same time period experienced a 217% increase in all sales through the use of a wireless EBT machine. (Denver Urban Gardens 2012)

To estimate total benefit, this analysis examined DUG data. The first year of each garden yielded relatively low numbers of SNAP transactions. This CBA uses a figure of $100 as an estimate for the first year of operation. In out years, a 35% increase in sales is calculated annually. Implementing an aggressive marketing campaign and utilizing strategic partnerships with organizations already pursuing this policy will realize this increase. Using this calculation the Net Present Value (NPV) of this proposal is $4,063.51.

A sensitivity analysis (S.A.) stresses the importance of rapid and sustained growth. A S.A. was conducted for annual sales growth rates of 5% and 10%. In these scenarios the Net Present Values equal losses of $13,700 and $9,500, respectively. (See Notes for Sensitivity Analysis.)
There are multiple limitations for this analysis. It is important to note that this figure does not include credit and debit card transactions. It is also important to note that the longer a market is in existence the more sales they should expect. This analysis fails to quantify additional benefits that are realized with this policy. These benefits include increased local economic activity, healthier diets, and improved long-term health outcomes.

This figure assumes rapid growth of sales in out-years of an established farmers market or fruit stand.

**Further considerations**

Technology plays a critical role in expanding the infrastructure of wireless EBT. There are currently a number of new technologies that allow for convenient transactions of credit and debit cards using smart phones or tablets. While USDA states that the added security requirements of SNAP transactions prevent these technologies from being utilized the attention to these innovations have dramatically reduced the costs of these machines over their lifetime. (Paulos 2013)

It would not be an unrealistic assumption that this technology will continue to decline in cost and become more accessible.

There is also a recent philanthropic strategy to increase the purchasing power of SNAP dollars. This program is often referred to as ‘Double Bucks’ and, through donations and contributions, matches each SNAP dollar spent at a farmers’ market. These programs provide a benefit to SNAP recipients who are more able to afford healthy food and farmers’ market vendors who experience higher sales volume due to added value of SNAP. Where available, this strategy should be pursued.

This policy option examines the potential for single vendor retailers. Often times farmers markets serve multiple vendors through the organization of a market manager. Increasing the number of vendors also increases the potential for sales. A
2012 USDA report examined the viability of farmers markets that accept SNAP. Nine markets were evaluated and each of them showed a substantial sales figures ranging from $20,000 to $666,000 annually. (United States Department of Agriculture 2012) Recruiting additional vendors for each location should remain a goal for expanded locations.

**Urban Gardens:**
This proposal calls for the provision of grants to build urban/community gardens. The primary stakeholders for this policy proposal are residents of Denver food deserts. Benefits for this option are numerous and not easily quantifiable but include increased exercise, improved diet, and developing community pride. These intangible items, while beneficial, prove difficult to quantify. Therefore, this analysis will attempt to establish a market price for each garden based on the total amount of produce harvested per year per garden.

The option put forward in this proposal is modeled after DUG sponsored gardens. DUG has provided aggregate information on these gardens. They state that for each garden an average of 5175 pounds of produce is harvested each year.

This estimate does not include a fruit and vegetable breakdown. Nor does it include a market price for these items. Therefore, this CBA is forced to rely on a couple of assumptions. The first assumption is that the items harvested will represent the most suitable produce for this climate and typical of household gardens. The second assumption is that the harvest will command average market price for produce.

In the spirit of these assumptions this has identified viable garden vegetable crops for Colorado’s climate. Colorado State University's Extension office, through their master gardening program, has released a vegetable planting guide. (Whitig, O’Meara and Wilson 2012) This guide outlines crop options for both cool and warm seasons. This analysis has used this guide to establish a ‘standard list’ of Colorado
vegetables to be used in establishing market price. The produce varieties this analysis uses are: tomatoes, cantaloupe, potatoes, kale, and broccoli.

With the ‘standard’ list established the analysis then relies on average market price of each of the vegetables. USDA’s Economic Research Service provides an average market price of ‘153 commonly consumed fresh and processed fruits and vegetables’ that is used to calculate average market price of each item. (USDA Economic Research Services 2012) The average of each of these prices is calculated and applied to the 5175 pounds that each garden may be expected to produce.

