Nutrition Effects on Health and Recidivism in the American Prison Complex

Catherine Peabody

Washington and Lee University

Author Note

Catherine Peabody enrolled in POV 423: Poverty: A Research Seminar at Washington and Lee University.

Correspondence concerning this article should be addressed to Catherine Peabody, an undergraduate student at Washington and Lee University.

Nutrition Effects on Health and Recidivism in the American Prison Complex

In the United States, 2.3 million people are incarcerated, a 700 percent increase from 1970 (ACLU, 2019). Each year, this industrial complex costs $57.7 billion in state expenditures, a dramatic increase from the $6.7 billion in state prison expenditures recorded in 1985 (The Sentencing Project, 2016). This mass incarceration trend has significantly increased American poverty, as incarcerating individuals has a ripple effect on families and communities (DeFina & Hannon, 2013). More importantly, poverty rates would be lowered by 20 percent had mass incarceration not occurred. With recidivism rates in the US around 76 percent in the first five years of release, mass incarceration cannot be reduced because of the constant return of individuals to prison (NIJ, 2014).

Because incarcerated individuals are not included in poverty rates, incarcerated individuals do not receive the same services as other impoverished individuals, but experience similar hardships, such as food insecurity. While prisons may offer training and educational opportunities to inmates, is there a more fundamental issue that underlies the recidivism rate? This paper seeks to explore the relationship between nutrition, negative health outcomes, and recidivism.

Inconsistent access to proper nutrition is correlated with higher body mass index and obesity, which in turn leads to cardiovascular disease, diabetes, and cancer (Dixon, 2010; Franklin et al., 2012; Larson & Story, 2001; Olson, 1999). Additionally, mental illness is correlated to both improper nutrition and recidivism. The question of prison nutrition is important because inmates are a vulnerable population whose rights have been historically violated, but more importantly, national rhetoric about prison's purpose is focused on

punishment, which dehumanizes inmates and opposes the holistic rehabilitation necessary to reduce recidivism.

If food in prison was made more nutritious, would health outcomes improve, and recidivism be reduced? Using the Virginia State Department of corrections as my population, I explore this question in three parts; the existing empirical evidence, the political feasibility through a budget analysis, and the moral argument that treatment of inmates should be humane. Background literature from sociology, psychology, criminology, health science, environmental science, and public policy will be analyzed closely to create an argument on existing empirical data.

Prison Food

Why are inmate populations experiencing negative effects similar to food insecurity? Prison meals are marked by processed foods, similar to diets of individuals living in food deserts, including processed meat, canned fruits and vegetables, and packaged bakery items. In Georgia, inmates receive two meals a day, with the average price per meal at $1.77 (Santo & Iaboni, 2015). Inmates eating this meal complain about insufficient calories, which the prison makes up by providing the population with two or three servings of margarine. In Arizona, inmates' meals are priced at 56 cents per meal and all meat has been replaced with soy products. These meals both lack in sufficient calories and nutritional qualities. In Alabama, inmate meals fall around 58 cents per meal and include two baloney sandwiches for lunch and half an egg with oatmeal and bread for breakfast. A 28-day study of Georgia prisons found that the average cholesterol intake was 156% the recommended amount (Cook et al., 2015). Sodium was also found to be in extreme excess, served at 303% of the recommended daily intake. Total calories for female inmates was 121% of recommended daily consumption. In Washington state, 95% of prison food

is “industrialized, plastic-wrapped, sugar-filled ‘food products’” (Sawyer, 2017). Minimum requirements of fruits, vegetables, and whole grains are not met, and nutrition is supplemented through fortified drink mixes that go largely unconsumed.

Additionally, the food is often served in deplorable conditions. Inmates have been fed rancid chicken and maggot infested food, leading the incarcerated population to be six times more likely to fall ill due to foodborne pathogens (Delgadillo, 2018). The CDC found that 6% of all foodborne illness case reports occurred in prisons, which is disproportionate to the amount of the population that is incarcerated (Marlow et al., 2017). In Oregon, inmates have complained of being fed bait fish with “not fit for human consumption” labels on it, sour milk, and moldy bread (Woodworth, 2017). The distressing condition of prison food is leading to health concerns that increase reliance on prison services, raising prison spending and decreasing time inmates have to participate in rehabilitative programs.

Methodology

This review strives to give reasoning to improve nutrition in inmate meals through a political, moral, and empirical lens. This topic was originally approached because of personal experience I had with inmates in Augusta Correctional Facility. The discussion around food in prison was broached multiple times in a single month period, which interested me and began my research into prison nutrition. Upon finding little scientific analysis that was translated into policy, I decided to explore this topic in depth.

This analysis revises previously researched work and creates analysis based on previous literature because of time constraints that made primary analysis from Virginia prisons through qualitative and quantitative means impossible. This investigation focuses on papers written in both academic settings, through psychology, nutrition, and prison research; and journalistic

endeavors, through articles on prison nutrition. Both quantitative and qualitative research was used to portray a holistic account of prison meal quality. Additionally, multiple reports from the Virginia Department of Corrections were utilized to create accurate portrayals of health, both physical and mental, and budgeting in the current system.

The main databases used were Google's search engine and Google Scholar. Because basic definitions, news stories, and department of corrections reports were needed to create a holistic argument the Google search engine was used. Additionally, to find academic literature that presented mechanisms behind the correlations between nutrition, health, and recidivism Google Scholar was used. Key searches included variations of the following words; "prison", "nutrition", "macronutrients", "micronutrients", "obesity", "noncommunicable diseases", "mental health", "depression", "Virginia", "Dietary Standards", "Punishment", "Rehabilitation", "8th Amendment", "Lawsuit", and "Rehabilitation". Sources that exclusively analyzed juvenile populations were excluded from the study. Sources that did not analyze the United States were also excluded. All studies analyzed were in English.

Much of the analysis was done through reviewing news articles and then finding studies and facts that confirmed written information. Nutritional analysis compared the dietary recommendations of the Food and Nutrition Board of the National Academy of Sciences with the more comprehensive healthy eating guidelines defined by the USDA. In the budgetary analysis, Virginia Department of Corrections documents were utilized. These included the Report to the Governor on *Spending on Inmate Health Care* for 2018, *Medical Care Provided in State Prisons- Study of the Costs* published in 2016, and the *Management Information Summary Annual Report* for 2018.

Analysis

Nutrition and Physical Health

Poor nutrition, consuming foods low in fiber and high in fat, sugar, and salt, has direct impacts on physical health (Government of Southern Australia, 2019). To determine appropriate intake quantities of nutrients for individuals, activity level and total energy expenditure for each day must be taken into consideration. According to Pencharz et al. (2016) daily caloric values of nutrients are separated into two distinct categories, the minimal intake of macronutrients and the flexible intake of additional calories. These macronutrients: protein, fat, and carbohydrates, are the key energy providers in diet and critical to maintaining bodily health.

Protein, constituted of amino acids, is the primary component that makes up cells in the human body (Institute of Medicine, 2005). Proteins function as antibodies, binding to foreign particles to fight viruses; messengers; enzymes, which carry out chemical reactions at a cellular level; and the structural components of cells (National Institute of Health, 2019). These macronutrients are found in meat, poultry, fish, beans, and soy products. Because of this range of function, protein deficiency causes loss of muscle mass, decreased immunity, and weakening in the heart and respiratory system (Harvard School of Public Health, 2019). Additionally, diets moderately low in protein cause body fat gain due to increasing energy intake without increasing energy expenditure (Pezeshki et al., 2016). Protein-energy malnutrition (PEM) is predominantly in hospitals because of its association with disease and aging populations (Institute of Medicine, 2005).

The carbohydrate group, fats, includes saturated, monosaturated, or polyunsaturated fatty acids (Hermann, 2017). Fats make up cell membranes and are a concentrated source of energy the body stores for later use. Additionally, it is required to break down fat-soluble micronutrients (Institute of Medicine, 2005). However, eating high amounts of saturated and trans-fat increase

risk of heart disease, whereas high amounts of total fat increase risk of both cancer and obesity. While the body can synthesize saturated fats, it cannot synthesize trans-fats, leading to no known benefit to health.

