



# **FRUIT & VEGETABLE GAP ANALYSIS**

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Bridging The Disparity Between Federal Spending  
& America's Consumption Crisis

**FULL REPORT**



## About The Produce for Better Health Foundation

Produce for Better Health Foundation (PBH), a nonprofit 501(c)(3), is the only national organization dedicated to helping consumers live happier, healthy lives by eating more fruits and vegetables, including fresh, frozen, canned, dried and 100% juice, every single day.

Since 1991, PBH has invested in developing trended insights on attitudes toward all forms of fruit and vegetable consumption, in addition to campaigns and partnerships with government, food industry stakeholders, health professionals and other thought leaders to collaborate, facilitate and advocate for increased intake. Campaigns included first, the 5-A-Day program, and then, the Fruits & Veggies—More Matters public health initiative. While five fruits and vegetables each day is great advice, and more will always matter, PBH's new behavior-based call-to-action is Have A Plant®. Rooted in behavioral science, PBH's transformative Have A Plant® Movement is an invitation that will inspire people with compelling reasons to believe in the powerful role fruits and vegetables can play to create happy, healthy and active lives.

Be sure to join the Have A Plant® Movement and get new recipes, snack hacks, meal ideas and other tips from chefs, registered dietitians, as well as food and wellness experts by visiting [www.fruitsandveggies.org](http://www.fruitsandveggies.org). Follow us on Facebook @fruitsandveggies; on Twitter @fruits\_veggies; on Instagram @fruitsandveggies; on Pinterest @fruits\_veggies; and on LinkedIn at Produce for Better Health Foundation. And remember to #haveaplant.

PBH is also responsible for the Lead The Change Collaborative Consumption Campaign – a multi-sector, multi-year initiative designed to maximize the power of PBH's unique thought leadership position, widespread influencer network, credible scientific and market research, and, most importantly, its innovative members and partners, to lead a call-to-action for addressing the global fruit and vegetable consumption crisis. The initiative includes research, thought leadership and communication platforms to ensure stakeholders speak with One Purpose, One Voice and One Call-to-Action for maximum impact. For more information about the Lead The Change campaign visit: [www.fruitsandveggies.org/lead-the-change](http://www.fruitsandveggies.org/lead-the-change).



## About Nutrition On Demand

Nutrition On Demand (NOD) is a Washington, DC-based food and nutrition affairs consulting firm specializing in building and translating scientific evidence; navigating policy; and creating compelling communications strategies for various audiences. NOD's multidisciplinary team of registered dietitian nutritionists and communication experts has extensive expertise in *Dietary Guidelines for Americans* development and implementation, food assistance programs, government relations, coalition-building, influencer partnerships, thought leadership and stakeholder

engagement, research and evaluation, omnichannel marketing, food retail, school nutrition, technology, and consumer and marketplace trend analysis and application. NOD delivers exemplary, strategic support and flawless execution by bringing energy, expertise, and excellence to every client partnership. Visit [www.nutritionondemand.net](http://www.nutritionondemand.net) for policy and implementation insights on demand from talented food and nutrition affairs experts today. Follow us on LinkedIn at Nutrition On Demand and Instagram @nutritionondemand.

## Special Recognition

The Produce for Better Health Foundation (PBH) and Nutrition On Demand (NOD) teams are grateful for the significant contributions provided by the National Fruit & Vegetable Consumption Coalition (NFVCC), as well as all stakeholders who offered meaningful perspectives and supporting

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## CHAPTER 1

# INTRODUCTION

### The opportunity is NOW to elevate fruit & vegetable consumption as a national priority.

Growing evidence demonstrates the significant impact of poor diet on overall health and disease risk. Americans are currently at a heightened risk for developing chronic diseases as a result of poor diet, physical inactivity, and other increasingly prevalent upstream drivers of health. Overweight and obesity are of significant public health concern due to rising prevalence, health consequences, and associated healthcare costs. In fact, 16 states had rates of adult obesity at or above 35% in 2020 compared to 12 states in 2019.<sup>1</sup> Social and economic factors related to obesity have been exacerbated by the COVID-19 pandemic. Sadly, those with diet-related diseases have been 12 times more likely to die of COVID infection compared to those who do not.<sup>2</sup>

In 2021, the United States (U.S.) Government Accounting Office (GAO) released a report, commissioned by Congress, reviewing 21 agencies' 200 efforts to improve diet quality and reduce the risk of chronic diseases. Ultimately, the GAO report found that federal government efforts were fragmented and duplicative. Specifically, the report stated that "A federal strategy for diet-related efforts could provide sustained leadership and result in improved, cost-effective outcomes for reducing Americans' risk of diet-related chronic health conditions."<sup>2</sup>

Fruits and vegetables are well-established in the scientific literature and in U.S. policy as the cornerstone of healthy eating patterns, yet underconsumption of these food groups remains rampant. Low intakes of fruits and vegetables among all age groups not only contribute to low Healthy Eating Index (HEI) scores (a measure of dietary quality), but also chronic health conditions, such as heart disease, cancer, and stroke and, ultimately, deaths. The *Dietary Guidelines for Americans* (DGA) consistently recognize strong evidence that healthy eating patterns include recommended amounts of fruits and vegetables.<sup>3</sup> Further, dietary patterns scoring high in fruits and vegetables are associated with more favorable outcomes related to body weight and risk of obesity.<sup>4</sup> Finally, the nutrient and bioactive content of fruits and vegetables is correlated with their health-promoting effects, such as reduced inflammation.<sup>5</sup>



In addition to too little fruits and vegetables, the typical American dietary pattern consists of too much saturated fat, sodium, and added sugars, and too little fiber, potassium, and healthy oils, as well as other key nutrients and dietary components recommended by the DGA. This has led the United States Department of Agriculture (USDA) Economic Research Service (ERS) to proclaim that "U.S. diets are out of balance with federal recommendations."<sup>2,6</sup>

The goal, as defined by the DGA and MyPlate, is to "make half your plate fruits and vegetables." Yet, 90% of Americans do not eat enough vegetables and 80% under consume fruit.<sup>7</sup> The average adult consumes 1.6 cups of vegetables, compared to the recommended 2 to 4 cups/day of vegetables, and 0.9 cups of fruit compared to the recommended 1 ½ to 2 ½ cups/day of fruit.<sup>7,8,9</sup> While there are many different methods and sources to measure fruit and vegetable intake, directionally, all data point to the importance of consumption and the concerning lack of intake among Americans.



The Food and Agriculture Organization (FAO) of the United Nations (UN) declared 2021 as “The Year of Fruits and Vegetables,” calling fruits and vegetables “dietary essentials” and marked this designation as “a unique opportunity to raise awareness on the important role of fruits and vegetables in human nutrition, food security, and health and as well in achieving UN Sustainable Development Goals.” As such, it is critically important to determine how the U.S. can positively impact chronic disease prevention and health promotion by supporting increased fruit and vegetable intake.

More closely aligning fruit and vegetable consumption with dietary recommendations in the U.S. is a complex prospect, and, there is no one-size-fits-all approach. Successfully and sustainably improving fruit and vegetable intake will require a comprehensive, systems-based approach that is widely accepted and adopted by multiple sectors.

**We can no longer treat inadequate fruit and vegetable consumption as “business as usual.” Rather, improving fruit and vegetable behaviors should be central to every diet-related public health initiative.**

## DIET-RELATED DISEASE RATES & COST <sup>2,10,11,12</sup>

### ADULT OBESITY

Forty-two percent of U.S. adults — approximately 100 million — have obesity. Prevalence of adult obesity has increased 12% since 1999-2000. Further, severe obesity almost doubled over the same period from 4.7% to 9.2%. Obesity occurs disproportionately in communities of color, with non-Hispanic Black adults having the highest rates (49.6%), followed by Hispanic adults (44.8%).

### CHILDHOOD OBESITY

In 2017-2018, 19.3% of children and adolescents could be classified as having obesity, with an obesity prevalence of 13.4% in children aged 2 to 5 years. As with adults, levels of childhood obesity tend to be highest among Hispanic children (25.6%) and non-Hispanic Black children (24.2%).

### DIET-RELATED CHRONIC DISEASE DEATHS

Cardiovascular diseases, cancer, and diabetes accounted for half of all annual deaths in the U.S. (about 1.5 million deaths) in 2018. People living in southern states, men, and Black Americans have disproportionately higher mortality rates than those living in other regions, women, and other races.

### COST

Government spending, including Medicare and Medicaid, to treat cardiovascular disease, cancer, and diabetes accounted for 54% of the \$383.6 billion in healthcare spending to treat these conditions.

This *Fruit & Vegetable Gap Analysis: Bridging The Disparity Between Federal Spending & America’s Consumption Crisis*, conducted by the Produce for Better Health Foundation (PBH) in partnership with Nutrition On Demand (NOD), seeks to examine how government funding and programming can be an asset and opportunity to better equip and empower Americans to increase consumption of fruits and vegetables, as well as adopt eating patterns that more closely resemble those recommended by the *Dietary Guidelines for Americans*.

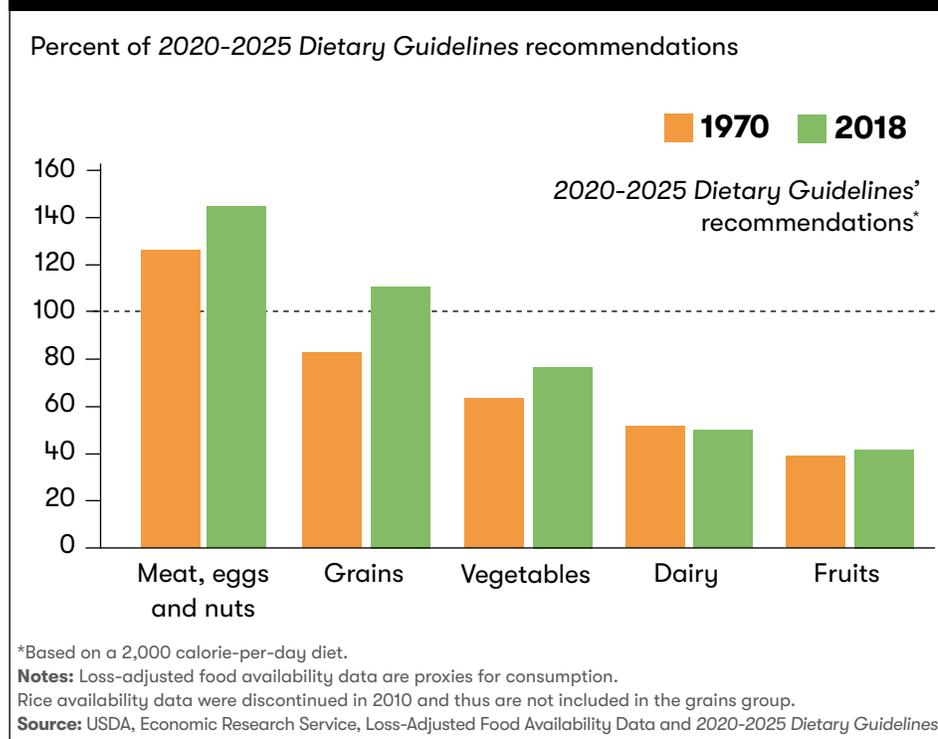
This report is rooted in the *2010 Gap Analysis* and *2015 Gap Analysis* produced by PBH, yet does not directly replicate the previous studies at all points as data sources and the current environment warrant a fresh look regarding methodology. It does, however, focus on the same federal departments and agencies, based on their significant responsibility for improving diet quality. It highlights appropriations (budgeted amounts) and authorizations (legal authority) for programs that promote increased consumption. It is not designed to delve into state funding, and the variability therein.

When possible, in this report, the data were standardized by averaging 2018 and 2019 fiscal year data to create a composite on which to evaluate spending and make recommendations. One major limitation should be noted: across federal government funding and agency spending, fruits and vegetables, in most cases, are not specifically earmarked. Subsequent chapters explore federal funding and associated programs from the following departments and agencies: U.S. Department of Agriculture (USDA), the Centers for Disease Control and Prevention (CDC), and National Institutes of Health (NIH). This report strives to be as transparent and detailed as possible for replication purposes.

It should also be noted that the consumption data used for this analysis are from before the COVID-19 pandemic. It remains to be seen how this long-term public health emergency will affect eating patterns into the future, if at all.

**Federal funding and programming are essential to close the current consumption gap, ensuring all Americans have equitable access and actionable education to enjoy fruits and vegetables easily and often.**

**FIGURE 1.1: ESTIMATED AVERAGE U.S. CONSUMPTION COMPARED TO RECOMMENDATIONS, 1970 & 2018**



**U.S. DIETS ARE OUT OF BALANCE WITH FEDERAL RECOMMENDATIONS**

While individuals in the U.S. are consuming more fruits and vegetables than in 1970, the average U.S. diet still falls short of the recommendations in the *2020-2025 Dietary Guidelines for Americans* for these major food groups. On average, 2018 consumption of vegetables, dairy, and fruits fell far short of recommendations, with few increases compared to other food groups. In 2019, the Behavioral Risk Factor Surveillance System (BRFSS), which assesses health-related data at the state level, found that about 12% of adults met recommendations for fruits and only 10% did so for vegetables.<sup>13</sup>

## CHAPTER 2

# EVALUATING THE FRUIT & VEGETABLE CONSUMPTION CRISIS

## METHODOLOGICAL CONSIDERATIONS

To quantify the gap between fruit and vegetable consumption and recommendations, as well as track progress toward improvement, it is necessary to begin with empirical measurement. To do that, it is helpful to ground the discussion in how we measure fruit and vegetable consumption and what constitutes a crisis. For this analysis, produce consumption was examined from the perspective of four different measures: 1) volume (how much the population is consuming overall, as well as by age, sex, racial/ethnic background, and income); 2) frequency (number of fruit and vegetable eating occasions during an average day, week or year); 3) types of produce consumed (specific fruits and vegetables, in all forms, consumed by volume and frequency); and 4) sales data. While sales of fruits and vegetables do not necessarily equate to consumption, sales data are the measure in which we currently have post-COVID values indicating potential changes in consumer purchasing behaviors since 2020. Together, the above measures provide significant insights into current, as well as historical, eating patterns and can illuminate the most effective ways to improve fruit and vegetable consumption behaviors moving forward.

## OVERALL CONSUMPTION VOLUME

The average adult consumes 1.6 cups, of the recommended 2 to 4 cups/day of vegetables, and 0.9 cups of the recommended 1 ½ to 2 ½ cups/day of fruit.<sup>7,8,9</sup> Across all age groups, the average American consumes just under 1 cup of fruit and 1 ½ cups of vegetables per day, about half the daily recommended amount (Table 2.1).<sup>14</sup> All fruit and vegetable intake recommendations can be found in Table 2.2. Total fruit intake remains fairly consistent, regardless of age, with the exception of 2-5 year olds who consume more (1.6 cup equivalent/day for males and 1.5 cup equivalent/day for females) than average. Males consume slightly more total fruit and fruit juice than females. Generally speaking, total vegetable intake increases as individuals age with the lowest consumption seen among young children and highest among older adults. Most notably, intake of fruit and vegetables did not significantly change between the 2003-2004 and 2017-2018 National Health and Nutrition Examination Survey (NHANES) survey periods.<sup>14</sup>

Other vegetables (a MyPlate subgroup consisting of vegetables that cannot be classified as red/orange; beans, peas, and lentils; dark-green; or starchy) contribute the most to total vegetable intake (0.5 cup equivalent/day), followed by starchy and red/orange vegetables (0.4 cup equivalent/day for both). Dark-green vegetables (0.1 cup equivalent/day) and legumes (0.1 cup equivalent/day) contribute the least to total vegetable intake for both males and females across all age groups, with the exception of females aged 40-49 years who consume just as much dark green vegetables as starchy and red/orange vegetables (0.4 cup equivalent/day of each).<sup>15</sup>

### MYPLATE FOOD GROUPS<sup>3</sup>

**Fruits:** Includes all forms (fresh, frozen, canned, or dried and 100% juice); may be whole, cut-up, pureed, or cooked

**Vegetables:** Includes all forms (fresh, frozen, canned, dried and 100% juice); may be raw or cooked, whole, cut-up, or mashed

#### Vegetable Subgroups:

Based on nutrient content, vegetables are grouped by color and recommended in weekly amounts (dark green; red and orange; beans, peas, and lentils; starchy; and other vegetables)

**Grains:** Includes any food made from wheat, rice, oats, cornmeal, barley, or other cereal grains

**Grain Subgroups:** Refined grain or whole grain, based on whether the entire grain kernel (bran, germ, endosperm) is intact

**Protein:** Includes foods made from seafood; meat, poultry, and eggs; beans, peas, and lentils; and nuts, seeds, and soy products

**Dairy:** Includes milk, yogurt, and cheese, as well as lactose-free milk and fortified soy milk and yogurt

The Produce for Better Health Foundation (PBH) conducts its *State Of The Plate: America's Fruit & Vegetable Consumption Trends* report every five years, and for the first time, the 2020 report addressed consumption of fruits and vegetables by volume. The *State of the Plate* report utilizes The NPD Group's National Eating Trends (NET<sup>®</sup>) database for both data collection and analysis. While there were some limitations in The NPD Group's volume measurement methodology in that only fruits and vegetables eaten "as is" could be captured (versus

as an ingredient or in addition to another dish), its fruit and vegetable volume consumption data are notably consistent with consumption amounts measured in the 2017-2018 NHANES. For instance, the *PBH State Of The Plate* research shows average consumption of fruit at less than one eating occasion per day, with the average amount consumed per occasion at just less than one cup, and average consumption of vegetables as one eating occasion per day, with the average amount consumed at one time as 1.4 cups.<sup>16</sup>

**TABLE 2.1: AVERAGE DAILY AMOUNT (VOLUME) OF FRUITS & VEGETABLES EATEN (IN CUP EQUIVALENTS/DAY) AMONG AGE GROUPS<sup>15</sup>**

AGE	2+ YEARS	2-19 YEARS		20+ YEARS	
Sex	All Americans	Male	Female	Male	Female
Total Fruit	0.9	1.1	1.1	0.9	0.8
Fruit juice	0.2	0.4	0.3	0.2	0.2
Total Vegetables*	1.5	0.9	1.0	1.7	1.6
Starchy	0.4	0.3	0.3	0.5	0.4
Red/orange	0.4	0.3	0.2	0.4	0.4
Dark green	0.1	0.1	0.1	0.1	0.2
Other	0.5	0.2	0.2	0.6	0.6
Legumes	0.1	0.1	0.1	0.1	0.1

\*Legumes included in total vegetable intake for consistency with MyPlate.<sup>7</sup>

**TABLE 2.2: DAILY FRUIT & VEGETABLE RECOMMENDATIONS (IN CUP EQUIVALENTS/DAY)**

	AGE	FRUITS <sup>9</sup>	VEGETABLES <sup>10</sup>
<b>Toddlers</b>	12 - 23 months	½ - 1	⅔ - 1
<b>Children</b>	2 - 4 years	1 - 1½	1 - 2
	5 - 8 years	1 - 2	1½ - 2½
<b>Girls</b>	9 - 13 years	1½ - 2	1½ - 3
	14 - 18 years	1½ - 2	2½ - 3
<b>Boys</b>	9 - 13 years	1½ - 2	2 - 3½
	14 - 18 years	2 - 2½	2½ - 4
<b>Women</b>	19 - 30 years	1½ - 2	2½ - 3
	31 - 59 years	1½ - 2	2 - 3
	60+ years	1½ - 2	2 - 3
<b>Men</b>	19 - 30 years	2 - 2½	3 - 4
	31 - 59 years	2 - 2½	3 - 4
	60+ years	2	2½ - 3½

## THE CLASSIFICATION OF LEGUMES IN NHANES DATA

When considering NHANES data, it is important to note that legumes are not included in total vegetables. This is because legumes can contribute to both vegetable and protein intake. Therefore, these data are captured separately and categorized as "legumes as vegetable (cups)" and "legumes as protein (oz)." The text and tables in this report include the data for legume intakes counted as vegetable in total vegetables, as they contribute to meeting vegetable recommendations in MyPlate and the USDA eating patterns.