**Average Market Price of Certain Vegetables**

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Price/Pound (2008)</th>
<th>CPI Adjusted 2013 dollars</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomato (Fresh Round)</td>
<td>$2.94</td>
<td>$3.17</td>
</tr>
<tr>
<td>Cantaloupe</td>
<td>$0.95</td>
<td>$1.02</td>
</tr>
<tr>
<td>Potato</td>
<td>$0.48</td>
<td>$0.52</td>
</tr>
<tr>
<td>Kale</td>
<td>$2.19</td>
<td>$2.36</td>
</tr>
<tr>
<td>Broccoli</td>
<td>$1.84</td>
<td>$1.98</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td><strong>$1.68</strong></td>
<td><strong>$1.81</strong></td>
</tr>
</tbody>
</table>


Given these average market prices applied to the expected 5175 pounds of produce each garden can expect to grow and multiplied by the total 19 new gardens. The benefit in terms of market price equals $177,968.25 annually.

Factoring the cost and benefits, **this proposal has a NPV of $549,995.89**.

This figure is subject to many unknowable variables. These variables including, drought, flood, and unstable market prices that have the potential to significantly impact the total benefit of this policy option. A sensitivity analysis was conducted to
account for a dramatic drop in production/prices. The S.A. predicted a 25% decline in total market value of the crops produced. This represents a loss of almost $44,500 per year. In this scenario the total NPV of this policy option is reduced to $530,000. (See Notes for complete S.A. matrix)\textsuperscript{10}

This analysis has multiple limitations. The primary limitation is the failure to quantify all benefits. These benefits include increased community pride, healthier diets, and improved health outcomes.

**Grocery Store Incentives:**
This proposal calls for the provision of $10,000,000 for grants and low-interest loans to supermarkets and grocery stores investing in low-income underserved neighborhoods. The primary stakeholders of this proposal are residents of Denver food deserts, the Denver economy, and Denver taxpayers. Benefits for this option are not easily quantifiable but include improved diet, developing community pride, and increased employment. While the cost of this program is fairly straightforward quantifying the benefits prove more difficult.

Pennsylvania has enacted a similar program to serve low-access neighborhoods. This initiative started in 2004 and has been continuously monitored. In 2006 an economic impact study was released. The CBA in this memo will assume Denver will see similar results to those achieved in Pennsylvania. Therefore, the economic impact Pennsylvania has realized will be used to estimate the benefits Denver might expect.

The Pennsylvania study identified three main measurable benefits: Improved Real Estate, New Investment, and Lower Prices (of food). \textsuperscript{10}While this study found significant positive impacts on both house prices and price of food, this CBA will focus on economic impact as its method of quantifying benefits. Within Metro areas, this study concluded an economic multiplier of 2.2 was
achieved during construction and 1.9 was realized during operation. This study will consider these two numbers and recommend a conservative estimate of 1.5 be used to quantify the benefit Denver will see. This proposal recommends spending $2.5 million each year. Therefore, by committing $2.5 per year and using a multiplier factor of 1.5 this CBA will be able to estimate its full impact.

Using these assumptions and calculations, the **NPV of this proposal equals $47,381,559.82.**

This analysis has limitations as it fails to account for improvements in diet. An assumption made for this analysis is that the economic multiplier impact that was realized in Pennsylvania will also be realized in Denver. This is a fairly large assumption. Additionally, economic multipliers are far from the gold standard of cost-benefit analysis. The author has limited confidence in this figure.

**Expanded Nutrition Education:**

This proposal calls for expanding availability for EFNEP classes in Denver. Numerous Cost-Benefit Analyses have demonstrated the positive impact nutrition education courses make. This analysis will rely on previous publications to estimate the potential benefit of expanding this program. The measured benefits that have been identified in previous studies, and which will be incorporated in this analysis, is better resource utilization by course attendees and improved long-term health outcomes, as a result of a more nutritious diet. The primary stakeholders for this proposal are residents of Denver food deserts, primarily SNAP recipients, and the health care system of Denver.

A 2002 study examines improved resource utilization exhibited by EFNEP attendees. This study indicated that subjects who completed the course saved $10.36 per month with an average standard deviation of $9.79 (based on cash register receipts as opposed to recall). (Burney and Haughton 2002) This is an important finding because it indicates the funds spent on food (oftentimes SNAP for
this population) are spent more wisely leaving excess funds for other purchases. This study concludes that it costs $388 per household to improve food resource management practice and that this investment realizes savings of $124 to $234 per year per household.