Carbohydrates, made up of molecules of sugars, fibers, and starches, have a primary goal of providing energy to the brain and body (Institute of Medicine, 2005; Harvard School of Public Health, 2017). An important distinction exists between extrinsic and intrinsic sugars, the former being added into foods while the latter occurring naturally. Even though foods with added sugars have no different sugar qualities than foods with naturally occurring sugar, it is the micronutrients that create health disparities. Mozaffarian et al. (2011) suggest that it is the type, rather than the amount, that is most important in diet. Wylie-Rosett et al. (2004) found that fructose, a carbohydrate present in processed food, is associated with higher body fat retention. Carbohydrates can be found in breads, beans, processed food, and soft drinks. However, the healthiest carbohydrates are unprocessed because important micronutrients are not filtered out. Because carbohydrates are high in sugars, the body processes them through the blood, resulting in an elevation in blood sugar. Minimum amounts of carbohydrates necessary in diet are determined by the brain's ability to break down the molecules into carbon dioxide and water.

Micronutrients are vitamins and minerals required by the body receives for development, disease prevention, and functioning (Centers for Disease Control and Prevention, 2018). Because they cannot be made by the body, consumption of vitamin and mineral rich diets are required for healthy functioning. There are approximately 40 important micronutrients, which are primarily found in fruits and vegetables (Ames, 1998). Deficiencies in these cause illnesses and exacerbate preexisting symptoms of chronic disease (Tulchinsky, 2010). Additionally, deficiencies cause

damage to DNA, working similar to many harmful chemicals. Resulting negative symptoms are determined by the specific amount an individual is deficient (Ames, 1998).

Some of the most prominent deficiencies of micronutrients worldwide are in iron, vitamin D and vitamin B12. Iron, found in meat, is required for the body to transport oxygen in the blood (Harvard Health Publishing, 2015). A deficiency in iron results in anemia, which reduces physical activity and causes fatigue (Zimmermann & Hurrell, 2007). Vitamin D, absorbed through skin from exposure to sunlight and obtained through diet, plays a critical role in decreasing risk of developing chronic illnesses (Holick, 2007). Having a vitamin D deficiency puts individuals at risk for low bone density, autoimmune conditions, cancer, and cardiovascular diseases (Bendik et al., 2014). Very few foods contain this vitamin; it can only be found in fatty fish and fish liver oils. Vitamin B12 is necessary to create red blood cells, DNA, and nerves in the body (Skerrett, 2013). Having a deficiency can lead to depression, mental illness, joint pain, and other negative health outcomes. This deficiency is prevalent in vegetarian/ vegan populations because B12 is found in animal products. Therefore, diets that substitute animal products for soy must make up for a lack of B12 with fortified foods such as breads and cereals.

Obesity and Non-Communicable Disease

Obesity, caused by mixed factors of genetics, metabolism, and lifestyle, refers to body mass index (weight divided by height) above 30 (Centers for Disease Control and Prevention, 2017). Obesity is highly prevalent in low income communities because of food insecurity and unhealthy nutrition (Mobley et al., 2006). Eating lower-quality foods can lead to obesity, heart disease, high blood pressure, type-2 diabetes, and many other illnesses. (Government of Southern Australia, 2019). The extreme rise in obesity is correlated to the rapid growth of fructose as sugar in processed food, first introduced in the 1970s through the invention of high fructose corn syrup

(Bray et al., 2004; White, 2008). Because fructose does not stimulate the body to use insulin or leptin, which send signals that regulate hunger and body weight, individuals consume excess energy which causes storage of body fat. Diets high in saturated fats and simple carbohydrates also effect cognitive processes, including memory and learning in the hippocampus (Kanoski & Davidson, 2010). Because hippocampal signals are critical for learning cues associated with hunger, individuals consume too many unusable calories and store excess as body fat. In studies examining correlations between consumption of processed food and obesity, individuals that consume processed foods for 40 percent of daily energy were 37 percent more likely to be obese than individuals who only consumed 15 percent of their daily energy through processed foods (Canella et al., 2014). Additionally, Obesity causes negative health outcomes, including high risk for major cardiovascular diseases. This is caused by increasing high blood pressure and blood cholesterol in the body (World Cancer Research Fund International, 2014). Not only is cardiovascular health affected, but the presence of abdominal fat affects respiratory function and leads to sleep apnea (Shinohara et al., 1997). Respiratory failure, hypoxemia, and pulmonary hypertension are also observed in obese populations (Poulain et al., 2006).

Unhealthy diet is a key factor in the onset of non-communicable illnesses, including cardiovascular disease, cancer, respiratory ailments, and diabetes (Plugge et al., 2014). Consumption of high levels of processed foods increase the risk of non-communicable diseases because of the negative effect on nutrient intake, replacing whole foods with sugar, oil and fats (World Cancer Research Fund International, 2014). Additionally, consumption of processed meats is linked to colon cancer (Goldbohm et al., 1994). A dietary suggestion to protect the digestive system from developing cancer is to eat large amounts of fruits and vegetables (World Cancer Research Fund International, 2014). Additionally, high levels of micronutrients including

folic acid, Vitamin B12, and Vitamin D are recommended to prevent cancer (Donaldson, 2004). However, diets high in saturated fat, trans fat, and sodium increase risk of cardiovascular diseases. This correlation between diet and cardiovascular disease is also echoed in obesity comorbidities (Mokdad et al., 2003). Obesity is highly correlated with diabetes, high blood pressure, high cholesterol, and asthma. A diet high in fruits and vegetables has been linked with decreasing risk of cardiovascular diseases and preventing death from cardiovascular problems (Bazzano, 2002). Fruits and vegetables provide antioxidants and potassium which increase defenses against molecules that damage DNA (Betteridge, 2000; Diplock et al., 1998; Nojiri et al., 2004).

Nutrition and Mental Health

Mental Health and nutrition are correlated; nutrients can cause changes in mood, learning abilities, and memory (Zainuddin & Thuret, 2012). Poor nutrition can also lead to depression and disordered eating (Government of Southern Australia, 2019). Additionally, food insufficiency, an inadequate amount of food intake, is liked to poor mental health in women (Alaimo et al., 1998; Siefert et al., 2004). Gut dysbiosis, an imbalance in the gut bacteria associated with poor diet, causes inflammatory responses of the immune system that can lead to mental illness such as depression, PTSD, bipolar disorder, and schizophrenia (Berk et al., 2013). Additionally, deficiencies of specific micronutrients may increase risk of developing mental illness. Low intake of Omega 3 and deficiencies in Vitamin B12, iron, zinc, and folate are more prevalent in individuals with depression than in those without depression (Bodnar & Wisner, 2005). Mechling (2019) found that implementing an intervention increasing nutrition and physical activity decreased anxiety and depression symptoms in a population with mental illness.

An in-depth analysis of nutrition and mental health revealed that individuals with depression should consume a low-sugar carbohydrate diet to provide lasting effects in positive mood and brain chemistry because sugars only temporarily change mood (Rao et al., 2008). Consumption of highly processed, sugary food leads to these temporary blood sugar changes, creating a risk for depression (Flight et al., 2018). Diets that lack sufficient protein levels can cause low levels of dopamine production, which affects both mood and aggression (Rao et al., 2008). Additionally, Omega-3 depletion is linked to developing depression and decreasing cognitive functioning (Flight et al., 2018; Rao et al., 2008). A Folate deficiency, which is critical to metabolic pathways, has a common symptom of depression. Low levels of iron, magnesium, and zinc lead to anxiety and low mood, which can cause sleep disturbance. Because of the multiple brain pathways affected by micronutrients, meeting nutrition guidelines is important to mental health. One such diet that meets guidelines is the Mediterranean diet, which is a low-fat high-carb diet that prioritizes fish, vegetables, fruit, and dietary fiber (Muñoz et al., 2008). Eating this diet is correlated to positive perceptions of one's mental health.

Prison and Health

Inmates have a sedentary lifestyle; they partake in light physical activity no more than required for daily living (Owen et al., 2010). This influences their nutritional needs, causing calorie requirements that need to match inmates' sedentary lifestyle. Because meals tend to give too many calories to female inmates, they are more likely to be obese than their non-imprisoned counterparts (Herbert et al., 2012). Additionally, both male and female inmates were found to have a sodium intake two to three times the recommended amount and were disproportionately affected by diseases such as diabetes and hypertension. A large proportion of inmates have a chronic illness, which is worsened by prison conditions (Delgadillo, 2018). As of 2012, 43.9% of

inmates had chronic illnesses, including cancer, diabetes, heart problems, high-blood pressure and kidney problems (Maruschak & Berzofsky, 2016). This is staggering given that only 31% of the general population have chronic conditions. Because of the direct tie of nutritional quality to health outcomes, creating healthy meals is important to both the mental and physical health of the inmate population.

