

## Fruit & Vegetable



Bridging The Disparity Between Federal Spending & America's Consumption Crisis The Produce for Better Health Foundation (PBH), in partnership with Nutrition On Demand (NOD), is happy to release the DRAFT Fruit & Vegetable Gap Analysis: Bridging The Disparity Between Federal Spending & America's Consumption Crisis report on Wednesday, January 5, 2022, which for the first time ever, will be open for a 30-day public comment period ending on Friday, February 4, 2022.

In an effort to be inclusive, thoughtful and provocative as well as further informed and impactful, part of the report development process includes an open comment period for all interested parties to contribute pertinent expertise and perspectives. Public comments will be considered for integration into the report's final analysis, results and recommendations, which will be issued later in 2022.

All vested stakeholders committed to improving public health through fruit and vegetable consumption are encouraged to review the report and submit comments, either in the body of an email or as an attachment (with all relevant scientific research and references also attached to support perspectives as necessary) to gaps@pbhfoundation.org by Friday, February 4, 2022. NOTES: When submitting your comments, please reference both the report page number and line number with your corresponding comment and/or references. Data will only be considered if references are provided.

#### We look forward to receiving your comments and insights! Thank you for sharing them with us!

#### PRODUCE FOR® BETTER HEALTH FOUNDATION

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 decades into 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<sup>®</sup>. Rooted in behavioral science, PBH's transformative Have A Plant<sup>®</sup> 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<sup>®</sup> 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. 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 Movement – 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 the Movement speaks with One Purpose, One Voice and One Call-to-Action. For more information about the Lead The Change Movement visit: www.fruitsandveggies.org/lead-the-change.



#### **About Nutrition On Demand**

Nutrition On Demand (NOD) is a Washington, DC-based consulting firm specializing in nutrition science, policy,

communications, and strategy. NOD's multidisciplinary team of registered dietitian nutritionists have extensive expertise in Dietary Guidelines for Americans development and implementation, food assistance programs, government relations, coalition-building, research and evaluation, omnichannel marketing, food retail, school nutrition, technology, and consumer and marketplace trends. NOD delivers exemplary, strategic support by bringing energy, expertise, and excellence to each and every collaboration and project. Visit www. nutritionondemand.net for policy and implementation insights on demand from a team of government insiders. Follow us on LinkedIn at Nutrition On Demand and Instagram @nutritionondemand.

## **CHAPTER 1: Introduction**

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# The Opportunity Is NOW To Elevate Fruit & Vegetable Consumption As A National Priority.

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6 Growing evidence demonstrates the significant impact of poor diet on overall health and disease risk. 7 While the importance of fruit and vegetable intake is well-established in the scientific literature and in 8 United States policy, consumers consistently under consume these food groups. Americans are currently 9 at an elevated risk of developing chronic diseases (e.g., hypertension and diabetes) as a result of poor 10 diets, physical inactivity and other upstream drivers of health continue to be high in our country --11 including poverty and education, overweight/obesity prevalence and other diet-related health 12 conditions. These social and economic factors related to obesity have been exacerbated by the COVID-13 19 pandemic. In fact, 16 states had rates of adult obesity at or above 35% in 2020 compared to 12 states 14 in 2019.<sup>1</sup> Sadly, those with diet-related diseases have been 12 times more likely to die of COVID 15 infection compared to those who do not.<sup>2</sup> 16 17 In 2021, the U.S. Government Accounting Office (GAO) released a report, commissioned by Congress, 18 reviewing 21 agencies' 200 efforts to improve diet quality and prevent chronic diseases. Ultimately, 19 GAO found Federal government efforts fragmented and duplicative and stated that "A federal strategy 20 for diet-related efforts could provide sustained leadership and result in improved, cost-effective 21 outcomes for reducing Americans' risk of diet-related chronic health conditions."2 22 23 Fruits and vegetables are the cornerstone of healthy eating patterns. Low intakes of fruits and 24 vegetables among all age groups not only contribute to low Healthy Eating Index (HEI) scores (a measure 25 of dietary quality), but ultimately chronic health conditions, such as heart disease, cancer, and stroke 26 and, ultimately, American deaths. The Dietary Guidelines for Americans consistently recognize strong 27 evidence that healthy eating patterns include recommended amounts of fruits and vegetables. In fact, 28 increasing fruit and vegetable intake may be the single most important action Americans can take to 29 improve their overall health and well-being. The nutrient, as well as bioactive, content of fruits and 30 vegetables is likely related to their health-promoting effects, such as reduced inflammation.<sup>3</sup> 31 32 The typical American dietary pattern consists of too much saturated fat, sodium, and added sugars and 33 too little fiber, potassium, and healthy oils, as well as other key nutrients and dietary components -34 which has led the United States Department of Agriculture (USDA) Economic Research Service (ERS) to 35 proclaim that "U.S. diets are out of balance with Federal recommendations."<sup>2</sup>,<sup>4</sup> And, while there are 36 many different methods and sources to measure fruit and vegetable intake, directionally, all data point 37 to the importance of consumption and concerning lack of intake among Americans. According to the 38 National Health and Nutrition Examination Survey (NHANES), 90% of Americans do not eat enough 39 vegetables and 80% under consume fruit.<sup>5</sup> The average adult consumes 1.6 cups, of the recommended 40 2-4 cups/day of vegetables and 0.9 cups of the recommended 1 ½ - 2 ½ cups/day of fruit.<sup>6,7</sup>,<sup>8</sup><sup>(2)</sup> The 41 goal, as defined by the Dietary Guidelines for Americans and MyPlate, is to "make half your plate fruits 42 and vegetables."