Based on this calculation, the funding increase of $163,842 for EFNEP in Denver can be estimated to serve just over 420 individuals. The estimation for individuals served was reduced to 400 to ensure a conservative figure. For CBA calculations the median savings was used, which equals $179 annually.

A 2003 paper examining EFNEP effectiveness in Oregon took a different approach. This study evaluated how the lessons taught during EFNEP courses impacted behavior and inferred that improved behavior would lead to improved health outcomes. Their analysis took into account diet’s impact on heart disease, colorectal cancer, stroke, hypertension, osteoporosis, obesity, type 2 diabetes, foodborne illness, common infant diseases, and low birth weight. The conclusion in this study indicated that for every $1 spent on EFNEP $3.63 was avoided in future costs. The CBA in this memo uses the same ratio. This provides an average benefit of $1,486 in today’s dollars over the lifetime of the program graduate, estimated at 30 years. In order to calculate the net present value of this program intervention this CBA assumes these benefits will be realized annually for 30 years. This assumption leads the analyses to conclude that each participant will experience $49.56 in cost savings per year, in today’s dollars. For the total of 400 participants per year this CBA uses the above assumptions and calculations to identify $19,823 in health related savings.

Given the assumptions used, the total cost of this program for seven years will equal a present value of $947,993.13. The total present value of the benefits equals $1,898,289.94. The NPV for this proposal equals $950,296.82.
Since long-term health benefits are extremely difficult to quantify a sensitivity analysis was conducted by removing all health related benefits. In this scenario, the only benefits accrued to stakeholders are improved shopping habits of EFNEP graduates. These benefits remained constant from the original CBA. In this situation, there is still a Net Present Value of this intervention of over $620,000. (See Notes for Complete Sensitivity Analysis.)

This analysis has many limitations. While most benefits have been accounted for these figures may not be completely reliable as they assume graduates of nutrition education programs will continue their improved habits indefinitely.

<table>
<thead>
<tr>
<th>Policy Option</th>
<th>Net Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expanded EBT</td>
<td>$4,063.51</td>
</tr>
<tr>
<td>Urban Gardens</td>
<td>$549,995.89</td>
</tr>
<tr>
<td>Grocery Store Incentives</td>
<td>$47,381,559.82</td>
</tr>
<tr>
<td>Expanded Nutrition Education</td>
<td>$950,296.82</td>
</tr>
</tbody>
</table>
## Cost Benefit Analysis Matrix

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expanded EBT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefits</td>
<td>$1,900</td>
<td>$2,565</td>
<td>$3,462.75</td>
<td>$4,674.71</td>
<td>$6,310.86</td>
<td>$8,519.66</td>
<td>$11,501.55</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Urban Gardens</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>$(250,000)</td>
<td>$(250,000)</td>
<td>$(50,000)</td>
<td>$(250,000)</td>
<td>$(250,000)</td>
<td>$(250,000)</td>
<td>$(250,000)</td>
</tr>
<tr>
<td>Benefits</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Grocery Store Incentives</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>$(2,500,000)</td>
<td>$(2,500,000)</td>
<td>$(2,500,000)</td>
<td>$(2,500,000)</td>
<td>$ (2,500,000)</td>
<td>$(2,500,000)</td>
<td>$(2,500,000)</td>
</tr>
<tr>
<td>Benefits</td>
<td>$ 3,750,000</td>
<td>$ 7,500,000</td>
<td>$11,250,000</td>
<td>$15,000,000</td>
<td>$18,750,000</td>
<td>$18,750,000</td>
<td>$  58,205,251.50</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Expanded Nutrition Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
</tr>
<tr>
<td>Benefits</td>
<td>Median Food Savings, Estimate</td>
<td>$71,600</td>
<td>$143,200</td>
<td>$214,800</td>
<td>$286,400</td>
<td>$358,000</td>
<td>$429,600</td>
</tr>
<tr>
<td></td>
<td>Improved Health Outcomes Estimate</td>
<td>$ 19,823</td>
<td>$ 39,646</td>
<td>$ 59,469</td>
<td>$ 79,292</td>
<td>$ 99,115</td>
<td>$118,938</td>
</tr>
<tr>
<td>Total NPV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Sensitivity Analysis