Noncommunicable diseases are highly prevalent in prison populations (Plugge et al, 2014). In 2012, 74% of state and federal prisoners and 62% of jail inmates were obese (Wang et al., 2017). This is especially prevalent in female inmate populations, who are more likely to be obese than the general public due to over consumption of energy (Herbert et al., 2012). In contrast, however, male inmates are more likely to underweight than the general public due to being underfed. Gates and Bradford (2015) found that female inmates were gaining significantly more weight than males in prison, due to overconsumption of energy. Compared to the general population, inmates experience much higher rates of hypertension, heart problems, diabetes, and other chronic conditions (Wang et al., 2017). In examining prisoner deaths from 2000 to 2013, over half were caused by cancer or heart disease (Noonan et al., 2015). Furthermore, the mortality rate of inmates from cancer rose every year from 2008 to 2013. 30% of state and federal prisoners experience hypertension, as opposed to only 18% of the general public. Additionally, 10% of prisoners experience heart problems, whereas only 3% of the general public does. In Virginia state, these numbers are even more staggering: 30% of inmates under 55 and 60% of inmates over 55 have a cardiovascular diagnosis (Joint Legislative Audit and Review Commission, 2018). The Virginia prison population also experiences a high number of diabetes diagnosis, 10% of inmates over 55 have diabetes which is much larger than the general population average. Not only does the Virginia incarcerated population have these diseases, but

in 2016, 32 inmates died from cancer and 24 from cardiovascular disease amounting to 62% of all Virginia prison deaths (Weiss, 2018). This is a dramatic increase from the national death rates of around 50% for these two complications (Petrochko, 2012). These staggering differences in noncommunicable diseases between the general public and the incarcerated population showcases the need for a radical change in diet to combat this public health crisis.

Prison inmates are more likely to have a history of mental health issues than the general population, including both psychotic illness and depression (Lewis, 2015). Over 50% of those incarcerated meet the Diagnostic and Statistical Manual for Mental Disorders criteria for having a mental disorder (Dumont et al., 2012). Additionally, the female inmate population experience higher rates of mental illness than their male counterparts (James & Glaze, 2006). In Virginia, 53.4% of female inmates have a serious mental health diagnosis, compared to only 17.7% of male inmates (Joint Legislative Audit and Review Commission, 2018). About 24% of state prison inmates have experienced five or more major depressive symptoms, whereas only 30% have not experienced any symptoms. The specific symptom of persistent sad, numb or empty mood had been experienced by 33% of state inmates in a 12-month period. Furthermore, 56% of all state prison inmates had a mental health problem. Specifically, in Virginia, 20% of the population were diagnosed with a mental illness; however, 27% of Virginia inmates had experienced symptoms of mental illness (Weiss, 2018). While this could be due to selection bias, where inmates are more likely to have mental health issues before incarceration, the conditions faced in prison are undeniably linked to worsening mental health conditions. Many factors of prison life have negative effects on mental health including overcrowding, violence, solitary confinement, isolation from family and friends, lack of meaningful activity, and inadequate mental health care (Beynon & Drew, n.d.). Because of the link between mental health,

specifically depression, and nutrition, diet is important to regulate development of mood disorders and mental health problems. The Bard Prison Initiative in New York has worked to provide fresh food and nutrition education for inmates which has led to a decrease in aggravation in inmates and a decrease in their medical costs (Hirsch, 2013).

Food in Prison

While Virginia prison meal content was not available for analysis, a study by Collins and Thompson (2012) analyzed the South Carolina department of corrections inmate meals. A two-week sample menu revealed that inmates were fed 11% of daily calories from saturated fat alone. All inmates also consumed 53% of daily calories in carbohydrates, 14% from protein, and 33% from fats. Additionally, each meal had 11.3 ounces of grains, but only 1.3 cups of vegetables and 1.1 cups of fruits. In comparison to recommended amounts, inmates were served higher levels of sodium and sugar, but lower levels of fiber, vitamin D, and vitamin E.

Nutritional guidelines vary from state to state but are based in the Dietary Reference Intake data from the National Academies of Sciences (Hardy, 2016). VADOC boasts that inmate meals include vegetables and fruits grown on the 600 acres farmed by inmates (Hausman, 2018). In a response to an 8th amendment lawsuit citing cruel and unusual punishment through poor food quality, the VADOC stated that prison meal content follows dietary recommendations defined by the Food and Nutrition Board of the National Academy of Sciences. Additionally, the Virginia DOC employs a dietician to review meal plans. While the Virginia department of corrections may state this, inmate reports differ from this statement.

Even though there are set standards for meal requirements at the state level, studies have shown that prisons often deviate from meal plans. In Michigan, corrections officers have observed shortages in menu items, resulting in meals deficient in nutrients, with the largest

shortages in protein and complex carbohydrates (Zullo, 2017). Additionally, to cut costs, inmates have received smaller portions than required by menu guidelines. This precedent leads to inadequate nutrition for inmates and vast health concerns.

In Virginia, inmates have argued that the state's DOC does not follow USDA dietary guidelines, serving twice the recommended daily amount of grains, juice to replace the daily fruit requirement, and processed meats deemed by the World Health Organization as carcinogens (Hausman, 2018). During my semester studying prison privatization with inmates at August Correctional facility, anger over the food served was often a topic of discussion. Inmates at Augusta echoed the distain over the food quality served, receiving "meat rock" instead of quality meat products. Inmates describe "meat rock" as non-descript meat product served to substitute real meat. Additionally, inmates reported that when served insufficient calories in the meal, they were given multiple pads of butter to make up for the difference between guidelines and actuality. This is concerning because deficiencies in calories are being made up through unhealthy fats which increase inmates' risk of cardiovascular disease and obesity.

Government Nutritional Guidelines

Examining the Dietary Reference Intake data by the National Academy of Sciences provides a basis for the nutrition requirements of inmate meals. Average suggested daily intake of carbohydrates is 130 grams, protein is recommended at .66 grams per kilogram of body mass, and fats are not determined. Micronutrient amounts suggested for daily intake are included in Table 1. Because this model does not regulate fat allowance, inmate meals often have very high fat content.

Insert Table 1 Here.

While Virginia DOC follows this model, a more comprehensive dietary model of healthy eating habits is in the Dietary Guidelines for Americans 2015-2020. This guideline suggests that for males living a sedentary life, those ages 19 and 20 should receive 2600 calories each day. Males ages 21 to 40 should receive 2400 calories each day, 41 to 60 should receive 2200 calories per day, and those 61 and older should intake 2000 calories. For females living a sedentary life, ages 19 to 25 should eat 2000 calories per day, ages 26 to 50 need 1800 calories a day, and those over 50 should receive 1600 calories each day.

While the Dietary Intake data has specific information on micronutrients, the Dietary guidelines data is specific on categories of foods, including vegetables, fruits, grains, dairy, oils, protein, and other food groups. The information even further breaks down each category into specific recommended food items and quantities for specific calorie goals, shown in table 2 and 3.

Insert Table 2 and 3 Here.

Based on these guidelines, inmates should receive a specific number of calories based on age, and nutrition of meals should be based on the healthy eating guidelines defined by the USDA. The appropriate amount of specific protein, specifically real meats and not processed carcinogens, will regulate the levels of sodium inmates' intake, as well as other micronutrients that are currently in deficiency. A prioritization of vegetables, meeting the requirements of each subsection of specific vegetable groups, will also fill in the deficiencies of micronutrients, specifically vitamins and minerals that come from dark greens. Enforcing meal guidelines that outline meals with these specific nutrient intakes at correctional institutions will increase health of the incarcerated populations.

Budgetary Analysis

Virginia Department of Corrections spent 1.25 billion dollars on prison expenditures in 2018 (Virginia Department of Corrections, 2018). The average amount spent on each prisoner in 2018 was $31,610, with a range between $22,257 and $74,984 depending on facility. In total, direct spending on inmates was 218.5 million dollars. Additionally, 16.7% of operating spending was on medical expenses, which resulted in a cost of 179 million dollars. Per inmate, $7,226 was spent for medical care. To offset these medical costs, the department charged a co-pay to inmates able to afford it for each medical expense, resulting in an income of $534,345. Detention centers that treat mental illness had higher per capita costs because of higher costs in mental health services. In the 2018-2020 Biennium Budget, Virginia planned to spend 35.2 million dollars on increasing access to mental health care (Weiss, 2018).