## Fruits

All forms of fruit (fresh, frozen, canned, dried, and 100% juice) count as fruit in a healthy dietary pattern according to the DGA. When considering the volume of total fruit consumed by race and ethnicity, non-Hispanic Asians consume the most (1.3 cup equivalent/day), followed by Hispanics (1.2 cup equivalent/day); while non-Hispanic whites and non-Hispanic Blacks consume less than 1 cup equivalent daily (Table 2.3).

The DGA recommend that at least half of fruit recommendations be consumed as whole fruit. Fruit juice contributes more (0.3 cup equivalent/day) to total fruit intake among non-Hispanic Blacks and Hispanics, with intake being highest among 2-5 year olds (0.8 cup equivalent/day and 0.6 cup equivalent/day, respectively). Fruit juice accounts for an average of 0.2 cup equivalent per day for non-Hispanic whites and Asians. Two to five year olds consume the most fruit juice among non-Hispanic whites (0.6 cup equivalents /day), while 12-19 year olds have the highest intake of fruit juice among non-Hispanic Asians (0.5 cup equivalents/day).<sup>15</sup>

## Vegetables

According to 2017-2018 NHANES data, intake of vegetables is highest among non-Hispanic Asians (1.8 cup equivalents/day) followed by non-Hispanic whites (1.5 cup equivalents/day) and Hispanics (1.5 cup equivalents/day) (Table 2.3). Non-Hispanic Blacks have the lowest daily intake of vegetables (1.2 cup equivalents/day).

For all race/ethnic groups, intake of vegetables increases with age. Intake of dark green vegetables (0.2 cup equivalents/day) is highest among non-Hispanic Asians with every other race/ethnic group consuming 0.1 cup equivalents/day. Hispanics and non-Hispanic Asians consume more legumes (0.2 cup equivalents/day) than non-Hispanic Blacks and whites (0.1 cup equivalents/day). Other vegetables contribute the most to total vegetable intake among non-Hispanic Asians (0.7 cup equivalents/day), non-Hispanic whites (0.5 cup equivalents/day), and Hispanics (0.5 cup equivalents/day); while starchy vegetables contribute the most for non-Hispanic Blacks (0.5 cup equivalents/day).<sup>15</sup>

**TABLE 2.3: AVERAGE DAILY AMOUNT (VOLUME) OF FRUITS & VEGETABLES EATEN (IN CUP EQUIVALENTS/DAY) AMONG RACE/ETHNIC GROUPS (AGES 2+ YEARS)<sup>14,15</sup>**

RACE/ETHNIC GROUP	HISPANIC	NON-HISPANIC ASIAN	NON-HISPANIC BLACK	NON-HISPANIC WHITE
Total Fruit	1.2	1.3	0.9	0.8
Fruit Juice	0.3	0.2	0.3	0.2
Total Vegetables*	1.5	1.8	1.3	1.5
Starchy	0.4	0.4	0.5	0.4
Red/orange	0.4	0.4	0.3	0.4
Dark green	0.1	0.2	0.1	0.1
Other	0.5	0.7	0.3	0.5
Legumes	0.2	0.2	0.1	0.1

\*Legumes included in total vegetable intake for consistency with MyPlate.



Vegetable consumption increases with household income. Individuals aged 2+ years living in households with income below 131 percent of the poverty level, referred to as “very low income”, consume lower amounts of total fruit (0.9 cup equivalents/day) and total vegetables (1.3 cup equivalents/day) than individuals living in households with income above 350 percent of poverty (1.0 cup equivalents/day and 1.7 cup equivalents/day, respectively). Fruit juice contributes more to fruit intake among those living in very low income households (0.3 cup equivalents/day) than those living in households with income above 350 percent of poverty (0.2 cup equivalents/day).<sup>15</sup>

Individuals living in households above 350 percent poverty consume the most dark green (0.2 cup equivalents/day), red/orange (0.4 cup equivalents/day), and other vegetables (0.6 cup equivalents/day). Intakes of the dark green subgroup and red/orange vegetable subgroup among lower income groups are 0.1 cup equivalents/day and 0.3 cup equivalents/day, respectively. Intake of starchy vegetables ranges from 0.4 to 0.5 cup equivalents/day among the various family income levels, with potatoes contributing more than other starchy vegetables. Individuals living in households with very low income consume the lowest number of other vegetables (0.4 cup equivalents/day); and those living between 131 and 350 percent of the poverty level consume 0.5 cup equivalents/day. Intake of legumes as vegetables is consistent across all household income levels (0.1 cup equivalents/day).<sup>15</sup>

## OVERALL CONSUMPTION FREQUENCY

Frequency data provides invaluable information about fruit and vegetable habits among Americans as a population and by key demographic groups. Alarming, it appears that fruit and vegetable eating occasions have been consistently declining over time, potentially indicating an erosion of fruit and vegetable eating habits.

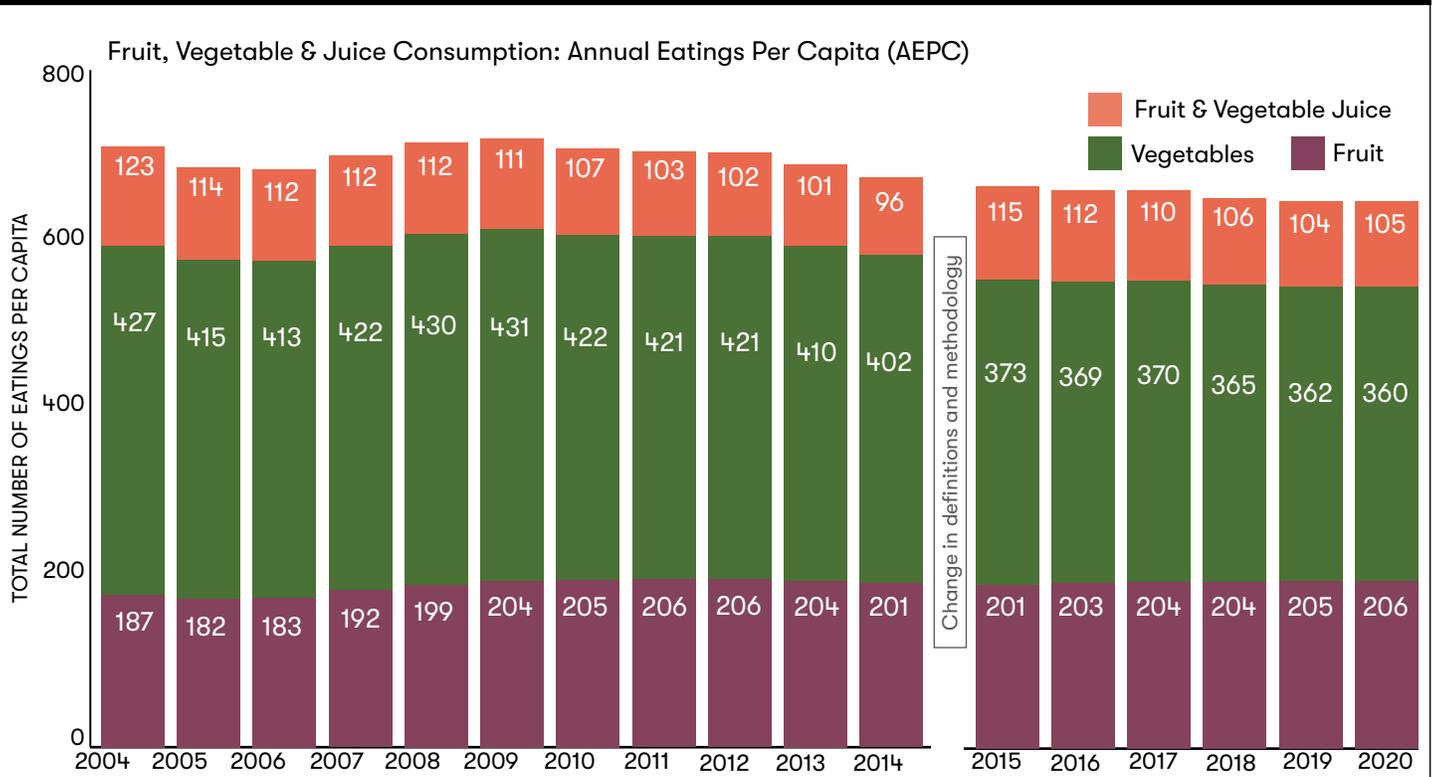
The *PBH State Of The Plate* research indicates that Americans reported 671 annual eating and drinking occasions that contained fruit, vegetable, or juice (approximately 13 eating/drinking occasions weekly) (Figure 2.1). While fruit occasions slightly increased by 3%, between 2015 and 2020, vegetable and juice occasions decreased 4% and 8% respectively, resulting in a 3% net decrease of fruit and vegetable eating/drinking occasions.<sup>16</sup>

The longer-term trend is even more concerning. Fruit and vegetable consumption frequency decreased nearly 10% between 2004 and 2020, with vegetable eating occasions down 16% and juice occasions down 15% over the same time period.<sup>16</sup>

Infrequent consumption of fruits and vegetables, as well as decreasing intake over time, appear to be secondary to two larger issues: 1) the greatest proportion of Americans are either low frequency fruit and vegetable eaters or non-eaters, with medium and high frequency fruit and vegetable eaters making up a minority of eaters overall; and 2) over time, historically high frequency eaters of fruits and vegetables have been consuming them less often.

The *PBH State Of The Plate* research classified consumers as low, medium or high frequency eaters, based on weekly eating occasions. As stated above, the majority of consumers fell into the “low” consumption category. For instance, among consumers who ate or drank any fruits, vegetables, or juice during the week, nearly 60% of the population were “low” frequency eaters (defined as 1-13 eating occasions of fruits, vegetables, and/or juice per week). Conversely, “high” frequency eaters (those with 22 or more eating or drinking occasions per week) comprised less than 15% of the total consuming population.<sup>16</sup>

FIGURE 2.1 FREQUENCY OF FRUIT, VEGETABLE & JUICE INTAKE<sup>16</sup>



**% Change In Frequency**

**2015 vs. 2020**

- Total Consumption -3% (-18 eatings)
- Total Fruit & Vegetable Juice -8% (-10 drinkings)
- Total Vegetable -4% (-13 eatings)
- Total Fruit +3% (+5 eatings)

**2015 vs. 2020**

- Total Consumption -9% (-66 eatings)
- Total Fruit & Vegetable Juice -5% (-18 drinkings)
- Total Vegetable -16% (-67 eatings)
- Total Fruit +10% (+10 eatings)

Source: PBH State Of The Plate: America's Fruit & Vegetable Consumption Trends



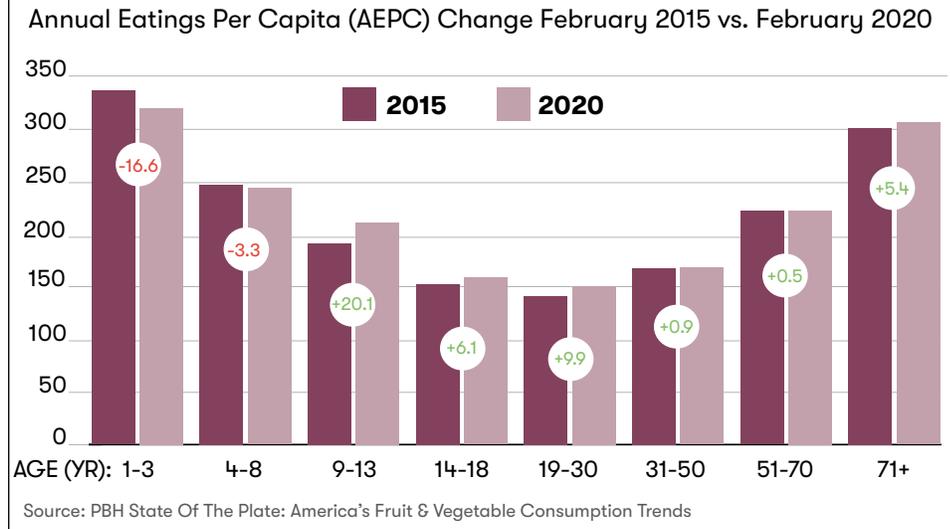
## Fruits

PBH State Of The Plate research provides insights into how frequently Americans of all ages eat fruit, with 74% of consumers eating fruit at least once per week and 26% not consuming fruit at all during a typical week. Non-Hispanic Blacks were more likely than other racial groups to not eat any fruit. Within those who do consume fruit, “low” frequency eaters (1-6 eating fruit occasions per week) comprised 50% of the consuming population, while “high” frequency eaters (12+ eating fruit occasions per week) account for less than 10% of the consuming population.<sup>16</sup>

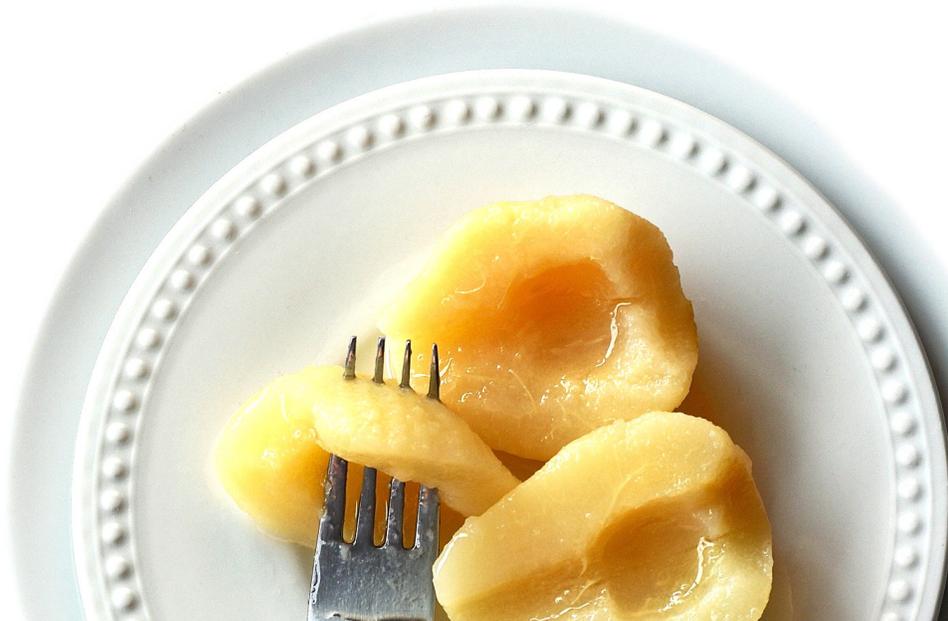
**The average American consumes fruits 5.8 times per week, or less than once per day.<sup>16</sup>**

NHANES 2017-2018 data tells a similar story on frequency of consumption. On a given day, less than half of adults eat fruit, with one quarter of adults reporting to eat only one type of fruit per day. Fruit intake increases with age and income based on frequency reporting among adults. Non-Hispanic Asian and Hispanic adults report consuming fruit more frequently, whereas non-Hispanic Black adults followed by non-Hispanic white adults choose fruit less frequently. Similar to other data sets, the percentage of adults consuming fruits decreased by just over 10% between the 1999-2000 and 2017-2018 survey periods.<sup>17</sup>

**FIGURE 2.2 CHANGES IN ANNUAL EATING OCCASIONS OF FRUIT, 2015-2020<sup>16</sup>**



Only about half of children 2-19 years of age consume fruit on a given day. Fruit intake was lowest among Black children.<sup>18</sup> In the high school-aged population, the percentage who did not eat fruit or drink 100% fruit juice during the week prior to being surveyed increased between 1999-2013 then decreased between 2013-2019. Overall, the percentage of high school-aged children who consumed fruit two or more times per day decreased between 1999 and 2019.<sup>19</sup> Intake increases with household income.<sup>18</sup> Unlike in adults, frequency of fruit intake decreases with age, with adolescents consuming fruit less often than younger children, as seen in the PBH State Of The Plate research (Figure 2.2).<sup>16</sup>



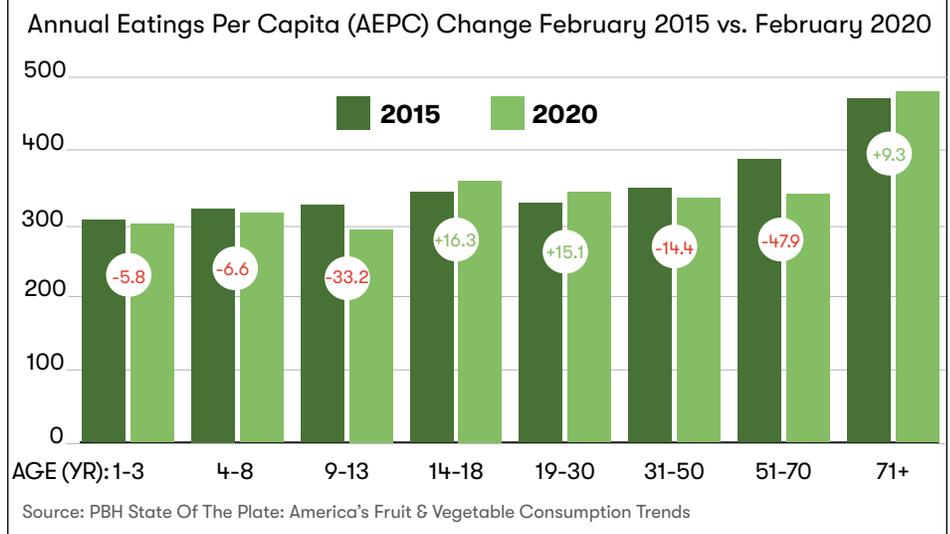
## Vegetables

Just over half of Americans eat vegetables on a given day. Females eat vegetables more frequently than males, with 64% and 58%, respectively, reporting consumption of vegetables on any given day. Of those consuming vegetables, over half ate one item and one-quarter ate two different items on the reporting day. Vegetable intake is reported least often by Hispanics, and most often by non-Hispanic Asians and non-Hispanic whites.<sup>20</sup> Intake increases with income.