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expanded EBT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benefits</td>
<td>$ 1,900.00</td>
<td>$ 2,565.00</td>
<td>$ 3,462.75</td>
<td>$ 4,674.71</td>
<td>$ 6,310.86</td>
<td>$ 8,519.66</td>
<td>$ 11,501.55</td>
</tr>
<tr>
<td>Benefit at 5% annual growth NPV</td>
<td>$ 1,900.00</td>
<td>$ 1,995.00</td>
<td>$ 2,094.75</td>
<td>$ 2,199.49</td>
<td>$ 2,309.46</td>
<td>$ 2,424.93</td>
<td>$ 2,546.18</td>
</tr>
<tr>
<td>Benefit at 15% annual growth NPV</td>
<td>$ 1,900.00</td>
<td>$ 2,185.00</td>
<td>$ 2,512.75</td>
<td>$ 2,889.66</td>
<td>$ 3,323.11</td>
<td>$ 3,821.58</td>
<td>$ 4,394.82</td>
</tr>
<tr>
<td><strong>Urban Gardens</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>$ -</td>
<td>$(50,000)</td>
<td>$(50,000)</td>
<td>$(50,000)</td>
<td>$(50,000)</td>
<td>$(50,000)</td>
<td>$(50,000)</td>
</tr>
<tr>
<td>Benefits</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
</tr>
<tr>
<td>25% productivity loss</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
</tr>
<tr>
<td>NPV</td>
<td>$772,343.06</td>
<td>$530,643.44</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Expanded Nutrition Education</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
</tr>
<tr>
<td>Benefits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median Food Savings, Estimate</td>
<td>$719</td>
<td>$719</td>
<td>$719</td>
<td>$719</td>
<td>$719</td>
<td>$719</td>
<td>$719</td>
</tr>
<tr>
<td>Improved Health Outcomes Estimate</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
<td>$ -</td>
</tr>
<tr>
<td>Total NPV</td>
<td>$628,528.26</td>
<td>$628,528.26</td>
<td>$628,528.26</td>
<td>$628,528.26</td>
<td>$628,528.26</td>
<td>$628,528.26</td>
<td>$628,528.26</td>
</tr>
</tbody>
</table>
**Weaknesses and Limitations**

This memorandum and accompanying cost benefit analysis is not without its own weaknesses and limitations. The primary weakness, when considering policy intervention to correct geographic food insecurity, is the ‘food desert’ definition. Many definitions have been offered and not all of them agree. The USDA definition, that this memo used, has its own limitations: A census tract is a broad area of land, and it lumps all residents together regardless of individual income or mobility, the factor of mobility is not considered, and it only counts supermarkets as food vendors, discounting the role other food merchants might fill.

There is also a concern of whether these areas significantly impact health. American diets have been deteriorating in quality for a number of years that makes it difficult to state access to food is the reason. Many Americans who have adequate access to healthy food may not choose to utilize it and suffer the same poor health outcomes. There are also a number of other factors that should be considered when evaluating the rise of overweight and obesity in America, especially in low-income populations. These factors range from built environment, access to running trails or playgrounds, to neighborhood crime, people who live in unsafe areas may be hesitant to head outside.

A recent article by Hattori, et al. examines the validity of ‘food deserts’ as a predictor for obesity among adults. The final conclusion in this paper was that, ‘food outlets within walking distance were not strongly associated with dietary intake, BMI, or probabilities of a BMI of 25 or more or a BMI of 30 or more.’ (Hattori, Ruopeng and Sturm 2013) While this report is an interesting interpretation of available data it does not paint a complete picture and much work remains. There are a number of concerns with this report that leave room for study improvements. This report relies on self-reported weights, which are often underreported, and self reported dietary intakes. The primary concern with this article is that it fails to consider
vehicle ownership as a factor for obesity. These factors need to be evaluated in future research.