Health care costs for inmates with diabetes are 2.3 times higher than incarcerated individuals without diabetes (American Diabetes Association, 2013). Housing an older inmate costs three times more than for a younger inmate due to higher rates of chronic conditions (Kinsella, 2004). 13% of Virginia inmates are above the age of 55 (Virginia Department of Corrections, 2018). This geriatric population accounts for 40% of Virginias hospital spending (PEW Charitable Trusts, 2018). By changing diet to substitute white breads and simple carbohydrates with two servings of whole grains each day reduces diabetes risk by 21% (de Munter et al., 2007). Implementing a Mediterranean diet reduces risk of cardiovascular disease by 28% and breast cancer by 35% (Ahmad, 2018; American Association for Cancer Research, 2018). Additionally, adherence to a Mediterranean diet reduces colon and rectal cancer risk by 45%.

Between 2015 and 2016, high cost claims for cardiac problems and heart disease amounted to 4.63 million dollars (Weiss, 2016). Additionally, 9.92 million was paid for cancer

related illnesses. 2,400 of Virginia's inmates receive insulin on a regular basis, which costs 2.17 million each year (Joint Legislative Audit and Review Commission, 2018). By using nutrition to reduce risk and cases of these three non-communicable diseases, Virginia could save 1.3 million dollars on cardiovascular disease care, $45,000 on diabetes care, and 4.46 million dollars on cancer care over time. Additionally, if disease prevalence was reduced to average population percentage, medical costs would be similar to Medicaid spending in Virginia, which for adults is $4,326 per year per person (Henry J Kaiser Family Foundation, 2017). This reduction of $2,900 per individual would result in a savings of 75.6 million dollars per year.

Of direct inmate costs in the prison budget, 10.3% was spent on food and food services. In total on food expenditures, the department spent 22.5 million in 2018, which is broken down into an average of $2.10 per inmate per day resulting in an average per inmate cost of $770 a year (Hausman, 2018; Virginia Department of Corrections, 2018). Rhode Island, the state with the highest spending on prison meals, spends $4.40 per day (Haigh, 2018). While this is still a stark contrast to the $8.12 that the average American spends on food daily, $4.40 a day can increase quality of food significantly (Wagner, 2003). However, in a cost analysis done in Greece, adherence to the Mediterranean diet for men cost on average 25.45 euros each week, which amounts to $28.79 a week (Saulle et al., 2013). For women that cost was 25.63 euros, amounting to $29. Another estimate suggested that the Western diet costs .80 cents less per 1000 calories (Lopez et al., 2009). In the average 2000 calorie diet, an increase between $1.60 and $2.30 a day per inmate in Virginia would substantially increase health quality of inmates and reduce health care costs. This increase would result in spending of 41.9 million per year on food, an increase of 19.4 million from the current food spending. However, 75.6 million savings in

health care costs over time would cover the 19.4 million increase in food spending, as well as save the department 56.2 million dollars overall.

Recidivism

Recidivism directly influences the number of individuals incarcerated, with more than 76 percent of ex-inmates rearrested within five years of release and 83 percent within nine years (NIJ, 2014; Alper et al., 2018). Many programs that have been implemented in prisons have reduced recidivism rates. In Minnesota, work-release programs which allow inmates to work in the community near their release dates are reducing recidivism rates by 17% (Reich, 2017). A California prison implemented a farming system to provide jobs and nutritional food to inmates and saw recidivism rates of 5-10 percent compared to the California average of 60 percent (O'Connor, 2014). A second prison in California switched to a vegan diet program, which 85% of inmates agreed to participate in and saw a dramatic reduction in recidivism rates (Robbins, 2018). While factors outside of prison have been studied in detail, the effect of prison itself has a much smaller body of research. Additionally, while effective programs to create rehabilitative systems that include better nutrition have shown a decrease in recidivism, no research has looked at the mechanisms behind the relationship of nutrition and recidivism.

The prison system in the United States focuses on punishment, not on rehabilitation. Providing inmates with opportunities to better themselves and treating inmates with respect greatly reduces recidivism rates. However, there is political gain to be made through control of the social order in responding to crime (Smith, 2004). Additionally, if the public thinks crime is increasing resulting in a feeling of being unsafe, precedent shows they demand politicians work to reduce crime. Since the 1960s, the "war on crime" has been a popular bipartisan debate topic in politics, with those who push agendas tough on crime coming out as victors (Hinton, 2015).

Because the war on crime targets impoverished and minority communities, politicians overtly undermined and underfunded welfare programs by pushing the agenda that created racist institutions disguised as punishment for those who violated social norms.

This focus on punishment over rehabilitation stems from the idea that prisoners must be kept away from society because they broke social rules and must be punished (Rubin, 2001). However, through a Utilitarian approach, it can be argued that there is a moral obligation to rehabilitate citizens. Because the government's job is to create good citizens who have 'competence, character, and usefulness' towards the goals of the state, it must also rehabilitate those who have broken society's rules (Raynor & Robinson, 2009). Furthermore, the goal of a penal system through a Utilitarian lens is to create community with efficiency, which includes changing the behaviors of individuals who break social laws through rehabilitation so that society functions with maximum efficiency.

In the context of nutrition in prison, there is a rehabilitative component of proper nutrition. Food in itself should not be used as a punitive measure. More importantly, however, is nutrition directly correlates to negative physical and mental health problems. These problems then create barriers towards rehabilitation. By suffering from serious health complications, inmates cannot focus on changing behaviors, but rather are further punished because of a lack of access towards mental health treatment and inability to participate in programs intended to reduce recidivism.

Poor nutrition is not only linked to negative health outcomes, but also to violent and aggressive behavior (Flight et al., 2018). Aggressive behavioral syndrome, which includes symptoms of irritability, impulsivity, and a proneness to violence, can be influenced by deficiencies in multiple vitamins, iron, magnesium, other minerals, and amino acids (Werbach,

1992). These aggressive behavioral symptoms are predictive of future recidivism in inmates, as well as development of mental illness (Salekin et al., 1998; Stanford et al., 2008). Offenders who have a mental illness diagnosis are 15 percent more likely to be rearrested five years after release than those without one (Bales et al., 2017). Additionally, depression in female inmates is highly correlated with recidivism (Zust, 2009). Without proper treatment for mental health problems, recidivism rates are increased (Nissly, 2015). Because nutrition has been linked with mental health issues, a correlation between nutrition and recidivism can be inferred.

The main goal of this paper is to correlate nutrition with both negative health costs and recidivism. While health costs are very explicit, the correlation to recidivism is more nuanced. Recidivism rates are directly correlated to the role of rehabilitation in prison, which is not just influenced by nutrition alone, but also by physical and mental health outcomes. If mental load is consumed by symptoms of depression or anxiety, positive effects from rehabilitative programs cannot be reaped. Prison is intended to rehabilitate individuals to become productive members of communities, not to punish and hide those who break society's rules. Inmates should be able to focus on healing and changing actions, not on coping with worsening mental and physical health. By creating a health crisis in inmate populations through inadequate nutrition, prison officials have created a space where rehabilitation cannot take place and inmates who are released return to their communities more violent and in worse mental health than when they left.

Discussion

Does poor food quality in prisons qualify as cruel and unusual punishment under the 8th amendment? The question lies in whether using food as a punishment violates inmates' rights due to forcing negative health outcomes on a population that does not have autonomy over their eating choices. Inmates in Oregon filed an 8th amendment lawsuit due to being fed from

shipments of food marked ‘not fit for human consumption’ (Woodworth, 2017). Additionally, inmates have argued that nutrition loaf, a meal replacement given for bad behavior that consists of a meal mashed together in a loaf, is cruel and unusual punishment (Barclay, 2014). A judge of the 7th Circuit ruled that if nutraloaf has negative health side effects, such as vomiting and stomach cramps, then it is in violation of the 8th amendment (HG.org, 2019).