Similar to adults, female children consume vegetables more often than males, except for those 2-5 years of age. Hispanic children and adolescents' vegetable consumption is lower than other race/ethnic groups.<sup>21</sup> As with fruit, the percentage of high school-aged children who did not consume vegetables during the week prior to being surveyed increased between the 1999-2019 survey periods.<sup>19</sup>

**The average American consumes vegetables 7.5 times per week, or about once per day.<sup>16</sup>**

**FIGURE 2.3 CHANGES IN ANNUAL EATING OCCASIONS OF VEGETABLES, 2015-2020<sup>16</sup>**



Again, *PBH State Of The Plate* data are consistent with NHANES, indicating that average vegetable consumption is about 7.5 times per week, or about once per day. Among the 95% of consumers that eat vegetables at least once during a typical week, low frequency vegetable eaters (1-7 eating occasions per week) account for just more than half of the consuming population (i.e., 55%) while high frequency vegetable eaters (12+ eating occasions per week) make up just over 15% of the consuming population. As shown in Figure 2.3, vegetable eating occasions declined between 2015 and 2020 in five of eight age groups, with the greatest loss of 47.9 annual eating occasions seen among adults aged 51 to 70 years – the second highest consumer group for vegetables.<sup>16</sup>



## TYPES OF FRUITS & VEGETABLES MOST COMMONLY CONSUMED

Knowing what types of fruits and vegetables consumers are choosing more and less often, and in what forms (fresh, frozen, canned, dried and 100% juice), provides granularity that allows for targeted consumer outreach related to behaviors to encourage. These data are available in volume and frequency and, as such, provide insight into consumer preferences and behaviors that can be leveraged in policy, dietary guidance, education, and system-wide approaches.

Based on the 2020 Dietary Guidelines Advisory Committee Food Pattern Modeling Report, using NHANES data from 2015-2016, 73% of fruit consumed by Americans 2 years and older is in the form of whole fruit and 27% is in juice form. Proportion of juice intake increases and whole fruit decreases among those 2-18 years of age compared to adults. Variability is seen between age groups on specific fruits and vegetables consumed (Table 2.4).<sup>22</sup>

USDA’s Economic Research Service (ERS) reports availability data (representing the amount grown or produced) of fruits and vegetables in all forms (fresh, frozen, canned, dried, and juice). ERS data from 2019 shows the highest availability of apples (fresh, juice); oranges (fresh, juice); bananas; grapes (fresh, juice); pineapple (fresh, frozen, juice); and watermelon (Table 2.5).

TABLE 2.4: TOP FRUIT & VEGETABLE CONSUMPTION BY AGE<sup>22</sup>

FOOD GROUP & SUBGROUP	2+ YEARS OF AGE	2-3 YEARS OF AGE	4-18 YEARS OF AGE	19-70 YEARS OF AGE	71+ YEARS OF AGE
<b>WHOLE FRUIT</b>					
<b>% Food Group Or Subgroup Consumption</b>					
<b>Apples</b>	19.5	17	23.9	19.3	13.6
<b>Bananas</b>	13.0	11.2	8.3	14.4	15.1
<b>Watermelon</b>	6.2	3.5	5.1	6.7	7.0
<b>Grapes</b>	4.5	6.5	4.2	4.4	4.7
<b>Strawberries</b>	4.2	2.6	4.8	3.9	5.2
<b>Oranges</b>	3.5	3.1	3.7	3.4	4.0
<b>FRUIT JUICE</b>					
<b>% Food Group Or Subgroup Consumption</b>					
<b>Orange Juice</b>	12.9	6.6	12.3	13.2	14.1
<b>Apple Juice</b>	7.2	25.0	14.5	4.3	3.1
<b>Grape Juice</b>	2.7	4.5	3.6	2.2	2.9
<b>VEGETABLES</b>					
<b>% Food Group or Subgroup Consumption</b>					
<b>Dark Green</b>					
<b>Broccoli</b>	3.6	4.4	3.3	3.9	2.2
<b>Spinach</b>	2.1	0.5	1.0	2.4	1.6
<b>Mixed Greens</b>	1.9	0.6	0.7	2.1	2.2
<b>% Food Group Or Subgroup Consumption</b>					
<b>Beans &amp; Peas</b>					
<b>Pinto Beans</b>	3.2	3.1	3.4	3.4	1.5
<b>Black Beans</b>	1.1	3.0	1.2	1.1	0.6
<b>White Beans</b>	1.0	1.2	0.9	0.9	1.5
<b>% Food Group Or Subgroup Consumption</b>					
<b>Red &amp; Orange</b>					
<b>Tomatoes</b>	17.2	16.7	21.0	16.6	17.2
<b>Carrots</b>	4.1	6.1	5.2	3.8	4.4
<b>% Food Group Or Subgroup Consumption</b>					
<b>Starchy</b>					
<b>Potatoes, Boiled</b>	7.4	11.8	8.4	6.9	8.8
<b>Potato Chips</b>	5.2	6.0	10.3	4.5	3.5
<b>Potatoes, Baked</b>	4.3	2.6	3.9	4.0	7.5
<b>% Food Group Or Subgroup Consumption</b>					
<b>Other</b>					
<b>Lettuce</b>	5.6	1.5	3.8	6.0	5.2
<b>Onions</b>	5.5	2.8	5.3	5.8	4.2
<b>Green Beans</b>	3.2	6.2	3.0	3.0	4.1

PBH State Of The Plate frequency data lists bananas as the top fruit consumed followed by berries. Bananas as well as blueberries and strawberries have seen growth in recent years. Apples round out the top three but have declined between 2015 and 2020, as have raisins, mixed fruit, peaches, cantaloupe, and pineapple (Table 2.5). Fruit is consumed “as is” (versus as an ingredient), the majority (greater than 80%) of the time. When consumed as is, the fruits eaten in the highest quantities at one time include melons (greater than 2 cups), apples and peaches (greater than 1 cup), and citrus and bananas (just less than 1 cup). It should be noted that many of the fruits consumed most by frequency and/or volume are also those with declining eating occasions.<sup>16</sup>

Vegetables eaten “as is” and in the highest quantities include lettuce/salads (close to 3 cups), French fries (about 2 cups), and green beans, broccoli, and beans/legumes (about 1.5 cups). Eating occasions that include avocados and tomato-based products (e.g., sauce, paste, salsa) grew between 2015 and 2020. Potatoes continue to be the most widely consumed vegetable. Lettuce and leafy salads lost close to 12 eating occasions between 2015 and 2020. Other vegetables, including onions, tomatoes, and carrots, also decreased.<sup>16</sup>

In 1985, 42% of eating occasions included a vegetable side dish. By 2000, there was a decrease to 36% of side dish eating occasions and this level remained steady in 2020.<sup>16</sup>

**If staples such as salads, vegetable side dishes, and the vegetables that often accompany burgers and sandwiches (e.g., onions, tomatoes) continue to decline, this could be concerning for vegetable intake going forward as trended data show a steady decline in vegetable eating occasions, demonstrating that those vegetables increasing in frequency are not compensating for those lost. Additionally, consistent declines are seen in vegetable side dish occasions, particularly at dinner, which have the potential to further erode vegetable intake over time.**

**TABLE 2.5: TOP FRUITS & VEGETABLES CONSUMED BY FREQUENCY & VOLUME\***

	AVAILABILITY DATA (volume) <sup>23</sup>	STATE OF THE PLATE (volume) <sup>16A</sup>	NHANES (frequency) <sup>16</sup>		STATE OF THE PLATE (frequency) <sup>16</sup>
<b>FRUITS</b>	<ol style="list-style-type: none"> <li>Apples</li> <li>Orange</li> <li>Bananas</li> <li>Grapes</li> <li>Pineapple</li> <li>Watermelon</li> </ol>	<ol style="list-style-type: none"> <li>Melons</li> <li>Apples</li> <li>Peaches</li> <li>Citrus</li> <li>Bananas</li> <li>Applesauce</li> <li>Berries</li> <li>Grapes</li> </ol>	<b>Adults<sup>17</sup></b> <ol style="list-style-type: none"> <li>Bananas</li> <li>Apples</li> <li>Grapes</li> <li>Oranges</li> <li>Fruit Salad</li> <li>Strawberries</li> </ol>	<b>Children<sup>18</sup></b> <ol style="list-style-type: none"> <li>Apples</li> <li>Bananas</li> <li>Oranges</li> <li>Grapes</li> <li>Strawberries</li> <li>Watermelon</li> </ol>	<ol style="list-style-type: none"> <li>Bananas</li> <li>Apples</li> <li>Strawberries</li> <li>Oranges</li> <li>Grapes</li> <li>Blueberries</li> <li>Applesauce</li> <li>Watermelon</li> </ol>
<b>VEGETABLES</b>	<ol style="list-style-type: none"> <li>Potatoes</li> <li>Tomatoes</li> <li>Onions</li> <li>Carrots</li> <li>Head lettuce</li> <li>Sweet corn</li> <li>Romaine/leaf lettuce</li> </ol>	<ol style="list-style-type: none"> <li>Lettuce/leafy salads</li> <li>French fries</li> <li>Green beans</li> <li>Broccoli</li> <li>Beans/legumes</li> <li>Corn</li> <li>Carrots</li> <li>Mashed potatoes</li> </ol>	<b>Adults<sup>20</sup></b> <ol style="list-style-type: none"> <li>Potatoes</li> <li>Salad</li> <li>Tomatoes</li> <li>Carrots</li> <li>Broccoli</li> <li>Corn</li> <li>String beans</li> <li>Mixed vegetables</li> </ol>	<b>Children<sup>21</sup></b> <ol style="list-style-type: none"> <li>Potatoes</li> <li>Salad</li> <li>Broccoli</li> <li>Carrots</li> <li>Corn</li> </ol>	<ol style="list-style-type: none"> <li>Potatoes</li> <li>Lettuce/leafy salads</li> <li>Onions</li> <li>Tomatoes</li> <li>Carrots</li> <li>Beans/legumes (excluding green beans)</li> <li>Corn</li> </ol>

\*Items with the same number are consumed at the same volume or frequency.

## SALES

Unlike the volume and frequency data presented previously, retail sales data included in this report are for the 2020 calendar year — the beginning of the coronavirus pandemic. Examining these data can provide insights into how COVID-19 has impacted consumers' decision making when purchasing and preparing food, including the dramatic decline in dollars spent in foodservice during this time.

According to the Food Industry Association (FMI) *The Power of Produce 2021* report, during 2020, the produce department at retail stores reported \$69.6 billion in sales — a 11.4% increase over the prior year. Growth in vegetables sales was more dramatic than fruit with 14.7% and 8.6%, respectively. Elevated use of fruit through increased at-home breakfast and snacking was reported by 40% of shoppers, while lunch and dinner consumption drove elevated vegetable purchases in 35% of shoppers.<sup>24</sup>

While fresh produce is ubiquitous in most households (99% penetration), 44% of shoppers said they consumed fresh produce three times or fewer per week. At the start of the pandemic, frozen and canned produce grew in market share compared to fresh through new buyers and increased purchasing of existing buyers. Using 2019 as a baseline, share of dollars decreased for fresh produce (70% vs. 84%) and grew for shelf-stable (19% vs. 10%) and frozen (11% vs. 6%) the weeks of March 15<sup>th</sup> and 22<sup>nd</sup>, 2021. One example is that, during the pandemic, prune sales increased by double digits.<sup>26</sup> Consumers reported that the top three reasons for increasing their purchases of frozen produce included the added meals eaten at-home (39%), as well as a desire to increase shelf life (34%) and minimize trips to the store (36%). Whether this shift in shopping behavior, and potential impact on dietary intake, from purchasing more frozen fruits and vegetables endures post-pandemic remains to be seen, with 62% of the shoppers buying more frozen produce saying they will not switch back to previous habits.<sup>24</sup>

### THE INCLUSION OF CANNED FRUITS & VEGETABLES IN FOOD & NUTRITION ASSISTANCE PROGRAMS<sup>25</sup>

In an average week, Americans consume more than five cans of fruits and vegetables. Those consumers who receive food assistance through the Supplemental Nutrition Assistance Program (SNAP) and Special Supplemental Nutrition Program for Women Infant and Children (WIC) consume more than seven cans of fruits and vegetables in an average week.

One quarter (25%) of the fruit consumed in the average American household is canned; this proportion rises to nearly one-third (32%) of all fruit consumed in SNAP and WIC households. A similar trend is seen among SNAP and WIC households in relation to canned vegetables with more than one-third of all fruits and vegetables consumed coming from cans compared to less than one-third (31%) in the average American household.

Further, while more than half of American consumers (56%) say that canned fruits and vegetables are important in helping them prepare convenient, nutritious, and affordable meals, this number rises to two-thirds (67%) among households receiving SNAP and WIC benefits.



## THE CONSUMPTION GAP & TRENDS OVER TIME

When comparing the gap between recommended and reported fruit and vegetable consumption using 2013-2014 and 2017-2018 NHANES data, no improvements are seen. The fruit gap is unchanged for adults (1.1 cup equivalents/day) over this timeframe and, for children (0.7 cup equivalents/day), slightly worsened with a 0.01 cup equivalent/day wider gap in 2017-2018. The vegetable gap for adults (1.4 cup equivalents/day) slightly improved by 0.01 cup equivalents/day in 2017-2018 while the vegetable gap for children is unchanged over this timeframe.<sup>26,27</sup>

In total, the net fruit and vegetable intake gap decreased by 0.1 cup equivalent/day between 2013-2014 and 2017-2018 with adults consuming slightly more vegetables and children consuming slightly fewer fruits. The total fruit and vegetable consumption gap for adults and children, as of 2017-2018, is 2.5 cup equivalents/day and 2.3 cup equivalents/day, respectively (Table 2.6).

**A variety of behaviors, such as consuming fruits and vegetables with greater frequency and/or larger volumes, are needed to help Americans increase consumption by the 2.5 cup equivalent per day needed to close the gap and achieve public health benefits.**

**TABLE 2.6: FRUIT & VEGETABLE CONSUMPTION GAP (IN CUP EQUIVALENTS/DAY)<sup>3</sup>**

	ADULTS (20+ YEARS)			CHILDREN (2-19 YEARS)		
	AVERAGE RECOMMENDATION <sup>^</sup>	AVERAGE INTAKE	AVERAGE GAP	AVERAGE RECOMMENDATION <sup>+</sup>	AVERAGE INTAKE	AVERAGE GAP
<b>Fruits</b>	1.5-2.5	0.9	<b>1.1</b>	1-2.5	1.1	<b>0.7</b>
<b>Vegetables</b>	2-4	1.6	<b>1.4</b>	1-4	0.9	<b>1.6</b>
<b>Fruits &amp; Vegetables, Combined</b>	3.5-6.5	2.5	<b>2.5</b>	2-6.5	2.0	<b>2.3</b>

<sup>^</sup>Aligns with the 1600-3200 kcal/day dietary patterns in the 2020-2025 Dietary Guidelines for Americans

<sup>+</sup>Aligns with the 1000-3200 kcal/day dietary patterns in the 2020-2025 Dietary Guidelines for Americans



## SUMMARY

### Evidence continues to demonstrate the far-reaching impact of the significant and persistent fruit and vegetable consumption crisis.

By all measures, the U.S. has been experiencing a substantial fruit and vegetable consumption crisis spanning decades. The significance of this public health crisis manifests itself in dramatic, persistent and pervasive underconsumption, as well as ongoing declines in consumption habits. This crisis has been further illuminated by the COVID-19 pandemic, despite efforts by the federal government to increase funding to help support greater nutrition security among all Americans.

Growing evidence continues to demonstrate that increasing fruit and vegetable intake may be one of the most important actions Americans can take to improve their overall health and well-being. The data unequivocally show:

- **Eating fruits and vegetables as recommended by the DGA is associated with significant health and well-being benefits.** In addition, emerging research indicates that those who eat the most fruits and vegetables may also have the highest rates of self-reported short-term happiness and long-term life satisfaction.<sup>28</sup>
- **Despite this evidence, Americans are not eating enough fruits and vegetables.** Consumption continues to fall below what is recommended in the DGA and MyPlate.<sup>3</sup>
- **Fruit and vegetable consumption data support greater volume and frequency for habit-building.** Data show that when people eat produce more frequently throughout the week, they also eat more fruits and vegetables overall (volume).<sup>28</sup>
- **Fruit and vegetable consumption habits are at risk.** Frequency of fruit and vegetable eating occasions continues to decline, particularly among those consumers with historically higher intakes.<sup>16</sup> Importantly, fruit and vegetable consumption habits appear to not be passed down through generations, and positive produce eating behaviors are no longer being established at an early age and maintained through life.
- **Communities of color and low-income populations are at a higher risk for underconsumption compared to the general population.** Communities of color and low-income populations are disproportionately affected by lack of access to healthy foods, which jeopardizes their fruit and vegetable consumption habits, as well as overall food and nutrition security.<sup>29</sup>
- **All forms of fruits and vegetables deliver key nutrients and count toward meeting dietary guidance recommendations.** The DGA recommend enjoying fruits and vegetables as fresh, frozen, canned, dried, and 100% juice. All forms of fruits and vegetables convey the same or similar health benefits — providing an important opportunity to realistically improve overall consumption of fruit and vegetable volume and habits. In fact, data show that when consumers have and prepare fruits and vegetables in all forms at home, they report consuming more produce overall.<sup>28</sup>

#### THE IMPACT OF FDA HEALTH CLAIMS ON FRUITS & VEGETABLES

As the U.S. Food and Drug Administration (FDA) works to update its definition of “healthy,” potentially accompanied by an icon that can be used on food labels, it will be important to update and modernize all health claims to be consistent with current food and nutrition science as well as dietary guidance. For instance, the 1993 health claim on fruits and vegetables and cancer has a limitation on total fat and includes threshold requirements for nutrients that are not currently considered underconsumed. All fruits and vegetables that do not provide excess sodium, added sugars, and saturated fats should be able to qualify for this health claim.

## CHAPTER 3

# EXAMINING THE EXPONENTIAL COST OF THE CONSUMPTION CRISIS

Poor health and increased risk of noncommunicable diseases, which are the leading causes of mortality and morbidity worldwide, are exacerbated by numerous lifestyle factors, from socioeconomic status, to family history, to nutrition insecurity, including suboptimal fruit and vegetable consumption. In fact, the World Health Organization (WHO) counts low fruit and vegetable intake among the top 10 risk factors contributing to mortality.<sup>30</sup>

Nearly 4 million deaths worldwide were estimated to be attributable to the underconsumption of fruit and vegetables.<sup>31</sup> In the U.S., just one in 10 adults meet the daily recommended amount for fruit and vegetable intakes, with young adults, particularly young men, and adults living in poverty being most prone to underconsumption.<sup>32</sup> Seven of the top 10 leading causes of death in America stem from chronic diseases, which can, in part, be associated with poor nutrition and lifestyle, including low fruit and vegetable consumption.