43

44 The Food and Agriculture Organization of the United Nations declared 2021 as "The Year of Fruits and

- 45 Vegetables," calling fruits and vegetables "dietary essentials" and this designation as "a unique
- 46 opportunity to raise awareness on the important role of fruits and vegetables in human nutrition, food

- 47 security and health and as well in achieving UN Sustainable Development Goals." As such, it is critically
- 48 important to focus on what the U.S. is doing and how we can double down on chronic disease prevention
- 49 and health promotion, by supporting increased intake of fruits and vegetables.
- 50
- 51 More closely aligning fruit and vegetable consumption with recommendations in the U.S. is a complex
- 52 prospect, and as such, there will be no one-size-fits-all approach. Successfully and sustainably improving
- 53 fruit and vegetable intake will require a comprehensive, multi-platform, systems-wide approach that is
- 54 widely accepted and adopted by multiple sectors in partnership with those across the food supply
- chain. It cannot be an option to treat inadequate fruit and vegetable consumption as "business as usual."
   Rather, improving fruit and vegetable behaviors should be central to every public health initiative.
- 57

58 Ultimately, elevating the consumption of fruits and vegetables as a national priority – including the

- role of this type of guidance in Federal funding and programming is essential to ensure *all* Americans
- 60 have equitable access, knowledge, and preparation and cooking skills to enjoy fruits and vegetables
- 61 easily and often, and ultimately, close the current consumption gap. This 2021 Produce for Better
- 62 Health Foundation (PBH) Fruit & Vegetable Gap Analysis: Bridging The Disparity Between Federal
- 63 Spending & America's Consumption Crisis seeks to examine how government funding and programming
- 64 can be an asset and opportunity to better equip and empower Americans to adopt an eating pattern
- 65 that more closely resembles those recommended by the *Dietary Guidelines for Americans* and increasing
- 66 consumption of fruits and vegetables.
- 67
- 68 This report is rooted in the 2010 and 2015 Gap Analyses conducted by PBH entitled, *The Fruit and*
- 69 Vegetable Consumption Challenge: How Federal Spending Falls Short of Addressing Public Health Needs,
- 50 but does not directly replicate the previous studies at all points as data sources and the current
- 71 environment warrant a fresh look regarding methodology. It does, however, focus on the same
- 72 Departments and Agencies, based on their significant responsibility for improving diet quality. It also
- highlights appropriations (budgeted amounts) and authorizations (legal authority) for programs that
- 74 promote increased consumption.
- 75
- When possible, in this report, the data was standardized by averaging 2018 and 2019 fiscal year data to
   create a composite on which to evaluate spending and make recommendations. One major limitation
- 78 should be noted: across Federal government funding and Agency spending, fruits and vegetables, in
- 79 most cases, are not specifically earmarked. Remaining chapters focus on a different Federal Agency and
- 80 follow a similar approach, with Agency- and program-specific modifications, as needed and noted. This
- 81 report strives to be as transparent and detailed as possible so that it can be replicated by others now
- 82 and in the years to come.

U.S. diets are out of balance with Federal recommendations

While people in the United States are consuming more vegetables and fruit 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 meat, eggs, and nuts as well as grains in the United States was higher than the recommended amounts.

Estimated average U.S. consumption compared to recommendations, 1970 and 2018

Percent of 2020-2025 Dietary Guidelines' recommendations



Based on a 2,000 calorie-per-day diet.

Notes: Loss-adjusted food availability data are proxies for consumption. Rice availability data were discontinued in 2010 and thus are not included in the grains group. Source: USDA, Economic Research Service, Loss-Adjusted Food Availability Data and 2020-2025 Dietary Guidelines.