From a nutritional standpoint, while prison food does not have to be high quality, it is required to keep inmates healthy by having sufficient nutritional values (HG.org, n.d.). Prison law dictates that prison food can be held in contempt of the 8th amendment if it violates ‘contemporary standards of decency’ (Naim, 2005). Additionally, conditions of food must be known by prison officials prior to consumption. In examining the increase in risk of death through inadequate nutrition, it can be argued that because nutrition is indisputably linked with chronic disease, which may result in death it violates the 8th amendment. This was precedented by the ruling of Estelle v. Gamble which stated that “deliberate indifference to serious medical needs of prisoners” was in contempt of the 8th amendment (Radin, 1977). While courts may interpret this amendment differently, precedent shows that punishment through food is unconstitutional and health outcomes must be taken into account when serving inmate meals.

Female inmates in America are receiving too much energy in their diets, resulting in high levels of obesity. Male inmates, however, receive too few calories, especially from high nutrient foods, leading to nutrient deficiencies. By underfeeding male inmates and overfeeding female inmates, the prison system creates preventable health complications. Inmates have a right to experience imprisonment free of cruel and unusual punishment. It is cruel punishment to serve a diet that officials know does not meet national nutrition guidelines, which then results in

negative health outcomes, including chronic disease and death. Imposing health risks that may result in death is a clear violation of the Constitution.

Not only does poor nutrition violate inmate's rights, but the burden of paying for their health care imposes a significant burden on American taxpayers. For inmates that do not recidivate, many face poverty that results in reliance on government programs, including Medicaid, which is paid for through taxes. By creating negative health outcomes in prison, inmates must bear the burden of health complications out of prison too, and so must the public who pay for social services.

The long-term solution to these problems is fixing the nutrition in inmate meals. Creating diets that contain appropriate caloric intake for an individual's age and lifestyle is important to lowering negative health outcomes. Inmates should be prepared meals that contain an exact number of calories appropriate for each individual, with the proper nutrition recommended. This includes serving whole foods, including unprocessed meats, fresh vegetables, fresh fruit, and whole grain breads. While increasing quality of food is more expensive than current meal costs, the decrease in negative health outcomes resulting in less medical expenses will lower the prison budget over time. Additionally, creating a system that sources foods locally without the influence of large private companies will increase the local labor market, creating and maintaining smaller communities around prisons, and allow for cheaper sourcing of high-quality foods.

While the proposed budget showcases the ability to lower health costs and save the Virginia Department of Corrections a substantial amount of money by increasing spending on food, the mechanisms involved in this change have not been explored. To increase healthy food intake of inmates, a combination of gardens maintained by inmates and a cooperation system with local farmers is recommended. Creating gardening systems provides a low-cost option to

better nutrition. More importantly, it provides a means of rehabilitation through horticultural therapy, skill development for employment after incarceration, and high-quality produce for the prison population's consumption. Cooperation with local farmers reduces privatization of food services in prison and creates more jobs for local workers. Most crucial, however, is that it provides fresh, non-processed foods for inmates, that will help rehabilitation during their prison sentence. Local livestock and produce farmers could work in cooperation with prisons to provide low cost ingredients while also reaping more benefits than selling crops to large companies. Farmers benefit by avoiding the cost of processing, transportation, and packaging fees which makes up 80 percent of mass marketed food's cost, resulting in a mutually beneficial, sustainable means of food sourcing (Ikerd, 2001).

The relationship between inadequate nutrition and health complications is clear; food directly relates to disease and mental illness. Additionally, the relationship between mental illness and recidivism is not contestable; inmates with mental health concerns are more likely to return to prison than those without mental health issues. By reducing recidivism, the power of the industrial prison complex is decreased because there is a smaller incarcerated population. Policy changes must be made in order to create these outcomes; Virginia must follow more comprehensive nutrition guidelines and hold prison officials accountable for implementing them properly. Health autonomy is not something that can be taken from an individual and creating a system of negative health outcomes that increase chance of death is unethical and a form of cruel and unusual punishment. The crisis of mass incarceration is directly affected by the number of inmates who recidivate, and reducing the negative effects associated with recidivism is critical to reducing incarceration rates in America.

References

ACLU. (2019). Mass Incarceration. Retrieved from https://www.aclu.org/issues/smart-justice/mass-incarceration

Ahmad, S., Moorthy, M.V., Demler, O.V., Hu, F.B., Ridker, P.M., Chasman, D.I., & Mora, S. (2018, December 07). Assessment of Risk Factors and Biomarkers Associated With Risk of Cardiovascular Disease Among Women Consuming a Mediterranean Diet. *JAMA Netw Open.* 2018;1(8):e185708

Alaimo, K., Briefel, R. R., Frongillo Jr, E. A., & Olson, C. M. (1998). Food insufficiency exists in the United States: results from the third National Health and Nutrition Examination Survey (NHANES III). *American Journal of Public Health*, *88*(3), 419-426.

American Association for Cancer Research. (2018, July 26). Adherence to healthy diets associated with lower cancer risk: An analysis of four nutritional scores showed biggest benefit from diet that discourages alcohol. *ScienceDaily*. Retrieved March 13, 2019 from www.sciencedaily.com/releases/2018/07/180726162730.htm

American Diabetes Association. (2013). Economic costs of diabetes in the US in 2012. *Diabetes care*, *36*(4), 1033-1046.

Ames, B. N. (1998). Micronutrients prevent cancer and delay aging. *Toxicology letters*, *102*, 5-18.

Bales, W. D., Nadel, M., Reed, C., & Blomberg, T. G. (2017). Recidivism and inmate mental

illness. *International Journal of Criminology and Sociology*, *6*, 40-51.

Barclay, E. (2014, January 02). Food As Punishment: Giving U.S. Inmates 'The Loaf' Persists. Retrieved from https://www.npr.org/sections/thesalt/2014/01/02/256605441/punishing-inmates-with-the-loaf-persists-in-the-u-s

Bazzano, L. A., He, J., Ogden, L. G., Loria, C. M., Vupputuri, S., Myers, L., & Whelton, P. K. (2002). Fruit and vegetable intake and risk of cardiovascular disease in US adults: the first National Health and Nutrition Examination Survey Epidemiologic Follow-up Study. *The American journal of clinical nutrition*, *76*(1), 93-99.

Bendik, I., Friedel, A., Roos, F. F., Weber, P., & Eggersdorfer, M. (2014). Vitamin D: a critical and essential micronutrient for human health. *Frontiers in physiology*, *5*, 248.

Berk, M., Williams, L. J., Jacka, F. N., O'Neil, A., Pasco, J. A., Moylan, S., ... & Maes, M. (2013). So depression is an inflammatory disease, but where does the inflammation come from?. *BMC medicine*, *11*(1), 200.

Betteridge, D. J. (2000). What is oxidative stress?. *Metabolism*, *49*(2), 3-8.

Beynon, J. & Drew, N. (n.d.) Information Sheet. Mental Health and Prisons. Retrieved from: https://www.who.int/mental_health/policy/mh_in_prison.pdf

Bodnar, L. M. & Wisner, K. L. (2005). Nutrition and depression: implications for improving mental health among childbearing-aged women. *Biological psychiatry*, *58*(9), 679-685.

Bray, G. A., Nielsen, S. J., & Popkin, B. M. (2004). Consumption of high-fructose corn syrup in beverages may play a role in the epidemic of obesity. *The American journal of clinical nutrition*, *79*(4), 537-543.

Canella, D. S., Levy, R. B., Martins, A. P. B., Claro, R. M., Moubarac, J. C., Baraldi, L. G., ... &

Monteiro, C. A. (2014). Ultra-processed food products and obesity in Brazilian households (2008–2009). *PloS one*, *9*(3), e92752.

Centers for Disease Control and Prevention. (2017, April 11). Defining Adult Overweight and Obesity | Overweight & Obesity | CDC. Retrieved from https://www.cdc.gov/obesity/adult/defining.html

Centers for Disease Control and Prevention. (2018, April 30). Micronutrient Facts | Nutrition | CDC. Retrieved from https://www.cdc.gov/nutrition/micronutrient-malnutrition/micronutrients/index.html

Collins, S. A., & Thompson, S. H. (2012). What are we feeding our inmates?. *Journal of Correctional Health Care*, *18*(3), 210-218.

Davis, L. M., Bozick, R., Steele, J., Saunders, J., & Miles, J. (2013). Education and vocational training in prisons reduces recidivism, improves job outlook. *Rand Corporation*.

DeFina, R., & Hannon, L. (2013). The impact of mass incarceration on poverty. *Crime & Delinquency*, *59*(4), 562-586.