Accordingly, Americans may be at elevated risk for leading shorter lives and bearing soaring medical costs. Recent reports have pointed, not only to the direct and indirect health consequences, but also to the exorbitant cost of diet-related diseases related to health care spending, job absenteeism, and productivity, as well as other implications such as military eligibility.<sup>2</sup> In fact, more than 30% of U.S. men and women ages 17-24 years do not qualify for military service due to weight status, which affects almost half of those who do not qualify.<sup>2</sup>

**Closing the fruit and vegetable consumption gap is considered a lever to lower disease burden in both developed and developing countries, with its impact potentially being greater in developed regions such as the U.S.<sup>33</sup>**

## METHODOLOGICAL CONSIDERATIONS

Based on available data and guided by previous literature consistently showing protective effects of consuming fruits and vegetables, the following health outcomes were selected for close examination in this analysis: coronary heart disease (CHD), stroke, and cancer. Within the U.S., CHD and cancer, combined, result in more than 1.2 million deaths annually, while stroke remains the leading cause of serious long-term disability.<sup>34,35,36</sup>

### DIET RELATED CHRONIC DISEASE & HEALTH CARE COST IN THE U.S.<sup>2</sup>

In 2018, spending to treat cardiovascular diseases, cancer, and diabetes accounted for about one-quarter (\$386.6 billion) of the approximately \$1.5 trillion in total health care spending among U.S. adults.

Of this spending on treatment, 54% was shouldered by the government and 46% by private-party payers, including private insurance and out-of-pocket spending by beneficiaries.

Government spending on diet-related health conditions increased 30% from 2009 through 2018. This amount is five times greater than the increase experienced by private-party payers, including private insurance and out-of-pocket spending by beneficiaries over the same period of time.

Specifically, this analysis uses relative risk contributing to the development of CHD, stroke, and total cancer attributable to low intake of fruits and vegetables to calculate the economic cost of the consumption gap in the U.S.

In a perfect scenario, the analysis would calculate the economic cost of the fruit and vegetable consumption gap in the U.S. based on the burden of disease resulting from mortality, morbidity, and disability. Further, the analysis would be inclusive of all-cause mortality and all the various chronic health conditions associated with fruit and vegetable intake (overweight, obesity, and severe obesity; cardiovascular disease (CVD) — including coronary heart disease (CHD), stroke, hypertension; type 2 diabetes; and multiple types of diet-related cancers — including head and neck, lung, stomach, colorectal, and breast cancers). However, this is not currently possible due to deficits in burden of disease data specifically related to fruit and vegetable consumption.



## THE GLOBAL BURDEN OF DISEASE<sup>37</sup>

Global Burden of Disease (GBD) analyses quantify the impact of premature mortality and disability for major diseases or disease groups and use a summary measure of population health, the DALY (disability-adjusted life years), to combine estimates of the years of life lost and years lived with disabilities.

In 2005, WHO estimated that increasing fruit and vegetable intake up to 600 g/day, could reduce GBD by 1.8%. Additionally, WHO calculated that the reduction in GBD at this level of fruit and vegetable intake would be 31% for CHD, 20% for esophageal cancer, 19% for stroke and stomach cancer, 12% for lung cancer, and 2% for colorectal cancer.

The most recent estimates were based on a 2005 study by the World Health Organization (WHO) that investigated data from 14 geographical regions, including the United States. While these data are outdated and do not cover all of the diet-related conditions associated with fruit and vegetable intake, they capture economic burden which relative risk of disease morbidity and mortality is not able to do.

## THE ECONOMIC COST OF OBESITY & TYPE 2 DIABETES<sup>4,38,39,40,41,42</sup>

Dietary patterns higher in fruits and vegetables are associated with healthier body weights and decreased risk of obesity.<sup>4</sup> Direct and indirect costs of chronic diseases attributable to overweight and obesity were calculated to be \$1.72 trillion, or 9.3% of the U.S. gross domestic product, in 2016. In fact, close to half of the total cost of chronic disease in the U.S. that year was related to obesity.<sup>38</sup> Between the 1999-2000 and 2017-2018 time periods, obesity prevalence increased from 31% to 42% and the prevalence of severe obesity increased from 5% to 9% and continues to grow.<sup>39</sup>

While some studies have suggested that there are no significant associations between fruit and vegetable consumption and type 2 diabetes, a 2016 meta-analysis in the *Journal of Diabetes Investigation* reported that a higher intake of fruit, especially berries, green leafy vegetables, yellow vegetables, cruciferous vegetables, and the fiber from these fruits and vegetables, have protective effects against type 2 diabetes.<sup>40</sup> The economic cost of diabetes in America is \$327 billion and over 90% of cases are type 2 diabetes. Even if just 10% of the individuals with type 2 diabetes were low consumers of fruits and vegetables, closing the consumption gap could equate to savings of over \$16 billion in economic costs.<sup>41,42</sup>

It should be noted that the economic cost of the consumption gap calculated in this analysis may be a vast underestimation due to the lack of commensurate data on the entire spectrum of diet-related diseases that have been linked to fruit and vegetable consumption. For example, evidence suggests that higher intakes of fruits and vegetables may reduce the risk of obesity, type 2 diabetes, and individual types of cancer,<sup>43,44,45</sup> yet data summarizing the economic costs associated with these diseases attributable to low intakes of fruits and vegetables are unavailable. Therefore, the economic stakes of low intake of fruits and vegetables, even with conservative estimates, are high.



## KEY FINDINGS

The estimates in Table 3.1 represent the reduction of relative risk of developing CHD, stroke, and cancer that is attributable to the gap between fruit and vegetable consumption and federal dietary guidance. When evaluating the risk of mortality attributable to the fruit and vegetable consumption gap, a 2017 meta-analysis observed reductions in all-cause mortality risk (31%) in a dose-response manner up to an intake of 800 g of fruits and vegetables, combined, per day (roughly 5.5 cup equivalents). Disease-specific risk of mortality decreased 28% for cardiovascular disease, 24% for CHD and 33% for stroke. A 3% reduction in mortality risk from cancer was observed for each 200g of fruits and vegetables consumed up to 600g/day. The authors estimated that, globally, a cumulative total of 5.6 and 7.8 million premature deaths may have been attributable to fruit and vegetable intake below 500g/d and 800g/d, respectively, in 2013.<sup>43</sup>

Evidence continues to evolve regarding the types of cancers most impacted by low intakes of fruits and vegetables; dose-response and associated risk reduction; and nutrients contained in fruits and vegetables that confer protection against the development of cancer. For instance, according to the American Institute for Cancer Research (AICR) and the World Cancer Research Fund (WCRF) in 2018, strong evidence indicates that fruit and vegetable consumption is protective against aerodigestive cancers, and that fiber reduces the risk of colorectal cancer. Limited, but suggestive, evidence indicates that fruit and/or vegetable intake is protective against head and neck, breast, and lung cancers. Limited, but suggestive, evidence also demonstrates that nutrients contained in fruits and vegetables (e.g., fiber, beta-carotene, carotenoids, isoflavones, vitamin C) are protective against lung and breast cancers. Additionally, limited, but suggestive, evidence associates low intake of non-starchy vegetables with increased risk of colorectal cancer and low intakes of fruit with increased risk of stomach and colorectal cancers.<sup>46</sup> At this time, relative risks attributable to fruit and vegetable intakes are not available for all of the cancer sites discussed above. Further, some models measuring relative risk are more robust than others.

**TABLE 3.1: RELATIVE RISK OF CHRONIC DISEASES ATTRIBUTABLE TO LOW CONSUMPTION OF FRUIT & VEGETABLES<sup>43</sup>**

CHRONIC DISEASE	RELATIVE RISK*
Coronary Heart Disease	24%
Stroke	33%
Cancer	9%

\*Reduction of disease risk that would occur from the consumption of 800 g/day of fruits and vegetables for CHD and stroke and intakes of 600 g/day for cancer.

The 2015 *Gap Analysis* calculated the economic cost of disease attributable to the fruit and vegetable consumption gap by utilizing the approach of USDA economist, Elizabeth Frazao’s 1999 study in which she multiplied the disease risk associated with diet by the total economic cost of disease.<sup>47</sup> Consistent with this approach, the reduction in relative risk that would occur from the optimal consumption of fruits and vegetables in Table 3.1 was multiplied by the annual economic cost of each disease in the U.S. (Table 3.2) to obtain the total annual cost of those diseases attributable to the fruit and vegetable consumption gap (Table 3.3). The economic cost includes both the direct (hospital inpatient stays, hospital emergency department visits, and prescribed medicines) and indirect costs (e.g., lost productivity).

It should be noted that using relative risk reduction as this basis of the analysis could overstate the total effect in the case of co-morbidities. This illuminates the need for additional global burden of disease data related to leading chronic diseases in terms of morbidity and mortality, particularly those attributable to dietary factors such as the fruit and vegetable consumption gap.

Tables 3.2 and 3.3 demonstrate the combined economic burden of CHD, stroke, and cancer and the portion of the cost attributable to the fruit and vegetable consumption gap, respectively. The following are key takeaways regarding the economic burden of these three diseases:

- Economic Cost of Disease.** The economic burden of CHD, stroke, and cancer, combined, is anticipated to grow at an average of 18% every five years between 2015 to 2030. In 2015, this combined economic burden was \$437.2 billion – larger than the GDP of 182 countries in the same year.<sup>48</sup> This estimate is projected to increase by more than 55% to \$679.5 billion by 2030 (Table 3.2).

- Economic Cost of Disease Attributable to the Fruit and Vegetable Consumption Gap.** The total estimated annual cost of the consumption gap for just these three health outcomes combined (\$83.4 billion) exceeded the annual expenditures of 47 states in 2015.<sup>49</sup> The combined estimate is projected to increase by about 64% to \$137.0 billion from 2015 to 2030 (Table 3.3).

- Economic Cost of Fruit and Vegetable Gap in Context of Overall Disease Cost.** In 2015, the combined annual economic costs of the noted three health outcomes attributable to the fruit and vegetable consumption gap were equal to 19% of the total cost of those outcomes in the United States. By 2030, this estimate is projected to grow to 20% (Calculated from Tables 3.2 and 3.3).

The total economic cost of the consumption gap estimated in Table 3.3 may be an underestimate, as it is not all-inclusive of other diet-related chronic diseases that could be impacted by the underconsumption of fruits and vegetables.

**TABLE 3.2: ESTIMATED TOTAL ANNUAL COST OF DIET-RELATED DISEASES IN THE U.S.**

	2015	2020	2025	2030	% CHANGE FROM 2015 TO 2030
	BILLIONS OF DOLLARS				
<b>Coronary Heart Disease<sup>50</sup></b>	187.9	223.0	264.8	313.6	67
<b>Stroke<sup>50</sup></b>	66.3	80.8	98.7	119.9	81
<b>Cancer<sup>51</sup></b>	183.0	200.7	222.5	246.0	34
<b>TOTAL</b>	437.2	504.5	586.0	679.5	55

**TABLE 3.3: CALCULATED ESTIMATED TOTAL ANNUAL COST OF FRUIT & VEGETABLE CONSUMPTION GAP FOR DIET-RELATED DISEASES IN THE U.S.**

	2015 <sup>47</sup>	2020	2025	2030	% CHANGE FROM 2015 TO 2030
	BILLIONS OF DOLLARS				
<b>Coronary Heart Disease</b>	45.1	53.5	63.6	75.3	67
<b>Stroke</b>	21.8	26.7	32.6	39.6	81
<b>Cancer</b>	16.5	18.1	20.0	22.1	34
<b>TOTAL</b>	83.4	98.2	116.1	137.0	64

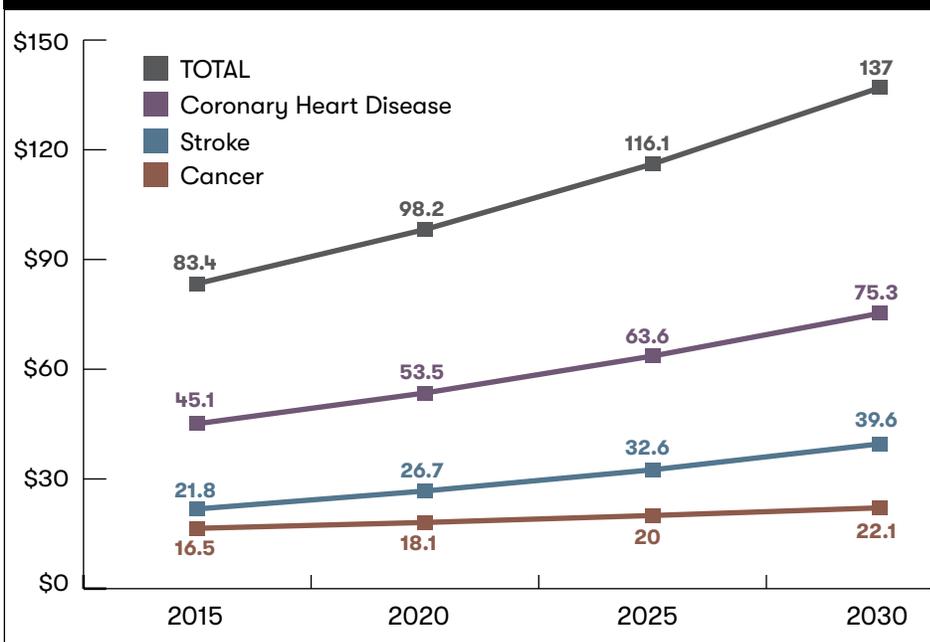


SUMMARY

The annual economic cost of America’s pervasive and persistent fruit and vegetable consumption crisis was an alarming \$98.2 billion in 2020 and is projected to grow to \$137.0 billion by 2030.

Even more concerning, these staggering numbers do not include costs associated with overweight, obesity, severe obesity, pre-diabetes, diabetes, or specific types of prevalent cancers — all conditions that most health experts agree can be improved with increased fruit and vegetable consumption. If the federal government is shouldering the majority of health care costs required to treat cardiovascular diseases, cancer and diabetes, and if associated spending has increased 30% just between 2009-2018<sup>2</sup>, how much return on investment could be achieved by bolstering funding earmarked for promotion of fruits and vegetables and closing the consumption gap?

FIGURE 3.1: ESTIMATED ANNUAL COST OF FRUIT & VEGETABLE CONSUMPTION GAP FOR DIET-RELATED DISEASES IN THE U.S. IN BILLIONS OF DOLLARS



Currently, the average adult consumes just 1.6 cups of the recommended 2-4 cups/day of vegetables and 0.9 cups of the recommended 1 ½ - 2 ½ cups/day of fruit, for a combined total of 2.5 cups/day.<sup>7,8,9</sup> Best estimates indicate that protection from CHD, stroke, and cancer occurs at levels of at least 600g/day - 800g/day of fruits and vegetables. This roughly calculates to 3.75 - 5.5 servings of fruits and vegetables, together. The average recommended to adults by the *Dietary Guidelines for Americans* is 3.5 - 6.5 cups/day of fruits and vegetables, combined.<sup>3</sup>

Closing the fruit and vegetable consumption gap will require widespread commitment and investment from the highest levels of the government to the American consumer. Supporting Americans in building healthy fruit and vegetable intake habits must be paramount throughout the food system. Subsequent chapters will examine government spending, across various departments and agencies, well as identify recommended steps to mitigate the fruit and vegetable consumption crisis.

## CHAPTER 4

# USDA: ASSESSING GAPS BETWEEN FEDERAL SPENDING & NATIONAL PUBLIC HEALTH GOALS

The U.S. Departments of Agriculture (USDA) and Health and Human Services (HHS) have joint responsibility for managing the federal government's efforts related to food and nutrition, and more specifically, the challenges corresponding with poor dietary quality and associated chronic disease. This chapter focuses on USDA spending to determine how closely the department's mandate coincides with the need to close the fruit and vegetable consumption gap to improve public health.

## METHODOLOGICAL CONSIDERATIONS

When reviewing the analyses of USDA spending in this chapter, it is important to consider that the allocation of USDA's resources is the result of policy and spending decisions made by Congress through its multi-year farm bills and in annual appropriations. The Farm Bill guides the USDA's Food and Nutrition Service (FNS), Food Safety and Inspection Service (FSIS), Agriculture Marketing Service (AMS), Economic Research Service (ERS), Agriculture Research Service (ARS), and National Institute of Food and Agriculture (NIFA). The Agricultural Improvement Act of 2018 is the name of the current farm bill that is in place through 2023.

Other legislation impacts how funds are used to support nutrition standards in federally-funded programs. The Child Nutrition Reauthorization (CNR) covers school meals (National School Lunch Program, NSLP, and School Breakfast Program, SBP), the Summer Food Service Program, the Special Milk Program, Fresh Fruit and Vegetable Program, the Child and Adult Care Food Program (CACFP), the Special Supplemental Program for Women, Infants, and Children (WIC), and the related WIC Farmers Market Nutrition Program (FMNP). Although the latest CNR, the Healthy, Hunger-Free Kids Act (HHKFA) of 2010 (Public Law 111-296), expired on September 30, 2015, programs are still operating under it until new legislation is passed.



Spending that supports the consumption and promotion of the major food groups — vegetables, fruits, grains, dairy, and protein foods — was included in this analysis:

- Food-group-specific purchases by the AMS to support food and nutrition assistance programs;
- Commodity-specific food and agricultural research, education, and extension; and
- Nutrition education programs, many of which target Americans participating in federal food and nutrition assistance programs, especially Americans with low incomes.

The time period used in this analysis covers the federal fiscal years (FY) of 2018 and 2019 for each data source (e.g., AMS purchases by commodity) as available. In the event that data were not available, the two most recent fiscal years were used. All findings reported in the tables in this chapter represent average annual values for the two fiscal years. Two years were selected for the analysis of spending to avoid bias from any exceptional spending that might have been incurred within a single year.

The analyses in this chapter were designed to determine the extent to which USDA spending aligns with the core elements of a healthy dietary pattern included in the *2020-2025 Dietary Guidelines (DGA) for Americans* and the five MyPlate food groups. While USDA spending depends on many factors, for the purpose of this analysis, USDA's updated *Thrifty Food Plan, 2021 (TFP)* was used as a guide to determine how closely USDA spending for each food group aligns with the food group recommendations of the DGA.<sup>3,52</sup>

The TFP includes market baskets that contain a variety of commonly consumed foods and beverages that are lower in price and higher in nutritional quality (or nutrient density) to support healthy meals and snacks on a limited budget at home. The market baskets include weekly amounts (i.e., pounds) from categories of foods and beverages in purchasable forms, and associated costs, to support a healthy dietary pattern. The cost-share percentages across categories — the five food groups and a miscellaneous category — were used to compare spending for each food group. These percentages are the cost shares for the combined market baskets for the four TFP reference family members (i.e., a child aged 6-8 years, a child aged 9-11 years, an adult female aged 20-50 years, and an adult male aged 20-50 years) and reflect national average retail prices in June 2021.

Many variables impact USDA spending, such as subsidies, crop insurance, and supply chain issues; and ideally, spending data accounting for these variables would be available from USDA by food group. Additionally, market conditions by food categories vary over time, and the cost-share percentages in the TFP are based on one month. Therefore, these analyses have some limitations and should be considered informed estimates that can be used to provide insights on USDA priorities by food group.



## KEY FINDINGS

### Food & Nutrition Assistance Programs

The majority of USDA funds are allocated for FNS. In 2018, and prior to COVID, FNS accounted for 72% of USDA’s spending,<sup>53</sup> which decreased slightly to 70% in 2019.<sup>54</sup> FNS’ mission is to increase food security and reduce hunger by providing children and low-income individuals access to food, a healthful diet, and nutrition education in a way that supports American agriculture and inspires public confidence.<sup>55</sup> The agency administers 15 food and nutrition assistance programs including WIC, SNAP, Child Nutrition Programs (CNP) like the NSLP, SBP, and CACFP, and the Food Distribution Program on Indian Reservations (FDPIR). SNAP accounts for the majority of FNS spending followed by the Child Nutrition Programs (e.g., NSLP, SBP, and CACFP) and WIC.