Additionally, while the main conclusion of this report does not reinforce the need for the policy interventions introduced in this memo there are a number of secondary findings that do. Primarily, the ‘number of fast-food restaurants in a 3.0 mile buffer was positively associated with the probability of a BMI of 25 or more’ and ‘the number of large supermarkets in the 3.0 mile buffer was associated with lower BMI and lower probabilities of a BMIE of 25 or more and a BMI of 30 or more.’ (Ibid)

The assumptions made in the cost benefit analysis within this memo should be considered a major limitation. While the costs are fairly straightforward, and the author feels fairly confident in each, the numbers arrived upon for each benefit are less than concrete. Each of the benefits has been measured by extrapolating results and data from prior experiences/publications. Inferring that the nineteen food desert census tracts in Denver, Colorado will experience the same results as other areas of the country is a major assumption.

Another weakness of the benefits, as they have been measured, is the lack of uniformity. The benefit for each policy option has been computed using available data. Unfortunately, this data and the outcomes it measured was not the same for each.

The policy options of Expanded EBT and Urban/Community Gardens make fairly conservative assumptions when measuring the benefits of each intervention. Expanded Nutrition Education makes a more aggressive assumption, but one that is backed up by multiple scholarly articles. The author is most comfortable with the assumptions used in these three options. Supermarket Incentives make aggressive assumptions with limited knowledge. The figures used were based from one study in Pennsylvania that only offer an economic multiplier. Given the large amount of
money involved in this option and the academic skepticism of an economic multiplier as an accurate measure, the author has the least amount of confidence in this figure.

**Conclusion**

America is gaining weight and suffering the health consequences. Low-income and minority individuals and families are experiencing a disproportionate share of this weight gain and accompanying poor health outcomes. A large body of research points to healthy food access, cost of healthy food, and inadequate education as serious contributors to the rising rates of overweight and obesity in America. The policy interventions proposed within this memorandum attempt to improve the diets of Denver residents, through enhanced access and increased education. Addressing this will reduce long-term costs associated with obesity and its related health outcomes.

Each of these policy proposals offers unique benefits to the stakeholders. A formal cost-benefit analysis makes it difficult to provide an adequate comparison of each of them. Grocery store benefits were measured through an economic multiplier, gardens were measured by the market price of produce expected, expanded EBT by total sales, and nutrition education by improved shopping techniques and a healthier diet. These are clearly unique measurements and that makes it vital to qualitatively examine each of the options.

While the supermarket incentives Net Present Value estimation scored highest among all policy options there are many factors to consider. When spending a sum of money this great there needs to be a clear picture of the market forces. Each of the nineteen neighborhoods has unique needs that need to be evaluated to a greater extent than they have been in this memo. This evaluation needs to be completed to better understand the needs of Denver and allocate funds to efficiently address those needs. Fortunately, philanthropy is attempting to fill this void. A Fresh Foods
Financing Fund has been established to provide the support outlined in this proposal. These fund managers will be able to analyze every opportunity to a much greater extent, and provide the best decisions moving forward. So, while this memorandum fails to offer a firm recommendation of this policy option there remains much potential moving forward.

This memorandum offers a formal recommendation for each of the other three options. This recommendation is based on the sustainability of each project, the potential to change dietary habits, and the opportunity to encourage community development. Building gardens not only provides fresh produce but also requires active participation from community members. This participation has the potential to encourage community development. Additionally, after the initial investment, community and urban gardens are largely self-sustaining. A relatively small sum of money today will achieve benefits far into the future.

The expansion of EBT has many of the same benefits of urban gardens including increased access to fresh produce and community development. Once SNAP recipients become aware of this opportunity, experience shows they are fare more likely to use it. This option also shifts some of the market share to small and local producers that may benefit the local economy.

Moving forward the policy option with the greatest body of research supporting its positive benefits is expanding nutrition education. By effectively improving behavior this policy intervention is able to impact change and save scarce resources well past the life of the program. This is the primary recommendation of this memorandum. This policy option would ideally be coupled with an additional option that increases access to fresh produce.
Bibliography


—. "Overweight and Obesity." CDC. April 27, 2012.


Paulos, Greg, interview by Dustin Moyer. *Food Stamp Program Specialist, USDA FNS* (March 18, 2013).


The Economist. "If you build it, they may not come." *The Economist*, July 7, 2011: -.