Delgadillo, N. (2018, February 01). Maggots With a Side of Dirt? What Privitization Does to Prison Food. Retrieved from https://www.governing.com/topics/public-justice-safety/gov-private-food-service-prisons-aramark-trinity-ohio-michigan.html

de Munter, J. S., Hu, F. B., Spiegelman, D., Franz, M., & van Dam, R. M. (2007). Whole grain, bran, and germ intake and risk of type 2 diabetes: a prospective cohort study and systematic review. *PLoS medicine*, *4*(8), e261.

Diplock, A. T., Charuleux, J. L., Crozier-Willi, G., Kok, F. J., Rice-Evans, C., Roberfroid, M., ... & Vina-Ribes, J. (1998). Functional food science and defence against reactive oxidative species. *British Journal of Nutrition*, *80*(S1), S77-S112.

Dixon, J. B. (2010). The effect of obesity on health outcomes. *Molecular and cellular endocrinology*, *316*(2), 104-108.

Donaldson, M. S. (2004). Nutrition and cancer: a review of the evidence for an anti-cancer diet. *Nutrition journal*, *3*(1), 19.

Dumont, D. M., Brockmann, B., Dickman, S., Alexander, N., & Rich, J. D. (2012). Public health and the epidemic of incarceration. *Annual review of public health*, *33*, 325-339.

Flight, H., Marsden, J., & Creaney, s. (2018, September 28). Crime and Nourishment- The Link Between Food and Offending Behaviour. Retrieved from https://theconversation.com/crime-and-nourishment-the-link-between-food-and-offending-behaviour-102791

Flight, H., Marsden, J., & Creaney, S. (2018, October 01). How poor nourishment in prisons can lead to reoffending. Retrieved from https://www.independent.co.uk/life-style/health-and-families/nourishment-crime-related-health-young-people-uk-diet-a8562941.html

Food and Nutrition Board, Institute of Medicine, National Academies, & Food and Nutrition Board, Institute of Medicine, National Academies. (2011). Dietary Reference Intakes (DRIs): estimated average requirements. *National Academies*, *1997*.

Franklin, B., Jones, A., Love, D., Puckett, S., Macklin, J., & White-Means, S. (2012). Exploring mediators of food insecurity and obesity: a review of recent literature. *Journal of community health*, *37*(1), 253-264.

Gates, M. L., & Bradford, R. K. (2015). The impact of incarceration on obesity: are prisoners with chronic diseases becoming overweight and obese during their confinement?. *Journal of obesity*, *2015*.

Goldbohm, R. A., van den Brandt, P. A., van't Veer, P., Brants, H. A., Dorant, E.,

Sturmans, F., & Hermus, R. J. (1994). A prospective cohort study on the relation between meat consumption and the risk of colon cancer. *Cancer research, 54*(3), 718-723.

Government of Southern Australia. (n.d.). The risks of poor nutrition. Retrieved from https://www.sahealth.sa.gov.au/wps/wcm/connect/public content/sa health internet/healthy living/is your health at risk/the risks of poor nutrition

Haigh, S. (2018, April 26). The State That Wants to Spend More, Not Less, on Prison Food. Retrieved from: https://www.usnews.com/news/best-states/connecticut/articles/2018-04-26/the-state-that-wants-to-spend-more-not-less-on-prison-food

Hardy. (2016). Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and Adequate Intakes, Vitamins, by The National Academies of Sciences. Retrieved from http://nationalacademies.org/hmd/~/media/Files/Report%20Files/2019/DRI-Tables-2019/2_RDAAIVVE.pdf?la=en.

Harvard Health Publishing. (2015, May). Iron and your health. Retrieved from https://www.health.harvard.edu/staying-healthy/iron-and-your-health

Harvard School of Public Health. (2017, March 21). Carbohydrates. Retrieved from https://www.hsph.harvard.edu/nutritionsource/carbohydrates/

Harvard School of Public Health. (2019, February 01). Protein. Retrieved from https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/protein/

Hausman, S. (2018, March 22). Virginia Prisoner Sues Over Food Behind Bars. Retrieved from https://www.wvtf.org/post/virginia-prisoner-sues-over-food-behind-bars#stream/0

Henry J Kaiser Family Foundation. (2017, June 09). Medicaid Spending per Enrollee (Full or Partial Benefit). Retrieved from: https://www.kff.org/medicaid/state-indicator/medicaid-spending-per-

enrollee/?currentTimeframe=0&sortModel=%7B%22colId%22:%22Location%22,%22sort%22:%22asc%22%7D

Herbert K, Plugge E, Foster C, Doll H. Prevalence of risk factors for non-communicable diseases in prison populations worldwide: a systematic review. Lancet. 2012;379(9830):1975–1982.

HG.org. (n.d.). Retrieved from https://www.hg.org/legal-articles/can-bad-food-be-a-violation-of-the-eighth-amendment-prohibition-of-cruel-and-unusual-punishment-31521

Hinton, E. (2015, March 20). Why We Should Reconsider the War on Crime. Retrieved from http://time.com/3746059/war-on-crime-history/

Hirsch, J. (2013, August 23). Convict Cultivation: Growing Organic Behind Bars. Retrieved from https://modernfarmer.com/2013/08/growing-organic-behind-bars/

Holick, M. F. (2007). Vitamin D deficiency. *New England Journal of Medicine*, *357*(3), 266-281.

Ikerd, J. (2001). 21st Century Agriculture: The end of the American farm or the new American \ farm?. *a paper presented at Partnerships for Sustaining California Agriculture, Woodland, A*, 27-28.

Institute of Medicine (US). Panel on Dietary Reference Intakes for Electrolytes, & Water. (2005). *DRI, dietary reference intakes for water, potassium, sodium, chloride, and sulfate*. National Academy Press.

James, D. J., & Glaze, L. E. (2006). Highlights mental health problems of prison and jail inmates.

Joint Legislative Audit and Review Commission. (2018, November 03). Spending on Inmate Health Care. Retrieved from: http://jlarc.virginia.gov/pdfs/reports/Rpt511.pdf

Kanoski, S. E., & Davidson, T. L. (2011). Western diet consumption and cognitive impairment: links to hippocampal dysfunction and obesity. *Physiology & behavior*, *103*(1), 59-68.

Larson, N. I., & Story, M. T. (2011). Food insecurity and weight status among US children and families: a review of the literature. *American journal of preventive medicine*, *40*(2), 166-173.

Lewis, A. (2015). Incarceration and Mental Health. Retrieved from https://www.prisonerhealth.org/educational-resources/factsheets-2/incarceration-and-mental-health/

Lopez CN, Martinez-Gonzalez MA, Sanchez-Villegas A, *et al*. (2009). Costs of Mediterranean and western dietary patterns in a Spanish cohort and their relationship with prospective weight change. *Journal of Epidemiology & Community Health* 2009;**63:**920-927

Mobley, L. R., Root, E. D., Finkelstein, E. A., Khavjou, O., Farris, R. P., & Will, J. C. (2006). Environment, obesity, and cardiovascular disease risk in low-income women. *American journal of preventive medicine*, *30*(4), 327-332.

Mokdad, A. H., Ford, E. S., Bowman, B. A., Dietz, W. H., Vinicor, F., Bales, V. S., &] Marks, J. S. (2003). Prevalence of obesity, diabetes, and obesity-related health risk factors, 2001. *Jama*, *289*(1), 76-79.

Mozaffarian, D., Hao, T., Rimm, E. B., Willett, W. C., & Hu, F. B. (2011). Changes in diet and lifestyle and long-term weight gain in women and men. *New England Journal of Medicine*, *364*(25), 2392-2404.

Munoz, M. A., Fito, M., Marrugat, J., Covas, M. I., & Schröder, H. (2008). Adherence to the Mediterranean diet is associated with better mental and physical health. *British Journal of Nutrition*, *101*(12), 1821-1827.

National Institute of Health. (2019, March 19). What are proteins and what do they do? – Genetics Home Reference - NIH. Retrieved from https://ghr.nlm.nih.gov/primer/howgeneswork/protein

National Institute of Justice. (2014, June 17). Recidivism. Retrieved from https://www.nij.gov/topics/corrections/recidivism/pages/welcome.aspx

Naim, C. (2005). Prison food law.

Nissly, E. J. (2015). *The rhetoric of imprisonment: Selections, deflections, and reflections of reality in correctional communication practices*. Western Carolina University.

Nojiri, S., Daida, H., & Inaba, Y. (2004). Antioxidants and cardiovascular disease: Still a topic of interest. *Environmental Health and Preventive Medicine*, *9*(5), 200.