In the 2018 and 2019 fiscal year time periods, 71% of FNS spending went towards SNAP, 23% towards the Child Nutrition Programs, 6% to WIC, and 0.3% to Commodity Assistance Programs (Table 4.1).<sup>53,54</sup> About 0.15% was spent on Nutrition Programs Administration, including USDA’s Center for Nutrition Policy and Promotion (CNPP), which oversees the development and implementation of the DGA.

The TFP determines SNAP benefits, which vary by household size. While SNAP participants can choose how to spend their benefits, the TFP market baskets illustrate how a household could use their resources to purchase foods and beverages that align with dietary guidance and consumer

choices, selecting items within each category that are lower in price and higher in nutritional quality.<sup>54</sup> Fruits account for 14% of the TFP cost share, while vegetables consist of 24%.

Fruits and vegetables play an important role in federal nutrition assistance programs. For Child Nutrition Programs, the meal and snack standards require varying levels of each for reimbursement. WIC participants receive monthly cash value vouchers for fruits and vegetables. The cash value of these vouchers was increased during COVID and was recently extended through September 30, 2022. In addition to the monthly WIC benefits, eligible WIC participants are also issued FMNP coupons to purchase foods from approved farmers, farmers’ markets, or roadside stands.

**TABLE 4.1: FNS SPENDING ON NUTRITION ASSISTANCE PROGRAMS, FY 2018/2019<sup>53,54</sup>**

PROGRAM AREA	SPENDING (\$)	% OF TOTAL FNS SPENDING
SNAP	73,745,210,000	71%
CNP	23,697,460,000	23%
WIC	6,125,000,000	6%
Commodity Assistance Program	322,139,000	0.3%
Nutrition Programs Administration	157,264,500	0.15%
<b>TOTAL</b>	<b>104,049,073,500</b>	<b>100%</b>

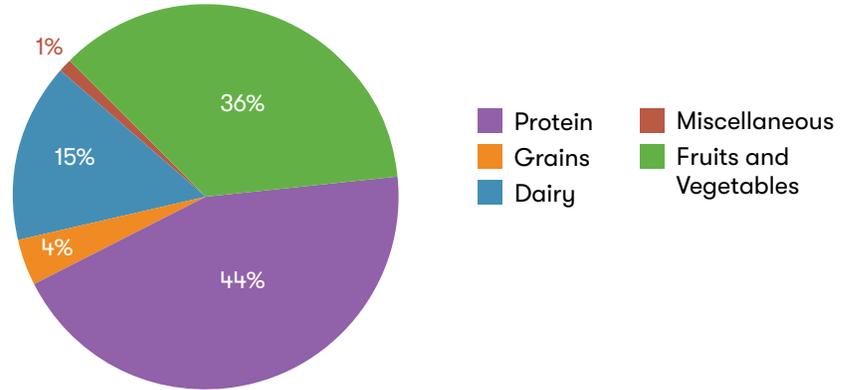
### THE IMPACT OF THE HEALTHY, HUNGER-FREE KIDS ACT (HHKFA)

The HHKFA is one example of how federal policy can impact federal nutrition assistance programs, and ultimately dietary intake. This Act changed the guidance for all meals and snacks provided through the NSLP and SBP. Specifically, the meal patterns for breakfast and lunch changed to increase the amounts of fruit and vegetables served and limited starchy vegetables. The HHKFA was associated with significant improvement in the nutritional quality of foods chosen by students,<sup>56</sup> with children consuming more fruits and vegetables (overall), and fewer starchy vegetables).<sup>57,58</sup> Furthermore, the HHKFA was associated with better changes in lunch diet among NSLP participants compared with nonparticipants.<sup>59</sup>

USDA’s AMS purchases a variety of 100% domestically produced and processed commodity food products — collectively called USDA Foods. These purchases are delivered to schools, food banks, and households in communities across the country to support nutrition assistance programs. As seen in Figure 4.1, protein foods receive the largest portion of funding (44%) followed by fruits and vegetables (36%).<sup>60</sup> Yet, the DGA recommendation for a healthy dietary pattern is to “make half your plate fruits and vegetables”.<sup>61</sup> Since the MyPlate icon does not include the dairy food group “on the plate”, fruits and vegetables do not technically make up 50% of the foods for each eating occasion. Regardless, at only 36% of spending, even a conservative estimate of spending needed for fruits and vegetables being nearly half the food at each meal would indicate that there is a need to increase USDA commodity spending on fruits and vegetables. Furthermore, commodity expenditures as well as food and nutrition assistance program standards and benefits could prioritize food groups that are most underconsumed (i.e., fruits, vegetables, and dairy).

USDA spending on commodity food purchases for nutrition assistance programs compared to the TFP (which is a market basket that accounts for food group cost shares and used as a proxy for alignment with dietary recommendations in this analysis), indicates that spending on fruits and vegetables is 2% below the TFP cost share percentage, demonstrating near alignment with the TFP, but not enough to make up deficits needed to fill the country’s gap in recommended fruit and vegetable consumption (Table 4.2).

**FIGURE 4.1 USDA SPENDING ON COMMODITY FOOD PURCHASES BY FOOD GROUP/CATEGORY, FY 2018/2019<sup>60</sup>**



**TABLE 4.2 USDA SPENDING ON COMMODITY FOOD PURCHASES COMPARED TO THE THRIFTY FOOD PLAN MARKET BASKET, FY 2018/2019<sup>60,52</sup>**

FOOD GROUPS	SPENDING (\$)	% OF TOTAL SPENDING	TFP COST SHARE PERCENTAGE
<b>Fruits &amp; Vegetables</b>	1,008,932,778	36%	38%
<b>Grains</b>	115,785,760	4%	16%
<b>Dairy</b>	440,823,165	15%	14%
<b>Protein Foods</b>	1,239,283,295	44%	25%
<b>Miscellaneous</b>	32,629,239	1%	7%
<b>ALL CATEGORIES</b>	<b>2,837,454,236</b>	<b>100%</b>	<b>100%</b>



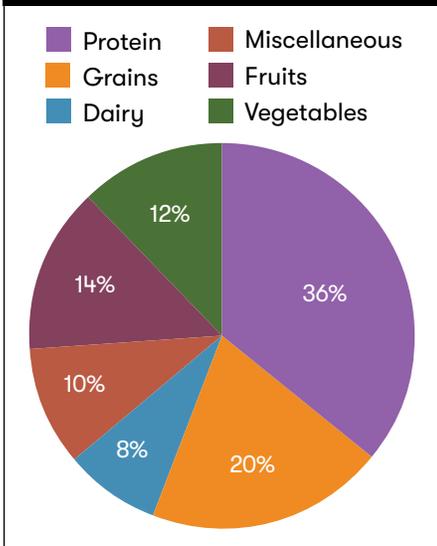
## Research, Education & Extension

Food group spending on research, education, and extension activities by USDA research agencies or satellite institutions was also analyzed. This includes projects conducted or sponsored by USDA research agencies, state agricultural experiment stations, land-grant universities, other cooperating state institutions, and participants in NIFA-administered grant programs, including Small Business Innovation Research and the Agriculture and Food Research Initiative.

The Current Research Information System (CRIS) which provides documentation and reporting for USDA’s ongoing agricultural, food science, human nutrition, and forestry research, education, and extension activities was used to obtain these data. As seen in Figure 4.2, protein foods receive the largest portion of funding (36%) followed by grains (20%).<sup>62</sup> Spending on fruits and vegetables each account for less than 15% of total spending, seemingly a lower level than would be indicated based on MyPlate’s recommendations and the chronic underconsumption of these food groups.

USDA spending on research, education, and extension activities as captured by CRIS and compared to the TFP, again indicates a disproportionate amount of spending on food groups that are adequately consumed versus those, notably fruits and vegetables, that are chronically and substantially underconsumed (Table 4.3).<sup>62</sup> After all, more than 80% of Americans have dietary patterns low in fruits, vegetables, and dairy and more than half of the population meets or exceeds total grain and total protein food recommendations (i.e., ~60% and 55%, respectively).<sup>3</sup>

**FIGURE 4.2 USDA SPENDING ON FOOD AND AGRICULTURAL RESEARCH, EDUCATION, AND EXTENSION ACTIVITIES BY FOOD GROUP/CATEGORY, FY 2018/2019<sup>62</sup>**



**TABLE 4.3 USDA SPENDING ON FOOD AND AGRICULTURAL RESEARCH, EDUCATION, AND EXTENSION COMPARED TO THE THIRTY FOOD PLAN MARKET BASKET, FY 2018/2019<sup>62,52</sup>**

	SPENDING (\$)	% OF TOTAL SPENDING	TFP COST SHARE PERCENTAGE
<b>Fruits &amp; Vegetables</b>	496,233,500	26%	38%
<b>Grains</b>	387,958,500	20%	16%
<b>Dairy</b>	161,797,500	8%	14%
<b>Protein Foods</b>	698,012,000	36%	25%
<b>Miscellaneous</b>	200,419,500	10%	7%
<b>ALL CATEGORIES</b>	<b>1,944,421,000</b>	<b>100%</b>	<b>100%</b>



## Nutrition Education & Promotion

Spending on nutrition education and promotion is an indicator of the federal government’s commitment to helping Americans develop a healthy eating pattern and close the fruit and vegetable consumption gap to help achieve the public health benefits associated with the DGA. Many of USDA’s nutrition education programs focus on low-income individuals participating in federal food and nutrition assistance programs, yet several are farther reaching, such as Team Nutrition curricula used in schools and CNPP’s MyPlate education efforts.

While other programs like WIC, FFVP, and the Gus Schumacher Nutrition Incentive Program (GusNIP) include nutrition education, EFNEP, FDPNE, SNAP-Ed, and Team Nutrition are the only programs with clearly identifiable line items in the Department’s and/or FNS’ fiscal year budget summaries for nutrition education. Thus, these are the programs evaluated in this report. We recognize that many state governments allocate additional funds for nutrition education in the context of these federal programs (e.g., with state-matching) as well as standalone programs. Given the nuances of various state programs and budgets, this report is solely focused on federal programs.

### SPECIFIC USDA NUTRITION EDUCATION PROGRAMS INCLUDED IN THIS ANALYSIS

**EFNEP**

The Expanded Food and Nutrition Education Program

**FDPNE**

The Food Distribution on Indian Reservations Nutrition Education (FDPNE) grants for FDPIR

**SNAP-ED**

The nutrition education arm of SNAP

**TEAM NUTRITION**

The team that supports nutrition education efforts accompanying Child Nutrition Programs



USDA PROGRAM	NUTRITION EDUCATION SPENDING (\$)	TOTAL PROGRAM SPENDING (\$)*	NUTRITION EDUCATION AS A % OF PROGRAM SPENDING
<b>EFNEP</b>	68,467,000	1,444,146,000	4.7%
<b>FDPNE</b>	998,000	153,000,000	0.7%
<b>SNAP-Ed</b>	427,000,000	73,745,210,000	0.6%
<b>Team Nutrition</b>	17,004,000	23,697,460,000	0.1%
<b>TOTAL</b>	<b>513,469,000</b>	<b>99,039,816,000</b>	<b>0.5%</b>

\*For EFNEP, NIFA; for FDPNE, FDPIR; for SNAP-Ed, SNAP; and for Team Nutrition, CNP.

Table 4.4 shows nutrition education as a percentage of spending for several USDA programs, in descending order. Nutrition education spending represented less than one percent of total spending for food and nutrition assistance programs during the FY2018/2019 period.<sup>63,64,65,66</sup> Although the relationship between nutrition education and dietary intake is complex, nutrition knowledge and health literacy can impact dietary patterns. Given that tens of millions of Americans participate in food and nutrition assistance programs each year and that the average Healthy Eating Index score (which is an indicator of adherence to the DGA) is 59 out of 100<sup>3</sup>, this suggests that nutrition education and promotion are substantially underfunded. Furthermore, research indicates that participation in federal nutrition education programs, and in particular EFNEP, results in improvement in total HEI scores<sup>67,68</sup> and fruit and vegetable subscores,<sup>67</sup> thus demonstrating the effectiveness of these programs and supporting the recommendation for additional funding.

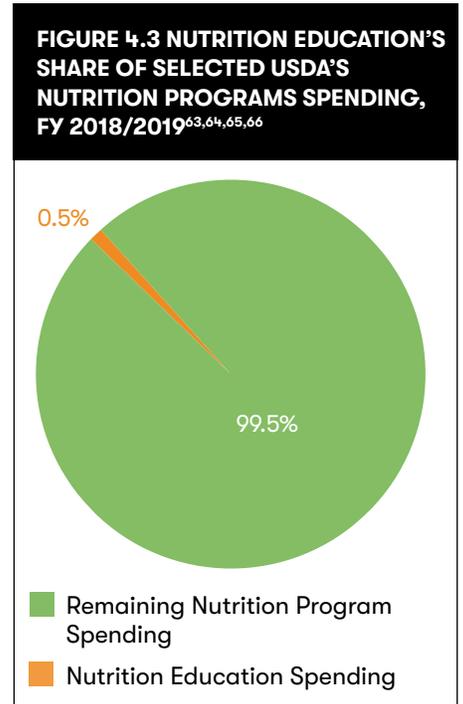
**SUMMARY**

These analyses indicate inconsistencies among overall USDA spending and specific food group spending to promote healthy eating in food and nutrition assistance programs, meeting DGA recommendations, and the TFP market basket cost-share percentages. The proportion of funding and spending for under-consumed food groups in the DGA and on MyPlate – especially fruits and vegetables – should be dramatically increased, commensurate with their levels of underconsumption and unrealized public health benefit.

First, it’s imperative to dedicate annual funds for USDA’s Center for Nutrition Policy and Promotion (CNPP) and HHS’ Office of Disease Prevention and Health Promotion (ODPHP) to fund the development and implementation of the DGA, including support for greater inclusion of eating behavior data and insights to drive better adherence to dietary guidance recommendations. Additionally, CNPP will require funding to update the Thrifty Food Plan every five years, as is now mandated.

Furthermore, although meal standards in federal food and nutrition assistance programs are intended to model healthy eating, 0.5% of the combined budget is allocated to nutrition education and promotion that is intended to sustain healthy behavior beyond program participation (Figure 4.3). Thus, there is opportunity to expand USDA spending on nutrition education and promotion within the nutrition assistance programs and beyond (e.g., MyPlate efforts targeting all Americans). It should be mentioned that, at press time, FNS is developing a branch within SNAP-Ed to focus solely on nutrition education. Given the substantial investment by the federal government in enhancing food access and nutrition security for low-income families, it makes sense to also invest in effective nutrition education and promotion programs to ensure that public health priorities are actualized and healthful behaviors sustained, especially among the vulnerable people served by these programs.

Analyses of USDA spending for fiscal years 2018 and 2019 demonstrated inconsistencies among the allocation of funds, the Thrifty Food Plan market basket cost-share percentages, and the food group recommendations in the DGA. Overall, using the DGA as a proxy, funding for and spending on for fruits and vegetables fell short of levels needed to correct long-standing patterns of underconsumption, and while meal standards have increased access to fruits and vegetables, allocations for nutrition education and promotion totaled well below 1% of the combined food assistance budget.



**The proportion of funding and spending for under-consumed food groups in the Dietary Guidelines and on MyPlate – especially fruits and vegetables – should be dramatically increased, commensurate with their levels of underconsumption and unrealized public health benefit.**

## CHAPTER 5

# NIH: ASSESSING GAPS BETWEEN FEDERAL SPENDING & NATIONAL PUBLIC HEALTH GOALS

As stated above, the US Department of Health and Human Services (HHS) plays a critical role in addressing nutrition and health. Within HHS these efforts are lead by two agencies, the National Institutes of Health (NIH) and the Centers for Disease Control and Prevention (CDC). NIH and CDC both lie at the heart of America’s health infrastructure, funding research and public health programs related to disease risk reduction and management, as well as biotechnologies. Analyzing the two agencies’ spending sheds light on current priorities and how these priorities might be shifted to help close America’s fruit and vegetable consumption gap.

### METHODOLOGICAL CONSIDERATIONS

This chapter looks at NIH’s spending to examine how closely the agency’s work aligns with the public health imperative of addressing inadequate intakes of fruits and vegetables. For this analysis, data were extracted from the NIH RePORTER<sup>69</sup>, an electronic database of NIH-funded research projects. Analyses were conducted for projects related to chronic disease prevention and treatment, as well as fruits and vegetables, specifically.

For each chronic disease in Table 5.1 (coronary heart disease (CHD), stroke, and cancer), relevant search terms were used to extract a list of NIH projects from fiscal years 2018 and 2019 related to that disease. For example, to obtain the dollar figure for all cancer research projects, search terms such as “cancer,” “tumor,” and “oncology” were used to extract a list of projects. Then, the spending for each project on the list was aggregated to obtain the total amount of funding provided for each chronic disease. The search terms used for this analysis are listed in the Appendix.

Of note, some search terms extracted projects that were irrelevant to this analysis. For example, when the term “berry” was included in the search for fruit and vegetable research projects; other projects that used the word outside of the context of fruits such as a “berry-like” shape of a tumor were obtained. While the list of search results was carefully reviewed, the total funding amounts for each chronic disease in this analysis should be considered estimates.

**TABLE 5.1 NUMBER OF NIH FRUIT AND VEGETABLE PROJECTS FOR DIET-RELATED DISEASES, FY 2018/2019\***

	NIH RESEARCH PROJECTS (#)	NIH FRUIT & VEGETABLE RESEARCH PROJECTS (#)	FRUIT & VEGETABLE PROJECTS AS A % OF NIH PROJECTS
<b>Coronary Heart Disease</b>	5,030	142	2.8%
<b>Stroke</b>	6,095	183	3.0%
<b>Cancer</b>	43,658	1700	3.9%
<b>TOTAL</b>	<b>54,783</b>	<b>2,025</b>	<b>3.7%</b>

\*See Appendix A.1 for the NIH RePORTER search terms.