United States Department of Agriculture. NUTRITION ASSISTANCE IN FARMERS MARKETS: UNDERSTANDING CURRENT OPERATIONS—FORMATIVE RESEARCH FINDINGS. USDA, FNS. Washington D.C. January 2012


**NOTES**

1 Definition of BMI, Centers for Disease Control and Prevention

Body Mass Index (BMI) is a number calculated from a person’s weight and height. BMI is a fairly reliable indicator of body fatness for most people. BMI does not measure body fat directly, but research has shown that BMI correlates to direct measures of body fat, such as underwater weighing and dual energy x-ray absorptiometry (DXA). BMI can be considered an alternative for direct measures of body fat. Additionally, BMI is an inexpensive and easy-to-perform method of screening for weight categories that may lead to health problems. (Centers for Disease Control and Prevention 2011)

2 Denver and surrounding counties, low-access to supermarkets, low-income, and no car statistics

<table>
<thead>
<tr>
<th></th>
<th>Households, low access and no car (%)</th>
<th>Low-access and no car (%)</th>
<th>Households, low-income and low access</th>
<th>Low-income and low access (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denver</td>
<td>4333</td>
<td>1.65</td>
<td>38267</td>
<td>6.38</td>
</tr>
<tr>
<td>Adams</td>
<td>1100</td>
<td>0.72</td>
<td>20005</td>
<td>4.54</td>
</tr>
<tr>
<td>Arapahoe</td>
<td>1516</td>
<td>0.68</td>
<td>20242</td>
<td>3.54</td>
</tr>
<tr>
<td>Jefferson</td>
<td>1905</td>
<td>0.88</td>
<td>23021</td>
<td>4.31</td>
</tr>
</tbody>
</table>

(USDA, Economic Research Service 2012)

3 American Meat Consumption, by decade
### Table: Pounds per capita, boneless-trimmed weight

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Meats</strong></td>
<td>138.2</td>
<td>161.7</td>
<td>177.2</td>
<td>182.2</td>
<td>189</td>
<td>195.2</td>
</tr>
<tr>
<td><strong>Red Meats</strong></td>
<td>106.7</td>
<td>122.34</td>
<td>129.5</td>
<td>121.8</td>
<td>112.4</td>
<td>113.5</td>
</tr>
<tr>
<td><strong>Beef</strong></td>
<td>52.8</td>
<td>69.2</td>
<td>80.9</td>
<td>71.7</td>
<td>63.2</td>
<td>64.4</td>
</tr>
<tr>
<td><strong>Pork</strong></td>
<td>45.4</td>
<td>46.9</td>
<td>45</td>
<td>47.7</td>
<td>47.6</td>
<td>47.7</td>
</tr>
<tr>
<td><strong>Veal and Lamb</strong></td>
<td>8.5</td>
<td>6.2</td>
<td>3.5</td>
<td>2.4</td>
<td>1.7</td>
<td>1.4</td>
</tr>
<tr>
<td><strong>Poultry</strong></td>
<td>20.5</td>
<td>28.7</td>
<td>35.2</td>
<td>46.2</td>
<td>61.9</td>
<td>66.5</td>
</tr>
<tr>
<td><strong>Chicken</strong></td>
<td>16.4</td>
<td>22.7</td>
<td>28.4</td>
<td>36.3</td>
<td>47.9</td>
<td>52.9</td>
</tr>
<tr>
<td><strong>Turkey</strong></td>
<td>4.1</td>
<td>6</td>
<td>6.8</td>
<td>9.9</td>
<td>13.9</td>
<td>13.6</td>
</tr>
<tr>
<td><strong>Eggs</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number per capita</td>
<td>374</td>
<td>320</td>
<td>285</td>
<td>257</td>
<td>236</td>
<td>250</td>
</tr>
</tbody>
</table>

(United States Department of Agriculture 2002)

‘The Thrifty Food Plan (TFP) is the basis for maximum food stamp allotments. ‘The TFP provides a representative healthful and minimal cost meal plan that shows how a nutritious diet may be achieved with limited resources. The Plan assumes that all purchased food is consumed at home.’

The TFP market baskets specify the types and quantities of foods that people could purchase to be consumed at home to obtain a nutritious diet at a minimal cost. There are 15 market baskets – one for each of the 15 specific age-gender groups.