Noonan, M., Rohloff, H., & Ginder, S. (2015). Mortality in local jails and state prisons, 2000-2013–statistical tables. *Bureau of Justice Statistics. available at: http://www. bjs. gov/content/pub/pdf/mljsp0013st. pdf (accessed 22 Aug 2016)*.

O'Connor, L. (2014, May 29). How A Farm-To-Table Program Could Revitalize Prisons. Retrieved from https://www.huffingtonpost.com/2014/05/27/california-inmate-farm-program_n_5400670.html

Olson, C. M. (1999). Nutrition and health outcomes associated with food insecurity and hunger. *The Journal of nutrition*, *129*(2), 521S-524S.

Pencharz, P. B., Elango, R., & Wolfe, R. R. (2016). Recent developments in understanding protein needs–How much and what kind should we eat?. *Applied Physiology, Nutrition, and Metabolism*, *41*(5), 577-580.

Petrochko, C. (2012, June 08). Heart Disease, Cancer Top Killers in U.S. Retrieved from https://www.medpagetoday.com/publichealthpolicy/publichealth/33167

The Pew Charitable Trusts. (2018, July 19). State Prisons and the Delivery of Hospital Care. Retrieved from https://www.pewtrusts.org/en/research-and-analysis/reports/2018/07/19/state-prisons-and-the-delivery-of-hospital-care

Pezeshki, A., Zapata, R. C., Singh, A., Yee, N. J., & Chelikani, P. K. (2016). Low protein diets Produce divergent effects on energy balance. *Scientific reports*, *6*, 25145.

Plugge, E., Martin, R. E., & Hayton, P. (2014). 10. Noncommunicable diseases and prisoners. *Prisons and Health*, *81*.

Poulain, M., Doucet, M., Major, G. C., Drapeau, V., Sériès, F., Boulet, L. P., ... & Maltais, F. (2006). The effect of obesity on chronic respiratory diseases: pathophysiology and therapeutic strategies. *Canadian Medical Association Journal*, *174*(9), 1293-1299.

Prison Food: What Could Happen If Prisoners Ate More Nutritious Food? (2018, October 01). Retrieved from https://foodrevolution.org/blog/prison-food/

Radin, M. J. (1977). Jurisprudence of Death: Evolving Standards for the Cruel and Unusual Punishments Clause. *U. Pa. L. Rev.*, *126*, 989.

Rao, T. S., Asha, M. R., Ramesh, B. N., & Rao, K. J. (2008). Understanding nutrition, depression and mental illnesses. *Indian journal of psychiatry*, *50*(2), 77.

Raynor, P., & Robinson, G. (2009). Why help offenders? Arguments for rehabilitation as a penal strategy. *European Journal of Probation*, *1*(1), 3-20.

Reich, J. (2017, August 17). The Economic Impact of Prison Rehabilitation Programs. Retrieved from https://publicpolicy.wharton.upenn.edu/live/news/2059-the-economic-impact-of-prison-rehabilitation/for-students/blog/news.php

Robbins, O. (Ed.). (2018, September 19). Can Improving Prison Food Help Rehabilitate

Convicts, So They Don't Reoffend? 20 Prisons and Organizations Around The World Are Finding Out. Retrieved from https://foodrevolution.org/blog/prison-food/

Rubin, E. L. (2001). The inevitability of rehabilitation. *Law & Ineq.*, *19*, 343.

Salekin, R. T., Rogers, R., Ustad, K. L., & Sewell, K. W. (1998). Psychopathy and recidivism among female inmates. *Law and human behavior*, *22*(1), 109-128.

Santo, A., & Iaboni, L. (2015, July 07). What's in a Prison Meal? Retrieved from https://www.themarshallproject.org/2015/07/07/what-s-in-a-prison-meal

Saulle, R., Semyonov, L., & La Torre, G. (2013). Cost and cost-effectiveness of the Mediterranean diet: results of a systematic review. *Nutrients*, *5*(11), 4566-4586.

The Sentencing Project. (n.d.). Criminal Justice Facts. Retrieved from https://www.sentencingproject.org/criminal-justice-facts/

Shinohara, E., Kihara, S., Yamashita, S., Yamane, M., Nishida, M., Arai, T., ... & Matsuzawa, Y. (1997). Visceral fat accumulation as an important risk factor for obstructive sleep apnoea syndrome in obese subjects. *Journal of internal medicine*, *241*(1), 11-18.

Skerrett, P. J. (2013). Vitamin B12 deficiency can be sneaky, harmful. *Harvard Health Blog*.

Stanford, M. S., Houston, R. J., & Baldridge, R. M. (2008). Comparison of impulsive and premeditated perpetrators of intimate partner violence. *Behavioral sciences & the law*, *26*(6), 709-722.

State Prisons and the Delivery of Hospital Care. (n.d.). Retrieved from https://www.pewtrusts.org/en/research-and-analysis/reports/2018/07/19/state-prisons-and-the-delivery-of-hospital-care

The state that wants to spend more, not less, on prison food. (2018, April 26). Retrieved from

https://wtop.com/living/2018/04/the-state-that-wants-to-spend-more-not-less-on-prison-food/

Tulchinsky, T. H. (2010). Micronutrient deficiency conditions: global health issues. *Public Health Reviews*, *32*(1), 243.

US Department of Health and Human Services. (2017). *Dietary guidelines for Americans 2015-2020*. Skyhorse Publishing Inc.

Alper, M., Durose, M.R., & Markman, J. (2018, May). 2018 Update on Prisoner Recidivism: A 9-Year Follow-up Period (2005- 2014). Retrieved from: https://www.bjs.gov/content/pub/pdf/18upr9yfup0514.pdf

Virginia Department of Corrections. (2018). Management Information Summary Annual Report For the Fiscal Year Ending June 30, 2018. Retrieved from: https://vadoc.virginia.gov/about/facts/managementInformationSummaries/2018-mis-summary.pdf

Wagner, P. (2003). The prison index. *Publication of the Prison Policy Initiative, Cincinnati, OH*.

Wang, E. A., Redmond, N., Himmelfarb, C. R. D., Pettit, B., Stern, M., Chen, J., ... & Roux, A. V. D. (2017). Cardiovascular disease in incarcerated populations. *Journal of the American College of Cardiology*, *69*(24), 2967-2976.

Weiss, S. (2016, October 05). Medical Care Provided in State Prisons- Study of the Cost. Retrieved from: http://jchc.virginia.gov/4.%20Medical%20Care%20Provided%20in%20State%20Prisons%20CLR.pdf

Werbach, M. (1992). Nutritional influences on aggressive behavior. *J Orthomol Med*, *7*(1), 45-51.

White, J. S. (2008). Straight talk about high-fructose corn syrup: what it is and what it ain't. *The American journal of clinical nutrition*, *88*(6), 1716S-1721S.

Woodworth, W. (2017, May 11). Lawsuit: Inmates at 4 Oregon prisons fed 'not for human consumption' food. Retrieved from https://www.statesmanjournal.com/story/news/crime/2017/05/10/prison-food-spoiled-oregon-not-for-humans/101528742/

World Cancer Research Fund International. (2014). The link between food, nutrition, diet and non-communicable diseases. Retrieved from https://www.wcrf.org/sites/default/files/PPA_NCD_Alliance_Nutrition.pdf

Wylie-Rosett, J., Segal-Isaacson, C. J., & Segal-Isaacson, A. (2004). Carbohydrates and increases in obesity: does the type of carbohydrate make a difference?. *Obesity research*, *12*(S11), 124S-129S.

Zainuddin, M. S. A., & Thuret, S. (2012). Nutrition, adult hippocampal neurogenesis and mental health. *British medical bulletin*, *103*(1), 89.

Zimmermann, M. B., & Hurrell, R. F. (2007). Nutritional iron deficiency. *The lancet*, *370*(9586), 511-520.

Zullo, R. (2017). An Input Adjustment Method for Challenging Privatization: A Case from Michigan Prison Health Services. *Labor Studies Journal*, *42*(2), 85-98.

Zust, B. L. (2009). Partner violence, depression, and recidivism: The case of incarcerated women and why we need programs designed for them. *Issues in mental health nursing*, *30*(4), 246-251.