KEY FINDINGS

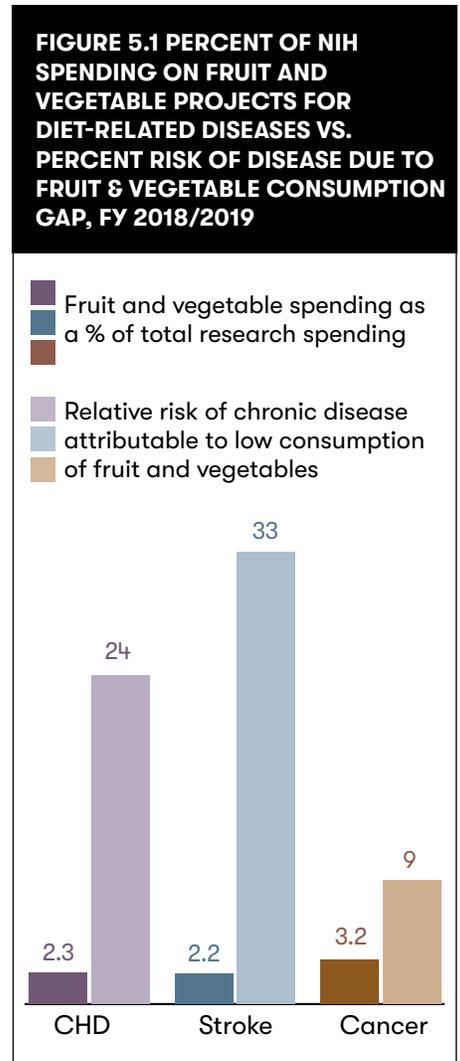
Fruit & Vegetable Projects For Diet-Related Diseases

Fruit and vegetable research accounts for less than 4% of all NIH projects. Tables 5.1 and 5.2 show the number of fruit and vegetable projects for diet-related diseases funded by NIH along with the amount spent for each disease category. For CHD and stroke, the percent of spending on fruit and vegetable research projects is much lower than the disease risk from suboptimal consumption. Specifically, for CHD and stroke, 24% and 33% of disease risk are attributable to the fruit and vegetable consumption gap. Yet, only 2.3% and 2.2% of NIH’s spending on CHD- and stroke-related research projects, respectively, is devoted to fruits and/or vegetables.

Similarly, for cancer, the percent of research funds spent on fruit and vegetable projects is lower than the disease risk associated with low intakes (3.2% and 9%, respectively). Figure 5.1 demonstrates the incongruence between NIH spending on fruit and vegetable projects for diet-related diseases (CHD, stroke, and cancer) and the risk of disease due to the fruit and vegetable consumption gap for fiscal years 2018 and 2019.

As discussed in previous chapters, the risk of developing other diet-related diseases is exacerbated by low fruit and vegetable consumption. Two prominent examples are obesity and type 2 diabetes. Because data related to the reduction of risk or global burden of disease directly attributable to underconsumption of fruits and vegetables, similar to that used for cancer, CHD, and stroke, are not available for obesity or type 2 diabetes, we did not include these conditions in the baseline analysis for this report. However, given the high prevalence of obesity and type 2 diabetes in the U.S., we did calculate the scale of related fruit and/or vegetable research projects for additional context and perspective.

For example, a total of 8,479 obesity research projects were funded by NIH during fiscal years 2018 and 2019, of which 509 were related to fruits and vegetables. These fruit and vegetable projects received 5.1% of all NIH funding for obesity research. NIH funded 11,858 research projects focused on type 2 diabetes during fiscal years 2018 and 2019, of which 587 were related to fruits and vegetables, comprising 4.1% of funding for projects studying this disease.



**TABLE 5.2 NIH SPENDING ON FRUIT & VEGETABLE PROJECTS FOR DIET-RELATED DISEASES, FY2018/FY2019\***

	ALL RESEARCH PROJECTS (\$)	FRUIT & VEGETABLE RESEARCH PROJECTS (\$)	FRUIT & VEGETABLE SPENDING AS A % OF TOTAL SPENDING	RELATIVE RISK OF CHRONIC DISEASE ATTRIBUTABLE TO LOW CONSUMPTION OF FRUIT & VEGETABLES**
<b>CHD</b>	2,558,634,167	58,493,884	2.3%	24%
<b>Stroke</b>	3,163,563,722	71,001,175	2.2%	33%
<b>Cancer</b>	22,775,940,798	727,014,531	3.2%	9%
<b>TOTAL</b>	<b>28,498,138,687</b>	<b>856,509,590</b>	<b>3.0%</b>	Data not available

\*See Appendix A.1 for the NIH RePORTER search strategy.

\*\*Reduction of disease risk that would occur from the consumption of 800 g/day of fruits and vegetables for CHD and stroke and intakes of 600 g/day for cancer. See Chapter 3 for additional details.

To assess the direction of NIH’s fruit and vegetable portfolio over time, Table 5.3 compares prioritization of fruit and vegetable projects for fiscal years 2012/2013 and 2018/2019. The comparison indicates that:

- Fruits and vegetables were very low priorities during both periods (with 5% or less of the research portfolio for diet-related diseases addressing fruits and vegetables).
- Little changed over this six-year period for CHD and cancer, both in terms of overall research projects (2.4% and 2.3% for CHD and 3.5% and 3.2% for cancer) and those projects focusing on disease-prevention (3.3% and 1.9% for CHD and 3.7% and 3.8% for cancer).
- Spending on stroke research overall and for disease prevention decreased markedly (e.g., by 46% and 63%, respectively).

**TABLE 5.3 CHANGES IN NIH RESEARCH PORTFOLIO FOR DIET-RELATED DISEASES (CHD, STROKE, CANCER), FY2012/2013 & FY 2018/2019**

SPENDING FOR	% DEDICATED TO FRUITS & VEGETABLES	
	FY 2012/2013	FY 2018/2019
Coronary Heart Disease Research Projects*	2.4%	2.3%
Coronary Heart Disease Prevention Research Projects**	3.3%	1.9%
Stroke Research Projects*	4.1%	2.2%
Stroke Prevention Research Projects**	5.2%	1.9%
Cancer Research Projects*	3.5%	3.2%
Cancer Prevention Research Projects**	3.7%	3.8%

\*See Appendix A.1 for the NIH RePORTER search terms.  
 \*\*See Appendix A.2 for the NIH RePORTER search terms.



## Fruit & Vegetable Projects Aimed At Prevention

Table 5.4 shows that, even when only NIH disease prevention projects are considered, the percentage of NIH spending for fruit and vegetable projects aimed at prevention is far below the percent of chronic disease risk attributable to inadequate intakes of fruits and vegetables. The same pattern as in Table 5.1 is observed, with the risk for CHD and stroke attributable to the fruit and vegetable consumption gap being much higher than the percent of NIH funding dedicated to fruit and vegetable research. For example, the percent of stroke risk due to the fruit and vegetable consumption gap is 1.9%, or 17 times as large as the percent of spending on fruit and vegetable prevention projects related to stroke in fiscal years 2018 and 2019. For cancer, the percent of research funds spent on fruit and vegetable projects also is lower than the disease risk associated with low intakes (3.8% and 9%, respectively).

Similar analyses were conducted for prevention projects related to obesity and type 2 diabetes. A total of 3,711 obesity prevention projects were funded by NIH during fiscal years 2018 and 2019, of which 248 were related to fruits and vegetables. The fruit and vegetable projects received 5.7% of all NIH funding for obesity prevention research. NIH funded 4,475 research projects focused on type 2 diabetes during fiscal years 2018 and 2019, of which 247 were related to fruits and vegetables. Similar to cancer and heart disease prevention projects associated with fruits and vegetables, obesity and diabetes prevention projects associated with fruits and vegetables received just 5.7% and 4.3% of funding for projects studying obesity and type 2 diabetes, respectively.

	<b>TOTAL PREVENTION PROJECTS (\$)</b>	<b>FRUIT &amp; VEGETABLE PREVENTION PROJECTS (\$)</b>	<b>FRUIT &amp; VEGETABLE PREVENTION SPENDING AS A % OF ALL PREVENTION SPENDING</b>	<b>RELATIVE RISK OF CHRONIC DISEASE ATTRIBUTABLE TO LOW CONSUMPTION OF FRUIT &amp; VEGETABLES**</b>
<b>Coronary Heart Disease</b>	1,064,477,645	19,880,440	1.9%	24%
<b>Stroke</b>	1,286,533,678	24,531,313	1.9%	33%
<b>Cancer</b>	6,708,925,005	257,662,000	3.8%	9%
<b>TOTAL</b>	9,059,936,328	302,073,753	3.3%	Data not available

\*See Appendix A.2 for the NIH RePORTER search terms.

\*\*Reduction of disease risk that would occur from the consumption of 800 g/day of fruits and vegetables for CHD and stroke and intakes of 600 g/day for cancer. See Chapter 3 for additional details.



The figures in Table 5.5 show how NIH spending on fruit and vegetable projects has changed in the past six years. In fiscal years 2018 and 2019, the spending and number of NIH projects associated with fruits and vegetables for diet-related diseases, for prevention projects as a whole, and for prevention projects for CHD, stroke, and cancer decreased from fiscal years 2012 and 2013. These estimates indicate that recent changes are not in line with public health needs or risk of CHD, stroke, and cancer attributable to the fruit and vegetable consumption gap.

## SUMMARY

NIH research covers a wide range of important topics related to health and this analysis demonstrates that increased spending on prevention projects is warranted, as is increased spending on fruit and vegetable projects, to be consistent with public health goals and needs.

**With fruit and vegetable consumption frequency continuing to decline, and associated detrimental health outcomes on the rise, NIH projects should increasingly elevate fruit and vegetable consumption as a priority recommendation within initiatives to prevent and/or reduce the risk of CHD, stroke, and cancer as well as obesity and type 2 diabetes.**

**TABLE 5.5 CHANGES IN NIH RESEARCH PORTFOLIO FOR PROJECTS ON DIET-RELATED DISEASES & NUTRITION, FY 2012/2013 & FY 2018/2019**

	% DEDICATED TO FRUITS & VEGETABLES	
	FY 2012/2013	FY 2018/2019
Spending on NIH Research Projects for Diet-related Diseases*	3.4%	3.0%
Number of NIH Research Projects for Diet-related Diseases*	3.9%	3.7%
Spending on NIH Diet-related Disease Prevention Projects**	3.8%	3.3%
Number of NIH Diet-related Disease Prevention Projects**	4.8%	4.0%
Spending on NIH Prevention Projects***	3.3%	3.0%
Number of NIH Prevention Projects***	4.8%	4.0%

\*See Appendix A.1 for the NIH RePORTER search terms.

\*\*See Appendix A.2 for the NIH RePORTER search terms.

\*\*\*See Appendix A.3 for the NIH RePORTER search terms.



## CHAPTER 6

# CDC: ASSESSING GAPS BETWEEN SPENDING & NATIONAL PUBLIC HEALTH GOALS

The Centers for Disease Control and Prevention's (CDC) work focuses on increasing America's health security by supporting individuals, communities, and states to fight disease whether they "start at home or abroad, are chronic or acute, curable or preventable, human error or deliberate attack".<sup>70</sup> Its work on chronic disease prevention efforts focuses on two, preventable causes of death — tobacco use and poor diet/physical inactivity — that have similar impact on public health yet dissimilar governmental investment.

Researchers studied actual causes of death in 2000. Tobacco use accounted for 18.1% of total US deaths, while poor diet and physical activity accounted for 15.2% of total US deaths. The authors predicted that poor diet and physical activity would soon overtake tobacco use as the leading actual cause of death.<sup>71</sup>

## METHODOLOGICAL CONSIDERATIONS

Since both poor diet and tobacco use significantly impact chronic disease-related morbidity and mortality rates in the U.S., this chapter compares spending on these two areas. CDC's Division of Nutrition, Physical Activity, and Obesity (DNPAO) was established to help lead the nation's efforts to prevent chronic diseases by promoting good nutrition, regular physical activity, and a healthy weight in places where people live, learn, work, and play. DNPAO is the primary unit sponsoring initiatives to increase fruit and vegetable consumption and, therefore, its work is the focus of this analysis.



### CDC PRIORITIES IN THE 21<sup>ST</sup> CENTURY<sup>70</sup>

#### INNOVATING FOR HEALTH SECURITY

Confronting global disease threats through advanced computing and lab analysis of huge amounts of data to quickly find solutions.

#### PUTTING SCIENCE INTO ACTION

Tracking disease and finding out what is making people sick and the most effective ways to prevent it.

#### HELPING MEDICAL CARE

Bringing new knowledge to individual health care and community health to save more lives and reduce waste.

#### FIGHTING DISEASES BEFORE THEY REACH OUR BORDERS

Detecting and confronting new germs and diseases around the globe to increase our national security.

#### NURTURING PUBLIC HEALTH

Building on its significant contribution to have strong, well-resourced public health leaders and capabilities at national, state, and local levels to protect Americans from health threats.

Table 6.1 compares fruit and vegetable intake and tobacco use in three areas: spending on prevention, proportion of attributable risk of three diseases (coronary heart disease [CHD], stroke, cancer), and ratio of spending to risk.

Methodologies to calculate the estimates in Table 6.1 are listed below. The average value between fiscal years 2018 and 2019 was used to calculate spending and disease risk estimates.

### ESTIMATED SPENDING ON FRUITS & VEGETABLES

This analysis focuses on Congressional budget appropriation for CDC’s DNPAO. As in other areas of federal spending, it is sometimes difficult to separate those dollars allocated to promote healthy dietary patterns overall from those to promote increased fruit and vegetable intake, specifically. As there are three primary focus areas in the division (nutrition, physical activity, and obesity prevention), this analysis uses the equation below to estimate spending on increasing fruit and vegetable consumption:

$$\begin{aligned}
 & [1/3 \times (\text{Budget for Nutrition, Physical Activity, and Obesity} - \text{Budget for Farm to School Program})] \\
 & + \text{Budget for Farm to School Program} \\
 & + [1/3 \times (\text{Budget for National Early Child Care Collaborative})] \\
 & + [1/3 \times (\text{Budget for Racial and Ethnic Approaches to Community Health})]^{72} \\
 & = \text{Spending on Increasing Fruit \& Vegetable Intake}
 \end{aligned}$$

### CDC SPENDING ON TOBACCO PREVENTION & HEALTHY EATING

This value is the average of the aggregate of the budget allocated to tobacco prevention projects based on the 2018 and 2019 President’s Budget.<sup>73,74</sup>

### RISK-BASED COMPARISON OF CDC FUNDING FOR TOBACCO CONTROL & NUTRITION

The disease risks of CHD, stroke, and cancer from Chapter 3 of this analysis were weighted by the percent of deaths from each disease in 2018 and 2019 and were summed together.<sup>75</sup> For example, for CHD, the disease risk due to low fruit and vegetable consumption from Chapter 3 was 31%. The average percentage of mortality due to CHD in the U.S. was 23.1% between 2018 and 2019.<sup>71</sup> So, 31% was multiplied by 0.231 to obtain 7.161%.

	SPENDING (MILLIONS OF DOLLARS)	CONTRIBUTION TO RISK OF CORONARY HEART DISEASE, STROKE & CANCER	RATIOS
(1) Estimated spending on fruits and vegetables	38 <sup>72</sup>		
(2) CDC actual spending on tobacco prevention	59 <sup>73,74</sup>		
(3) Percent of risk of coronary heart disease, stroke, and cancer attributable to fruit and vegetable consumption gap		8.5%	
(4) Percent of risk of coronary heart disease, stroke, and cancer attributable to tobacco use		28.4%	
(5) Fruit and vegetable risk compared to tobacco risk = (3)/(4)			0.30
(6) Fruit and vegetable spending compared to tobacco spending = (1)/(2)			0.18

Similar calculations were made for stroke and cancer and the estimate in Table 6.1 reflects the aggregated value of the three diseases. For reference, the disease risk due to low fruit and vegetable consumption for stroke and cancer was 19% and 1.9%, respectively (Chapter 3); and the average percent of mortality for each between 2018 and 2019 in the US was 5.2% and 21.1%, respectively.<sup>71</sup>

The percent risk of developing CHD, stroke, and cancer due to tobacco use was carried over from the *2015 PBH Gap Analysis*.<sup>47</sup> Since there has been no update of the report supporting that calculation, this percent risk estimate was applied to a weighted average of current mortality data.

## KEY FINDINGS

According to this analysis, congress dramatically underfunds CDC for its work to promote healthy eating, specifically fruit and vegetable consumption, compared to tobacco prevention. In fiscal years 2018 and 2019, CDC's appropriations for tobacco prevention were almost six times those for promoting fruit and vegetable consumption.

Further, funds earmarked for fruits and vegetables account for less than one-fifth (18%) of those aimed at tobacco prevention. While tobacco's contribution to coronary heart disease, stroke, and cancer risk is estimated at 3.3 times the disease risk attributable to

It should be noted that, in addition to DNPAO's efforts, there are smaller nutrition-related programs led by other divisions within CDC that have fruit and vegetable promotion components, including Sodium Reduction Efforts led by the Division for Heart Disease and Stroke Prevention and the Good Health and Wellness in Indian Country (GHWIC) led by the Division of Population Health. However, due to the smaller size of these programs, together with the challenges associated with isolating fruit and vegetable spending from within them, they were excluded from the calculation. While excluding these programs slightly underestimates actual CDC fruit and vegetable spending, it's likely that these calculations are an adequate estimation to inform the need to increase appropriations specifically targeted to increasing fruit and vegetable consumption, commensurate with tobacco prevention spending.

inadequate fruit and vegetable consumption gap, data indicate that poor diet and physical activity will soon overtake tobacco use a leading cause of death in the U.S. Therefore, congress may disproportionately underfund healthy eating, and specifically intake of fruits and vegetables, compared to tobacco prevention.

To bring fruit and vegetable spending more in line with tobacco prevention efforts, CDC's funding would need to increase to at least 30% (\$63 million) of tobacco prevention spending (at \$210 million) – almost double the current level associated with promoting fruits and vegetables for their public health benefits (\$38 million).

## SUMMARY

Clearly, funding both tobacco prevention and increased fruit and vegetable consumption are critical and consistent with public health goals and needs with the success of tobacco prevention attributable to higher funding. A proportional funding model could be achieved by increasing fruit and vegetable funding to at least 30% of tobacco prevention funding – or, in other words, doubling the current budget for fruit and vegetable promotion to \$63 million or more.

Additionally, increased funding could be provided for DPAO and CDC's Racial and Ethnic Approaches to Community Health program to ensure equitable funding for obesity prevention programs, honing in on fruit and vegetable consumption priorities, in all 50 states, Washington, D.C. and U.S. territories.

## CHAPTER 7

# RECOGNIZING COVID-19'S IMPACT ON FEDERAL SPENDING TO ADDRESS FOOD & NUTRITION INSECURITY

The COVID-19 pandemic further illuminated the critical role of healthy dietary patterns, including the recommended amounts of fruits and vegetables, to help reduce chronic disease risk and optimize health. At the same time, the impact of food and nutrition insecurity has significantly grown in the U.S., and public health stakeholders are advocating for fundamental shifts in the nation's food system, with emphasis on initiatives that ensure all Americans are less at risk for nutrition insecurity and the associated health implications.

COVID-19 also caused a level of disruption in our society not seen in our lifetime — including widespread and sudden unemployment; childcare shortages; unprecedented rates of severe illness and death; isolation; food supply chain failures; and more. Further, many of these disruptions are still in effect at the time this report was written.