The 2006 TFP is based on the 2005 Dietary Guidelines for Americans as well as the 2005 MyPyramid Food Guidance System, uses the prices low-income people paid for many foods, uses the latest data on food consumption, nutrient content, and food prices, and provides a realistic reflection of the amount of time available to prepare foods.

The TFP is adjusted for inflation

---

5 Denver and surrounding counties demographics and food store availability
<table>
<thead>
<tr>
<th></th>
<th>Denver</th>
<th>Adams</th>
<th>Arapahoe</th>
<th>Jefferson</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Census Tracts</td>
<td>18</td>
<td>15</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>classified as a ‘Food Desert’</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total pop. Affected</td>
<td>82,588</td>
<td>59,872</td>
<td>12,751</td>
<td>34,260</td>
</tr>
</tbody>
</table>

(United States Department of Agriculture 2011)

6 Food deserts in the Denver metro, by county

7 Greater Denver metropolitan area food deserts. Census tracts that classify as a food desert are shaded in pink.
Free Point-of-Sale EBT only devices - Markets that conduct $100 or more in SNAP business per month are eligible to receive a free POS device that can process solely EBT transactions. To receive and use such devices, markets must have a central location, with electricity and a phone line, where the device can be placed and operated.

Wireless Credit/Debit POS devices - A farmers’ market may choose to purchase or lease wireless point-of-sale (POS) equipment that accepts debit and/or credit cards, in addition to EBT cards. In some cases, State or Federal funds may be available to help farmers’ markets acquire such equipment. Please check with your State EBT office to determine the availability of such funds.

Manual Vouchers – In cases where a farmers’ market is unable to operate a POS device on site, the market may use manual vouchers. To use manual vouchers, market staff must call the State’s EBT processor to check if funds are available in a customer’s EBT account and, if so, place a hold on the purchase amount. The customer must then sign a voucher for the purchase amount, which the market must mail to the EBT processor. The EBT processor will then pay the market, via direct deposit (usually within two business days). If the market is eligible for a free POS device, the market can keep the device at an off-site location and clear all the manual vouchers through the device at the end of the day, instead of mailing them.

(United States Department of Agriculture 2011)

Expanded EBT Sensitivity Analysis
### Expanded EBT

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>$ 1,900.00</td>
<td>$ 2,565.00</td>
<td>$ 3,462.75</td>
<td>$ 4,674.71</td>
<td>$ 6,310.86</td>
<td>$ 8,519.66</td>
<td>$ 11,501.55</td>
</tr>
<tr>
<td>Benefit at 5% annual growth NPV</td>
<td>$ 1,900.00</td>
<td>$ 1,995.00</td>
<td>$ 2,094.75</td>
<td>$ 2,199.49</td>
<td>$ 2,309.46</td>
<td>$ 2,424.93</td>
<td>$ 2,546.18</td>
</tr>
<tr>
<td>Benefit at 15% annual growth NPV</td>
<td>$ 1,900.00</td>
<td>$ 2,185.00</td>
<td>$ 2,512.75</td>
<td>$ 2,889.66</td>
<td>$ 3,323.11</td>
<td>$ 3,821.58</td>
<td>$ 4,394.82</td>
</tr>
</tbody>
</table>

### Urban Garden Sensitivity Analysis

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
<td>$177,968.25</td>
</tr>
<tr>
<td>Benefits</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
<td>$133,476.19</td>
</tr>
<tr>
<td>25% productivity loss NPV</td>
<td>$772,343.06</td>
<td>$772,343.06</td>
<td>$772,343.06</td>
<td>$772,343.06</td>
<td>$772,343.06</td>
<td>$772,343.06</td>
<td>$772,343.06</td>
</tr>
</tbody>
</table>

### Expanded Nutrition Education Sensitivity Analysis

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Costs</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
<td>$(163,832)</td>
</tr>
</tbody>
</table>
| Benefits
| Median Food Savings, Estimate | $71,600 | $143,200 | $214,800 | $286,400 | $358,000 | $429,600 | $501,200 | $1,576,521.39 |
| Improved Health Outcomes Estimate | $ - | $ - | $ - | $ - | $ - | - | - | $0.00 |
| Total NPV                     | $ - | $ - | $ - | $ - | $ - | - | - | $628,528.26 |