Appendix A

Nutrient Tables

Table 1. DRI Micronutrient Requirements

Life-Stage Group	Calcium (mg/d)	CHO (g/d)	Protein (g/kg/d)	Vit A (µg/d)[c]	Vit C (mg/d)	Vit D (µg/d)	Vit E (mg/d)[h]	Thiamin (mg/d)	Ribo-flavin (mg/d)	Niacin (mg/d)[i]	Vit B_6 (mg/d)	Folate (µg/d)[f]	Vit B_{12} (µg/d)	Copper (µg/d)	Iodine (µg/d)	Iron (mg/d)	Magnes-ium (mg/d)	Molyb-denum (µg/d)	Phos-phorus (mg/d)	Sele-nium (µg/d)	Zinc (mg/d)
Infants																					
0–6 mo																					
7–12 mo			1.0													6.9					2.5
Children																					
1–3 y	500	100	0.87	210	13	10	5	0.4	0.4	5	0.4	120	0.7	260	65	3.0	65	13	380	17	2.5
4–8 y	800	100	0.76	275	22	10	6	0.5	0.5	6	0.5	160	1.0	340	65	4.1	110	17	405	23	4.0
Males																					
9–13 y	1,100	100	0.76	445	39	10	9	0.7	0.8	9	0.8	250	1.5	540	73	5.9	200	26	1,055	35	7.0
14–18 y	1,100	100	0.73	630	63	10	12	1.0	1.1	12	1.1	330	2.0	685	95	7.7	340	33	1,055	45	8.5
19–30 y	800	100	0.66	625	75	10	12	1.0	1.1	12	1.1	320	2.0	700	95	6	330	34	580	45	9.4
31–50 y	800	100	0.66	625	75	10	12	1.0	1.1	12	1.1	320	2.0	700	95	6	350	34	580	45	9.4
51–70 y	800	100	0.66	625	75	10	12	1.0	1.1	12	1.4	320	2.0	700	95	6	350	34	580	45	9.4
> 70 y	1,000	100	0.66	625	75	10	12	1.0	1.1	12	1.4	320	2.0	700	95	6	350	34	580	45	9.4
Females																					
9–13 y	1,100	100	0.76	420	39	10	9	0.7	0.8	9	0.8	250	1.5	540	73	5.7	200	26	1,055	35	7.0
14–18 y	1,100	100	0.71	485	56	10	12	0.9	0.9	11	1.0	330	2.0	685	95	7.9	300	33	1,055	45	7.3
19–30 y	800	100	0.66	500	60	10	12	0.9	0.9	11	1.1	320	2.0	700	95	8.1	255	34	580	45	6.8
31–50 y	800	100	0.66	500	60	10	12	0.9	0.9	11	1.1	320	2.0	700	95	8.1	265	34	580	45	6.8
51–70 y	1,000	100	0.66	500	60	10	12	0.9	0.9	11	1.3	320	2.0	700	95	5	265	34	580	45	6.8
> 70 y	1,000	100	0.66	500	60	10	12	0.9	0.9	11	1.3	320	2.0	700	95	5	265	34	580	45	6.8
Pregnancy																					
14–18 y	1,000	135	0.88	530	66	10	12	1.2	1.2	14	1.6	520	2.2	785	160	23	335	40	1,055	49	10.5
19–30 y	800	135	0.88	550	70	10	12	1.2	1.2	14	1.6	520	2.2	800	160	22	290	40	580	49	9.5
31–50 y	800	135	0.88	550	70	10	12	1.2	1.2	14	1.6	520	2.2	800	160	22	300	40	580	49	9.5
Lactation																					
14–18 y	1,000	160	1.05	885	96	10	16	1.2	1.3	13	1.7	450	2.4	985	209	7	300	35	1,055	59	10.9
19–30 y	800	160	1.05	900	100	10	16	1.2	1.3	13	1.7	450	2.4	1,000	209	6.5	255	36	580	59	10.4
31–50 y	800	160	1.05	900	100	10	16	1.2	1.3	13	1.7	450	2.4	1,000	209	6.5	265	36	580	59	10.4

Note. Reprinted from Dietary Reference Intakes (DRIs): Recommended Dietary Allowances and Adequate Intakes, Vitamins, by The National Academies of Sciences. Retrieved from http://nationalacademies.org/hmd/~/media/Files/Report%20Files/2019/DRI-Tables-2019/2_RDAAIVVE.pdf?la=en. 2019.

Table 2. Food Recommendations for Differing Calorie Intake Suggestions

Calorie Level of Pattern[a]	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Food Group[b]	**Daily Amount[c]** of Food From Each Group (vegetable and protein foods subgroup amounts are per week)											
Dairy	2 c-eq	2½ c-eq	2½ c-eq	3 c-eq	3 c-eq	3 c-eq	3 c-eq	3 c-eq	3 c-eq	3 c-eq	3 c-eq	3 c-eq
Protein Foods	2 oz-eq	3 oz-eq	4 oz-eq	5 oz-eq	5 oz-eq	5½ oz-eq	6 oz-eq	6½ oz-eq	6½ oz-eq	7 oz-eq	7 oz-eq	7 oz-eq
Seafood (oz-eq/wk)	3	4	6	8	8	8	9	10	10	10	10	10
Meats, Poultry, Eggs (oz-eq/wk)	10	14	19	23	23	26	28	31	31	33	33	33
Nuts Seeds, Soy Products (oz-eq/wk)	2	2	3	4	4	5	5	5	5	6	6	6
Oils	15 g	17 g	17 g	22 g	24 g	27 g	29 g	31 g	34 g	36 g	44 g	51 g
Limit on Calories for Other Uses, Calories (% of Calories)[e,f]	150 (15%)	100 (8%)	110 (8%)	130 (8%)	170 (9%)	270 (14%)	280 (13%)	350 (15%)	380 (15%)	400 (14%)	470 (16%)	610 (19%)

Note. Reprinted from Healthy U.S.-Style Eating Pattern: Recommended Amounts of Food From Each Food Group at 12 Calorie Levels, United States Department of Agriculture. Retrieved from https://health.gov/dietaryguidelines/2015/resources/2015-2020_dietary_guidelines.pdf. 2015.

Table 3. Food Recommendations for Differing Calorie Intake Suggestions

Calorie Level of Pattern[a]	1,000	1,200	1,400	1,600	1,800	2,000	2,200	2,400	2,600	2,800	3,000	3,200
Food Group[b]	**Daily Amount[c] of Food From Each Group (vegetable and protein foods subgroup amounts are per week)**											
Vegetables	**1 c-eq**	**1½ c-eq**	**1½ c-eq**	**2 c-eq**	**2½ c-eq**	**2½ c-eq**	**3 c-eq**	**3 c-eq**	**3½ c-eq**	**3½ c-eq**	**4 c-eq**	**4 c-eq**
Dark-Green Vegetables (c-eq/wk)	½	1	1	1½	1½	1½	2	2	2½	2½	2½	2½
Red & Orange Vegetables (c-eq/wk)	2½	3	3	4	5½	5½	6	6	7	7	7½	7½
Legumes (Beans & Peas) (c-eq/wk)	½	½	½	1	1½	1½	2	2	2½	2½	3	3
Starchy Vegetables (c-eq/wk)	2	3½	3½	4	5	5	6	6	7	7	8	8
Other Vegetables (c-eq/wk)	1½	2½	2½	3½	4	4	5	5	5½	5½	7	7
Fruits	**1 c-eq**	**1 c-eq**	**1½ c-eq**	**1½ c-eq**	**1½ c-eq**	**2 c-eq**	**2 c-eq**	**2 c-eq**	**2 c-eq**	**2½ c-eq**	**2½ c-eq**	**2½ c-eq**
Grains	**3 oz-eq**	**4 oz-eq**	**5 oz-eq**	**5 oz-eq**	**6 oz-eq**	**6 oz-eq**	**7 oz-eq**	**8 oz-eq**	**9 oz-eq**	**10 oz-eq**	**10 oz-eq**	**10 oz-eq**
Whole Grains[d] (oz-eq/day)	1½	2	2½	3	3	3	3½	4	4½	5	5	5
Refined Grains (oz-eq/day)	1½	2	2½	2	3	3	3½	4	4½	5	5	5

Note. Reprinted from Healthy U.S.-Style Eating Pattern: Recommended Amounts of Food From Each Food Group at 12 Calorie Levels, United States Department of Agriculture. Retrieved from https://health.gov/dietaryguidelines/2015/resources/2015-2020_dietary_guidelines.pdf. 2015.