The U.S. government responded by not only providing access to food and nutrition assistance, but by also incentivizing the purchase of fruits and vegetables. Since mid-2020:

- Congress passed five major pieces of legislation, appropriating approximately \$35 billion in specific funding for food and nutrition programs that are key to addressing access challenges related to COVID-19.
- Waivers and flexibilities were authorized in implementing all federal food and nutrition programs and increasing access to them. For example, all school children were eligible to receive breakfasts and lunches with fruit and vegetable components at no cost throughout the 2020-2021 school year.
- The Cash Value Benefit for fruits and vegetables was increased in WIC. Notably, the WIC program has demonstrated increases in fruit and vegetable consumption and improved associated health outcomes among participants by combining fruit and vegetable food packages with meaningful nutrition education.<sup>78</sup>
- Funds for purchasing fresh fruits and vegetables for the Emergency Food Assistance Program utilized by food banks, pantries, shelters, and other local settings were increased.
- Some families, especially those in rural areas, were provided fresh fruit and vegetables with other healthy foods via the Farmers to Families Food Box Program (May 2020 - May 2021).
- The Thrifty Food Plan (TFP), which serves as the basis for SNAP benefits, was reevaluated and increased by 21% over the previous level — an increase that amounts to \$36.24 more per person, per month, or \$1.19 per day. This is the first update that was not cost-neutral (increase went into effect October 1, 2021).

### A FRUIT & VEGETABLE SUCCESS STORY

As discussed earlier, Congress approved a temporary increase in WIC benefits to purchase fruits and vegetables during COVID as part of the American Rescue Plan Act. This benefit increase, extended until September 2022, provides \$24/month for children, \$43/month for pregnant and postpartum participants, and \$47/month for breastfeeding participants. The “WIC benefit bump” has resulted in more than triple the amount of fruit and vegetable purchases, a greater variety of produce bought by WIC families, and increased fruit and vegetable consumption for young children.<sup>78</sup>

- At the September 2021 United Nations (UN) Food Systems Summit, USDA and United States Agency for International Development (USAID) announced a planned multi-year investment of more than \$10 billion to end hunger and undernutrition, as well as to build sustainable, equitable, and resilient food systems globally. The commitment includes “innovation and climate-smart agriculture, improved infrastructure for food access and inclusive market opportunities, programs prioritizing women’s and children’s needs, improving nutrition, reducing food loss and waste, and climate change mitigation and adaptation within our own country and worldwide.” Feeding America projected that 42 million people, or one in eight, would experience food insecurity in 2021, including 13 million, or one in six, children.<sup>79</sup>
- USDA has elevated nutrition security as a top priority across its programming, as part of a strategic framework unveiled in March 2022 focusing on: providing nutrition support throughout all stages of life; connecting all Americans to healthy, safe, affordable food sources; developing, translating and enacting nutrition science through partnership; and prioritizing equity across all initiatives. Specifically, United States Secretary of Agriculture Thomas Vilsack noted the Department’s ongoing MyPlate nutrition education programs, including digital components to reach more Americans with practical behavior solutions, updates to school meal nutrition standards, as well as improved fruit and vegetable incentives within WIC and other food and nutrition assistance programs.

## **PREVENTION VS. TREATMENT DICHOTOMY: AN URGENT OPPORTUNITY TO PRIORITIZE FUNDING OF DISEASE PREVENTION PROGRAMS, INCLUDING THE ROLE OF FOOD & NUTRITION SECURITY<sup>80</sup>**

In the U.S., healthcare expenditures substantially outpace prevention or risk reduction measures. This was made abundantly clear in the November 2, 2021 hearing of the Senate Subcommittee on Food and Nutrition, Specialty Crops, Organics, and Research on The State of Nutrition in America 2021. At this hearing, there was bipartisan agreement that too much of the federal budget is spent on healthcare and disease treatment, rather than disease prevention.

Experts shared that nutrition security drives prevention and risk reduction of chronic diseases and needs to be prioritized through systematic change at a national, state and community level. Recommended strategies included prescriptions for fruits and vegetables, enhanced reimbursement for registered dietitian nutritionists, catalyzation of business innovations and promotion of food sovereignty as well as local and traditional foods.



## CHAPTER 8

# CONCLUSIONS

**There is an urgent need to address America's fruit and vegetable consumption gap with adequate federal spending for related research, food and nutrition assistance programs, and nutrition education.**

America is experiencing a pervasive and persistent fruit and vegetable consumption crisis. The evidence is consistent and clear: Fruits and vegetables are foundational to optimizing health and reducing chronic disease risk, yet most Americans do not consume the daily amounts of fruits and vegetables recommended in the *Dietary Guidelines for Americans* (DGA). In addition, fruit and vegetable consumption habits are eroding over time and are not being passed from generation to generation.

The economic stakes of low fruit and vegetable consumption, even with conservative estimates, are high. The annual economic cost of America's pervasive and persistent consumption crisis was an alarming \$98.2 billion in 2020 and is projected to grow to \$137.0 billion by 2030.

Despite this pervasive and persistent consumption crisis, fruit and vegetable consumption, as a primary dietary habit to support health and minimize chronic disease risk, is inadequately funded across key government departments and agencies – namely USDA, NIH and CDC – which are responsible for supporting evidence-based initiatives to improve public health.

As evidenced in this *Gap Analysis*, Congress is in the position to prioritize appropriations earmarked specifically toward spending on initiatives to close the fruit and vegetable consumption gap.

**Fruit and vegetable consumption must be elevated as a national priority, with increased and equitable funding across dedicated federal agencies, to support improved public health. This *Gap Analysis* identifies the urgent need to increase funding for:**

- **Innovative clinical and consumer research**, to support improved fruit and vegetable consumption behaviors;
- **Intentional and improved fruit and vegetable access for all people**, to assist populations at disproportionate risk of chronic disease and nutrition insecurity; and
- **Inspiring and actionable ideas that create new, sustainable habits**, highlighting positive and unifying messages, to support fruit and vegetable consumption in all forms, while also reinforcing existing behaviors as well as appreciating and acknowledging individual needs, barriers, and successes.

## Innovative Clinical & Consumer Research

Greater, more timely and relevant evidence continues to be foundational in identifying and implementing actions that can help improve Americans' fruit and vegetable consumption. Opportunities include:

- Continuing human nutrition research, such as clinical trials supported at CDC and NIH, to better understand the health benefits associated with fruit and vegetable intake, as well as the impact of bioactives and phytochemicals uniquely and readily available in fruits and vegetables.
- Prioritizing research within USDA and CDC that addresses fruit and vegetable consumption within population segments and among different geographies, to help all sectors support evidence-based, sustainable solutions.
- Expanding human nutrition research funding at CDC and NIH to better understand emerging health and wellbeing benefits associated with fruit and vegetable intake, such as mental wellbeing, happiness, gut health, inflammation and immunity, which could ultimately help inspire more healthful eating behaviors.
- Encouraging collaboration across disciplines including food, nutrition, agricultural and behavioral sciences to determine evidence-based strategies that increase adherence to DGA.



## Intentional & Improved Fruit & Vegetable Access For All People

Populations at risk for lower income and education tend to have less access to affordable, nutritious foods including fruits and vegetables. While emphasis on all forms of fruits and vegetables can help ensure these populations have greater access to their health benefits, intentional focus on these underconsumed food groups in national, state and local food and nutrition policies is also essential. Opportunities include:

- Supporting an increase in the availability, accessibility, and actionability of fruits and vegetables in all forms in federal feeding programs, such as SNAP, WIC, P-EBT, Summer EBT, and USDA Emergency Food Distribution programs, to improve nutrition security. For example, consider updating the WIC package according to NASEM recommendations to increase benefits for fruits and vegetables, to help families affordably achieve DGA recommendations, and requiring state WIC agencies to consider all forms of fruits and vegetables as part of supported products.
- Improving stocking standards for fruits and vegetables within SNAP and orienting GusNIP to demonstrate the revenue value for self-funding fruit and vegetable incentives to SNAP shoppers.
- Simplifying requirements for offering fruit and vegetable incentives to SNAP customers and assuring that online EBT includes a nutrition education and promotion component.
- Elevating fruit and vegetable recommendations and incentives within the Child Nutrition Reauthorization (CNR), to inform critical federal nutrition programs such as the National School Lunch Program, Fresh Fruit and Vegetable Program, WIC, and Farm to School Program.
- Expanding CDC efforts to address nutrition insecurity and healthy, sustainable food systems with increased fruit and vegetable access, including coordination with SNAP-Ed and GusNIP.
- Increasing program flexibilities and investments in emergency food assistance, ensuring federal agencies have the authority to grant needed waivers and flexibilities during times of future economic downturns, recessions, and public health emergencies.

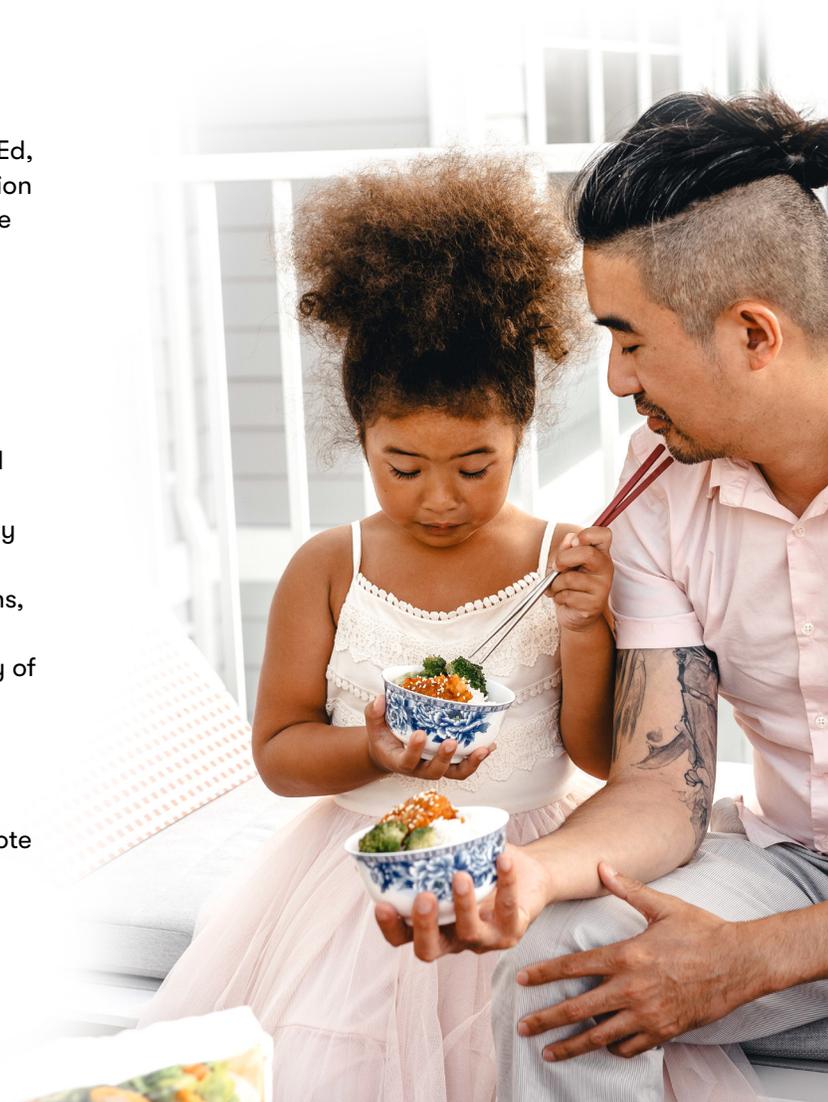


## Inspiring & Actionable Ideas That Create New, Sustainable Habits

Despite knowing that fruits and vegetables deliver health benefits, Americans continue to eat far fewer than recommended servings. As identified by PBH’s KNOW-FEEL-DO Behavioral Framework: Consumers know fruits and vegetables support healthy lifestyles, but they need to be motivated to change their behaviors through realistic and innovative ideas that tap into their feelings, to inspire action, or the “doing.” Clear, consistent and meaningful education is needed to effectively change consumption behaviors.

Stakeholders must ensure fruits and vegetables are not only purchased, but also *consumed* — and use innovative education to address behavioral barriers to doing so. Opportunities include:

- Highlighting research-based fruit and vegetable eating behavior recommendations and practical solutions within SNAP-Ed, DGA, MyPlate and similar federal programs reaching Americans.
- Increasing current funding for Team Nutrition, SNAP-Ed, and MyPlate to ensure fruit and vegetable consumption is not only encouraged, but that realistic solutions are also offered to Americans to effectively educate and engage them in increasing their intake over time.
- Incentivizing best practices for increasing access to, and choice of, fruits and vegetables, based on HHS criteria such as: knowledge of health foods and meal preparation; taste preferences, including genetic and cultural; socioeconomic determinants such as low-income and nutrition insecurity; availability of healthy foods at work, school, and other group settings; community access to grocery stores, produce gardens, farmers’ markets; marketing and nutrition labels on packaged foods; and quantity and nutritional quality of foods produced and available.<sup>2</sup>
- Demonstrating how all forms of fruits and vegetables count toward filling the consumption gap in nutrition education efforts. Recommendations that only promote fresh can cause a decrease in purchase of packaged fruits and vegetables. More inclusive language regarding all forms (fresh, frozen, canned, dried, and 100% juice) supports a positive view of other forms of fruits and vegetables without impeding intent to purchase fresh produce.<sup>81</sup>
- Enhancing nutrition education efforts with greater emphasis on more modern, digital vehicles to reach consumers whenever and wherever they are making food decisions, and to offer solutions that help address barriers such as taste and convenience, that Americans have when eating more fruits and vegetables.
- Empowering consumers via education initiatives to share ideas for enjoying fruits and vegetables among family, friends and peers — to create a community of advocates raising awareness that eating more fruits and vegetables can be one of the most important actions taken to improving health and happiness.



## A multi-sector, systems-based approach is needed to ultimately, close the gap and reverse the fruit and vegetable consumption crisis.

Clearly, there is an immediate need and opportunity to elevate fruit and vegetable consumption as a national priority and improve eating behaviors. While this *Gap Analysis* provides critical assessments of funding disparities and prioritization discrepancies across some federal agencies, the COVID-19 pandemic shed light on the shared sense of urgency and need for collaboration.

Stakeholders across all sectors—from farmers, shippers, and packers to retail and foodservice leaders, to public health officials and policy makers, to nutrition educators and health professionals, among many others—must work together to develop a national action plan, recognizing unique sector contributions and cross-sector collaboration opportunities, for improved fruit and vegetable consumption, now and in the future.



### THE 2022 WHITE HOUSE CONFERENCE ON FOOD, NUTRITION, HUNGER AND HEALTH

Congress has advanced plans for convening the second White House Conference on Food, Nutrition, Hunger and Health in September 2022, to develop a roadmap to end hunger and improve nutrition by 2030. The first conference in 1969 was instrumental in addressing caloric hunger and nutrition insecurity in the U.S., with an estimated 1,650 recommendations from that conference implemented, such as: expansion and standardization of the Food Stamp Program (now SNAP); expansion and standardization of the National School Lunch Program; creation of the School Breakfast Program; creation of the Special Supplemental Nutrition Program for Women, Infants and Children (WIC); advances and modernization of the development of dietary guidance, nutrition education; and standardized food labeling, including the Nutrition Facts label. This second conference provides a pivotal opportunity for a renewed multi-sector effort to address hunger and nutrition insecurity in the U.S., including the fruit and vegetable consumption crisis.

## SUMMARY

Fruit and vegetable consumption continues to decline, despite the significant and positive role produce plays in supporting public health. In addition, federal spending on initiatives to promote availability, access, and actionability related to fruit and vegetable consumption is remarkably low and imbalanced, compared to other public health initiatives. Despite the impact of healthy dietary patterns inclusive of the recommended intake of fruits and vegetables on health and disease prevention, federal spending on disease treatment far outpaces prevention programming. Striking a better balance on funding priorities is likely essential to set a path forward for a healthier population.

Helping all Americans achieve DGA recommendations for fruit and vegetable consumption, in all forms, requires a multi-sector, collaborative commitment. In addition, these efforts must be coordinated and supported at the highest levels of government. We're facing a global fruit and vegetable consumption crisis — affecting public health, our society, and our economy, and, in particular, impacting the most vulnerable populations at risk for poor health and increased chronic disease risk. It is critical that stakeholders across all sectors prioritize fruit and vegetable consumption in all federal, state, and local policies focused on innovative research, improved access, and inspiring, sustainable habits.

**The time is NOW to elevate fruit and vegetable consumption as a national priority in all federally funded programs affecting Americans' food decisions.**



# APPENDIX: SEARCH TERMS USED WHEN SEARCHING NIH REPORTER

## APPENDIX A.1: SEARCH TERMS USED WHEN SEARCHING NIH REPORTER FOR SPENDING ON CHRONIC DISEASE RELATED RESEARCH PROJECTS AND FRUIT AND VEGETABLE PROJECTS FOR DIET-RELATED DISEASES, FY2018 AND FY2019

DISEASE	ALL RESEARCH PROJECTS	FRUIT & VEGETABLE RESEARCH PROJECTS
<b>Cancer</b>	Cancer or Malignancy or Tumour or Tumor or Carcinoma or Metastasis or "Malignant growth" or Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or neoplasm or neurofibroma or Fibromatosis or teratoma or fibroadenoma or meningioma or Chemotherapy or Chemoprevention or Immunotherapy or Leukaemia or Leukemia or Oncology or Precancerous or "Pre-malignant" or Cancerous or A33 or A6 or Abemaciclib or ABI-007 or "Abiraterone acetate" or "Abscopal effect" or "ABT-263" or "ABT-510" or "ABT-75" or "ABT-869" or "ABT-888" or "ABVD"	("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or "Mixed Vegetables") AND (Cancer or Malignancy or Tumour or Tumor or Carcinoma or Metastasis or "Malignant growth" or Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or neoplasm or neurofibroma or Fibromatosis or teratoma or fibroadenoma or meningioma or Chemotherapy or Chemoprevention or Immunotherapy or Leukaemia or Leukemia or Oncology or Precancerous or "Pre-malignant" or Cancerous or A33 or A6 or Abemaciclib or ABI-007 or "Abiraterone acetate" or "Abscopal effect" or "ABT-263" or "ABT-510" or "ABT-751" or "ABT-869" or "ABT-888" or "ABVD")
<b>Coronary Heart Disease</b>	"Coronary Heart Disease" or "Ischemic Heart Disease" or "Heart Disease" or "Coronary Artery Disease" or "Coronary microvascular disease" or "Heart Attack" or Angina	("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or "Mixed Vegetables") and ("Coronary Heart Disease" or "Ischemic Heart Disease" or "Heart Disease" or "Coronary Artery Disease" or "Coronary microvascular disease" or "Heart Attack" or Angina)
DISEASE	ALL RESEARCH PROJECTS	FRUIT & VEGETABLE RESEARCH PROJECTS
<b>Obesity</b>	"Obesity" or "Obese" or Overweight or "Weight Management"	("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or "Mixed Vegetables") and ("Obesity" or "Obese" or Overweight or "Weight Management")
<b>Stroke</b>	"Stroke" or "Ischemic Stroke" or "Brain Attack" or "Hemorrhagic stroke" or "Cerebrovascular accident" or "Cryptogenic stroke" or "Brain stem stroke" or "intra-cerebral hemorrhage" or "subarachnoid hemorrhage" or "transient ischemic attack" or "TIA" or "thrombotic stroke" or "embolic stroke" or "ischemic attack")	("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or "Mixed Vegetables") and ("Stroke" or "Ischemic Stroke" or "Brain Attack" or "Hemorrhagic stroke" or "Cerebrovascular accident" or "Cryptogenic stroke" or "Brain stem stroke" or "intracerebral hemorrhage" or "subarachnoid hemorrhage" or "transient ischemic attack" or "TIA" or "thrombotic stroke" or "embolic stroke" or "ischemic attack")

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<p><b>Type 2 Diabetes</b></p>	<p>("Type 2 Diabetes" or "Type II Diabetes" or "Diabetes Mellitus" or "Adult-onset diabetes" or "Diabetes" or "Hyperglycemia")</p>	<p>("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or "Mixed Vegetables") and ("Type 2 Diabetes" or "Type II Diabetes" or "Diabetes Mellitus" or "Adult-onset diabetes" or "Diabetes" or "Hyperglycemia")</p>
<p><b>DISEASE</b></p>	<p><b>ALL RESEARCH PROJECTS</b></p>	<p><b>FRUIT &amp; VEGETABLE RESEARCH PROJECTS</b></p>
<p><b>Chronic Diseases, TOTAL</b></p>	<p>("Chronic" or "Chronic disease" or "Chronic disorder" or "Chronic condition" or "Chronic infection" or Cancer or Malignancy or Tumour or Tumor or Carcinoma or Metastasis or "Malignant growth" or Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or neoplasm or neurofibroma or Fibromatosis or teratoma or fibroadenoma or meningioma or Chemotherapy or Chemoprevention or Immunotherapy or Leukaemia or Leukemia or Oncology or Precancerous or "Pre-malignant" or Cancerous or A33 or A6 or Abemaciclib or ABI-007 or "Abiraterone acetate" or "Abscopal effect" or ABT-263 or ABT-510 or ABT-751 or ABT-869 or ABT-888 or ABVD or "Coronary Heart Disease" or "Ischemic Heart Disease" or "Heart Disease" or "Coronary Artery Disease" or "Coronary microvascular disease" or "Heart Attack" or Angina or "Stroke" or "Ischemic Stroke" or "Brain Attack" or "Hemorrhagic stroke" or "Cerebrovascular accident" or "Cryptogenic stroke" or "Brain stem stroke" or "intracerebral hemorrhage" or "subarachnoid hemorrhage" or "transient ischemic attack" or "TIA" or "thrombotic stroke" or "embolic stroke" or "ischemic attack" or "Obesity" or "Obese" or Overweight or "Weight Management" or "Type 2 Diabetes" or "Type II Diabetes" or "Diabetes Mellitus" or "Adult-onset diabetes" or "Diabetes" or "Hyperglycemia")</p>	<p>("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or "Mixed Vegetables") and ("Chronic" or "Chronic disease" or "Chronic disorder" or "Chronic condition" or "Chronic infection" or Cancer or Malignancy or Tumour or Tumor or Carcinoma or Metastasis or "Malignant growth" or Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or neoplasm or neurofibroma or Fibromatosis or teratoma or fibroadenoma or meningioma or Chemotherapy or Chemoprevention or Immunotherapy or Leukaemia or Leukemia or Oncology or Precancerous or "Pre-malignant" or Cancerous or A33 or A6 or Abemaciclib or ABI-007 or "Abiraterone acetate" or "Abscopal effect" or ABT-263 or ABT-510 or ABT-751 or ABT-869 or ABT-888 or ABVD or "Coronary Heart Disease" or "Ischemic Heart Disease" or "Heart Disease" or "Coronary Artery Disease" or "Coronary microvascular disease" or "Heart Attack" or Angina or "Stroke" or "Ischemic Stroke" or "Brain Attack" or "Hemorrhagic stroke" or "Cerebrovascular accident" or "Cryptogenic stroke" or "Brain stem stroke" or "intracerebral hemorrhage" or "subarachnoid hemorrhage" or "transient ischemic attack" or "TIA" or "thrombotic stroke" or "embolic stroke" or "ischemic attack" or "Obesity" or "Obese" or Overweight or "Weight Management" or "Type 2 Diabetes" or "Type II Diabetes" or "Diabetes Mellitus" or "Adult-onset diabetes" or "Diabetes" or "Hyperglycemia")</p>

**APPENDIX A.2: SEARCH TERMS USED WHEN SEARCHING NIH REPORTER FOR SPENDING ON DISEASE PREVENTION PROJECTS & FRUIT & VEGETABLE DISEASE PREVENTION PROJECTS, FY2018 & FY2019\***

DISEASE	TOTAL PREVENTION PROJECTS (\$)	FRUIT & VEGETABLE PREVENTION PROJECTS (\$)
<b>Cancer</b>	<p>(“Disease Prevention” or “Cancer Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression” or “Reduce disease progression”) AND (Cancer or Malignancy or Tumour or Tumor or Carcinoma or Metastasis or “Malignant growth” or Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or neoplasm or neurofibroma or Fibromatosis or teratoma or fibroadenoma or meningioma or Chemotherapy or Chemoprevention or Immunotherapy or Leukaemia or Leukemia or Oncology or Precancerous or “Pre-malignant” or Cancerous or A33 or A6 or Abemaciclib or ABI-007 or “Abscopal effect” or “ABT-263” or “ABT-510” or “ABT-75” or “ABT-869” or “ABT-888” or “ABVD”)</p>	<p>(“Disease Prevention” or “Cancer Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression” or “Reduce disease progression”) AND (Cancer or Malignancy or Tumour or Tumor or Carcinoma or Metastasis or “Malignant growth” or Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or neoplasm or neurofibroma or Fibromatosis or teratoma or fibroadenoma or meningioma or Chemotherapy or Chemoprevention or Immunotherapy or Leukaemia or Leukemia or Oncology or Precancerous or “Pre-malignant” or Cancerous or A33 or A6 or Abemaciclib or ABI-007 or “Abscopal effect” or “ABT-263” or “ABT-510” or “ABT-75” or “ABT-869” or “ABT-888” or “ABVD”) AND (“Fruit and Vegetable” or “Fruits and Vegetables” or “Fruit and Vegetables” or “Fruit” or “Vegetable” or “Juice” or “Fruit juice” or “Vegetable juice” or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or “Orange Juice” or “Apple Juice” or “Grape Juice” or “Apples” or Bananas or Watermelon or Grapes or Broccoli or Spinach or “Mixed Greens” or “Pinto Beans” or “Black Beans” or “White Beans” or Tomatoes or Carrots or Lettuce or Onions or “Green Beans” or Garlic or “Brussel Sprout” or Kale or Chard Cabbage or Potatoes or “Head lettuce” or “sweet corn” or “Romaine lettuce” or “Leaf lettuce” or Beans or Legumes or Corn or “String Beans” or “Leafy Greens” or “Dark Leafy Greens” or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or “Whole Fruit” or “Fruit Juice” or “Leafy Salads” or “French Fries” or “Mixed Vegetables”)</p>
<b>Coronary Heart Disease</b>	<p>(“Disease Prevention” or “Coronary Heart Disease Prevention” or “Ischemic Heart Disease Prevention” or “Heart Disease Prevention” or “Coronary Artery Disease Prevention” or “Coronary microvascular disease prevention” or “Heart Attack Prevention” or “Angina Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression”) AND (“Coronary Heart Disease” or “Ischemic Heart Disease” or “Heart Disease” or “Coronary Artery Disease” or “Coronary microvascular disease” or “Heart Attack” or Angina)</p>	<p>(“Disease Prevention” or “Coronary Heart Disease Prevention” or “Ischemic Heart Disease Prevention” or “Heart Disease Prevention” or “Coronary Artery Disease Prevention” or “Coronary microvascular disease prevention” or “Heart Attack Prevention” or “Angina Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression” or “Reduce disease progression”) AND (“Coronary Heart Disease” or “Ischemic Heart Disease” or “Heart Disease” or “Coronary Artery Disease” or “Coronary microvascular disease” or “Heart Attack” or Angina) AND (“Fruit and Vegetable” or “Fruits and Vegetables” or “Fruit and Vegetables” or “Fruit” or “Vegetable” or “Juice” or “Fruit juice” or “Vegetable juice” or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or “Orange Juice” or “Apple Juice” or “Grape Juice” or “Apples” or Bananas or Watermelon or Grapes or Broccoli or Spinach or “Mixed Greens” or “Pinto Beans” or “Black Beans” or “White Beans” or Tomatoes or Carrots or Lettuce or Onions or “Green Beans” or Garlic or “Brussel Sprout” or Kale or Chard Cabbage or Potatoes or “Head lettuce” or “sweet corn” or “Romaine lettuce” or “Leaf lettuce” or Beans or Legumes or Corn or “String Beans” or “Leafy Greens” or “Dark Leafy Greens” or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or “Whole Fruit” or “Fruit Juice” or “Leafy Salads” or “French Fries” or “Mixed Vegetables”)</p>
<b>Obesity</b>	<p>(“Disease Prevention” or “Obesity Prevention” or “Overweight Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression”) AND (“Obesity” or “Obese” or Overweight or “Weight Management”)</p>	<p>(“Disease Prevention” or “Obesity Prevention” or “Overweight Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression” or “Reduce disease progression”) AND (“Obesity” or “Obese” or Overweight or “Weight Management”) AND (“Fruit and Vegetable” or “Fruits and Vegetables” or “Fruit and Vegetables” or “Fruit” or “Vegetable” or “Juice” or “Fruit juice” or “Vegetable juice” or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or “Orange Juice” or “Apple Juice” or “Grape Juice” or “Apples” or Bananas or Watermelon or Grapes or Broccoli or Spinach or “Mixed Greens” or “Pinto Beans” or “Black Beans” or “White Beans” or Tomatoes or Carrots or Lettuce or Onions or “Green Beans” or Garlic or “Brussel Sprout” or Kale or Chard Cabbage or Potatoes or “Head lettuce” or “sweet corn” or “Romaine lettuce” or “Leaf lettuce” or Beans or Legumes or Corn or “String Beans” or “Leafy Greens” or “Dark Leafy Greens” or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or “Whole Fruit” or “Fruit Juice” or “Leafy Salads” or “French Fries” or “Mixed Vegetables”)</p>

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<p><b>Stroke</b></p>	<p>("Disease Prevention" or "Stroke Prevention" or "Prevention Research" or "Risk Factor" or "Risk Factors" or "Primary Prevention" or "Secondary Prevention" or "Preventive Interventions" or "Screening" or "Prevent harmful exposure" or "Reduce harmful exposure" or "Prevent disease onset" or "Reduce disease onset" or "Prevent disease progression" or "Reduce disease progression") and ("Stroke" or "Ischemic Stroke" or "Brain Attack" or "Hemorrhagic stroke" or "Cerebrovascular accident" or "Cryptogenic stroke" or "Brain stem stroke" or "intracerebral hemorrhage" or "subarachnoid hemorrhage" or "transient ischemic attack" or "TIA" or "thrombotic stroke" or "embolic stroke" or "ischemic attack")</p>	<p>("Disease Prevention" or "Stroke Prevention" or "Prevention Research" or "Risk Factor" or "Risk Factors" or "Primary Prevention" or "Secondary Prevention" or "Preventive Interventions" or "Screening" or "Prevent harmful exposure" or "Reduce harmful exposure" or "Prevent disease onset" or "Reduce disease onset" or "Prevent disease progression" or "Reduce disease progression") and ("Stroke" or "Ischemic Stroke" or "Brain Attack" or "Hemorrhagic stroke" or "Cerebrovascular accident" or "Cryptogenic stroke" or "Brain stem stroke" or "intracerebral hemorrhage" or "subarachnoid hemorrhage" or "transient ischemic attack" or "TIA" or "thrombotic stroke" or "embolic stroke" or "ischemic attack") AND ("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or "Mixed Vegetables")</p>
<p><b>Type 2 Diabetes</b></p>	<p>("Disease Prevention" or "Type 2 Diabetes Prevention" or "Type II Diabetes Prevention" or "Prevention Research" or "Risk Factor" or "Risk Factors" or "Primary Prevention" or "Secondary Prevention" or "Preventive Interventions" or "Screening" or "Prevent harmful exposure" or "Reduce harmful exposure" or "Prevent disease onset" or "Reduce disease onset" or "Prevent disease progression" or "Reduce disease progression") AND ("Type 2 Diabetes" or "Type II Diabetes" or "Diabetes Mellitus" or "Adult-onset diabetes" or "Diabetes" or "Hyperglycemia")</p>	<p>("Disease Prevention" or "Type 2 Diabetes Prevention" or "Type II Diabetes Prevention" or "Prevention Research" or "Risk Factor" or "Risk Factors" or "Primary Prevention" or "Secondary Prevention" or "Preventive Interventions" or "Screening" or "Prevent harmful exposure" or "Reduce harmful exposure" or "Prevent disease onset" or "Reduce disease onset" or "Prevent disease progression" or "Reduce disease progression") AND ("Type 2 Diabetes" or "Type II Diabetes" or "Diabetes Mellitus" or "Adult-onset diabetes" or "Diabetes" or "Hyperglycemia") AND ("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or "Mixed Vegetables")</p>

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<p><b>Chronic Diseases, TOTAL</b></p>	<p>(“Chronic” or “Chronic disease” or “Chronic disorder” or “Chronic condition” or “Chronic infection” or Cancer or Malignancy or Tumour or Tumor or Carcinoma or Metastasis or “Malignant growth” or Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or neoplasm or neurofibroma or Fibromatosis or teratoma or fibroadenoma or meningioma or Chemotherapy or Chemoprevention or Immunotherapy or Leukaemia or Leukemia or Oncology or Precancerous or “Pre-malignant” or Cancerous or A33 or A6 or Abemaciclib or ABL-007 or “Abiraterone acetate” or “Abscopal effect” or ABT-263 or ABT-510 or ABT-751 or ABT-869 or ABT-888 or ABVD or “Coronary Heart Disease” or “Ischemic Heart Disease” or “Heart Disease” or “Coronary Artery Disease” or “Coronary microvascular disease” or “Heart Attack” or Angina or “Stroke” or “Ischemic Stroke” or “Brain Attack” or “Hemorrhagic stroke” or “Cerebrovascular accident” or “Cryptogenic stroke” or “Brain stem stroke” or “intracerebral hemorrhage” or “subarachnoid hemorrhage” or “transient ischemic attack” or “TIA” or “thrombotic stroke” or “embolic stroke” or “ischemic attack” or “Obesity” or “Obese” or Overweight or “Weight Management” or “Type 2 Diabetes” or “Type II Diabetes” or “Diabetes Mellitus” or “Adult-onset diabetes” or “Diabetes” or “Hyperglycemia”) AND (“Disease Prevention” or “Coronary Heart Disease Prevention” or “Ischemic Heart Disease Prevention” or “Heart Disease Prevention” or “Coronary Artery Disease Prevention” or “Coronary microvascular disease prevention” or “Heart Attack Prevention” or “Angina Prevention” or “Stroke Prevention” or “Cancer Prevention” or “Obesity Prevention” or “Overweight Prevention” or “Type 2 Diabetes Prevention” or “Type II Diabetes Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression” or “Reduce disease progression”)</p>	<p>(“Chronic” or “Chronic disease” or “Chronic disorder” or “Chronic condition” or “Chronic infection” or Cancer or Malignancy or Tumour or Tumor or Carcinoma or Metastasis or “Malignant growth” or Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or neoplasm or neurofibroma or Fibromatosis or teratoma or fibroadenoma or meningioma or Chemotherapy or Chemoprevention or Immunotherapy or Leukaemia or Leukemia or Oncology or Precancerous or “Pre-malignant” or Cancerous or “Coronary Heart Disease” or “Ischemic Heart Disease” or “Heart Disease” or “Coronary Artery Disease” or “Coronary microvascular disease” or “Heart Attack” or Angina or “Stroke” or “Ischemic Stroke” or “Brain Attack” or “Hemorrhagic stroke” or “Cerebrovascular accident” or “Cryptogenic stroke” or “Brain stem stroke” or “intracerebral hemorrhage” or “subarachnoid hemorrhage” or “transient ischemic attack” or “TIA” or “thrombotic stroke” or “embolic stroke” or “ischemic attack” or “Obesity” or “Obese” or Overweight or “Weight Management” or “Type 2 Diabetes” or “Type II Diabetes” or “Diabetes Mellitus” or “Adult-onset diabetes” or “Diabetes” or “Hyperglycemia”) AND (“Disease Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression” or “Reduce disease progression”) AND (“Fruit and Vegetable” or “Fruits and Vegetables” or “Fruit and Vegetables” or “Fruit” or “Vegetable” or “Vegetable juice” or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or “Orange Juice” or “Apple Juice” or “Grape Juice” or “Apples” or Bananas or Watermelon or Grapes or Broccoli or Spinach or “Mixed Greens” or “Pinto Beans” or “Black Beans” or “White Beans” or Tomatoes or Carrots or Lettuce or Onions or “Green Beans” or Garlic or “Brussel Sprout” or Kale or Chard Cabbage or Potatoes or “Head lettuce” or “sweet corn” or “Romaine lettuce” or “Leaf lettuce” or Beans or Legumes or Corn or “String Beans” or “Leafy Greens” or “Dark Leafy Greens” or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or “Whole Fruit” or “Fruit Juice” or “Leafy Salads” or “French Fries” or “Mixed Vegetables”)</p>
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\*Search terms were informed by the NIH Office of Disease Prevention: <https://prevention.nih.gov/about-odp/prevention-research-defined>.<sup>82</sup>

**APPENDIX A.3: SEARCH TERMS USED WHEN SEARCHING NIH REPORTER FOR SPENDING ON PREVENTION PROJECTS & FRUIT & VEGETABLE PREVENTION PROJECTS, FY2018 & FY2019\***

ALL PREVENTION PROJECTS	FRUIT & VEGETABLE PREVENTION PROJECTS
<p>“Disease Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression” or “Reduce disease progression”</p>	<p>(“Disease Prevention” or “Prevention Research” or “Risk Factor” or “Risk Factors” or “Primary Prevention” or “Secondary Prevention” or “Preventive Interventions” or “Screening” or “Prevent harmful exposure” or “Reduce harmful exposure” or “Prevent disease onset” or “Reduce disease onset” or “Prevent disease progression” or “Reduce disease progression”) AND (“Fruit and Vegetable” or “Fruits and Vegetables” or “Fruit and Vegetables” or “Fruit” or “Vegetable” or “Juice” or “Fruit juice” or “Vegetable juice” or Lemon or Grapefruit or Orange or Lime or Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or “Orange Juice” or “Apple Juice” or “Grape Juice” or “Apples” or Bananas or Watermelon or Grapes or Broccoli or Spinach or “Mixed Greens” or “Pinto Beans” or “Black Beans” or “White Beans” or Tomatoes or Carrots or Lettuce or Onions or “Green Beans” or Garlic or “Brussel Sprout” or Kale or Chard Cabbage or Potatoes or “Head lettuce” or “sweet corn” or “Romaine lettuce” or “Leaf lettuce” or Beans or Legumes or Corn or “String Beans” or “Leafy Greens” or “Dark Leafy Greens” or Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or “Whole Fruit” or “Fruit Juice” or “Leafy Salads” or “French Fries” or “Mixed Vegetables”)</p>

\*Search terms were informed by the NIH Office of Disease Prevention: <https://prevention.nih.gov/about-odp/prevention-research-defined>.<sup>82</sup>

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