- 84 Original graphic here: https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-85 detail/?chartId=58334#:~:text=U.S.%20diets%20are%20out%20of,for%20these%20major%20food%20groups. 86 [BOX] Diet-Related Disease Rates and Cost<sup>2,9,10,11</sup> 87 88 89 Adult Obesity. Forty-two percent of adults have obesity—or approximately 100 million U.S. adults. 90 Prevalence of adult obesity has increased 12% since 1999-2000. Further, severe obesity almost doubled 91 over the same period from 4.7% to 9.2%. Obesity occurs disproportionately in minority populations, 92 with non-Hispanic black adults having the highest rates (49.6%), followed by Hispanic adults (44.8%). 93 94 Childhood Obesity. In 2017-2018, 19.3% of children and adolescents could be classified as having 95 obesity and this trend began early in life with an obesity prevalence of 13.4% in children aged 2 to 5 96 years. As with adults, levels of childhood obesity tend to be highest among Hispanic children (25.6%) 97 and non-Hispanic black children (24.2%). 98 99 Chronic Disease Deaths. Cardiovascular diseases, cancer, and diabetes accounted for half of all annual 100 deaths in the U.S. (about 1.5 million deaths). People living in southern states, men, and Black Americans
- have disproportionately higher mortality rates than those living in other regions, women, and other
   races.
- 103

104 Cost. Government spending, including Medicare and Medicaid, to treat cardiovascular disease, cancer,

and diabetes accounted for 54 percent of the \$383.6 billion in health care spending to treat theseconditions.

## **107 CHAPTER 2: The Fruit & Vegetable Consumption Crisis**

108

## **In Depth: Pervasive & Persistent Fruit & Vegetable**

### 110 Underconsumption

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112 To quantify the gap between fruit and vegetable consumption and recommendations, as well as track 113 progress toward improvement, it is necessary to begin with empirical measurement. To do that, it is 114 helpful to ground the discussion in how we measure fruit and vegetable intake and what constitutes a 115 crisis. For this report, we will examine produce consumption from the perspective of four different types 116 of intake measures: 1) **volume** (how much the population is consuming overall, as well as by age, sex, 117 racial/ethnic background, and income); 2) frequency (number of fruit and vegetable eating occasions 118 during an average day or week); 3) types of produce consumed (specific fruits and vegetables, in all 119 forms, consumed by volume and frequency); and 4) sales data. Together these measures provide 120 significant insights into current and historical eating patterns and behaviors and can illuminate the most

- 121 effective ways to improve fruit and vegetable consumption behaviors moving forward.
- 122

## 123 Volume

- 124 As discussed in Chapter 1, the average adult consumes 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.<sup>5</sup> When looking at all age
- 126 groups, Americans consume just under 1 cup of fruit and 1 ½ cups of vegetables, daily (Table 2.1) on
- average.<sup>12</sup> Total fruit intake remains fairly consistent, regardless of age, with the exception of 2- to 5 year-olds who consume more (1.6 cup eq/day for males and 1.5 cup eq/day for females) than average
- year-olds who consume more (1.6 cup eq/day for males and 1.5 cup eq/day for females) than average.
   Males consume slightly more total fruit and fruit juice than females. In general, total vegetable intake
- 130 increases as individuals age with the lowest consumption seen among young children and highest
- 131 among older adults. Most notably, intake of fruit and vegetables did not significantly change between

132 the 2003-2004 and 2017-2018 National Health and Nutrition Examination Survey (NHANES) survey

- 133 periods.<sup>12</sup>
- 134 [BOX: MyPlate Food Groups]<sup>5</sup>
- 135 Fruits Includes all forms (fresh, frozen, canned, or dried, and 100% juice); may be whole, cut-up,
- 136 pureed, or cooked
- 137 Vegetables Includes all forms (fresh, frozen, canned, dried, and 100% juice); may be raw or cooked,
- 138 whole, cut-up, or mashed
- 139 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)
- 141 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.
- 146 Dairy Includes milk, yogurt, and cheese, as well as lactose-free milk and fortified soy milk and yogurt

- 147 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
- eq/day), followed by starchy and red/orange vegetables (0.4 cup eq/day for both). Dark-green
- 150 vegetables (0.1 cup eq/day) and legumes (0.1 cup eq/day) contribute the least to total vegetable intake
- 151 for both males and females across all age groups, with the exception of females aged 40-49 years who
- 152 consume just as much dark green vegetables as starchy and red/orange vegetables (0.4 cup eq/day of
   153 each).<sup>13</sup>
- 153 e 154
- 155 [BOX] When considering NHANES data, it is important to note that legumes are not included in total
- 156 vegetables. This is because legumes can contribute to both vegetable and protein intake. Therefore,
- 157 these data are captured separately and categorized as "legumes as vegetable (cups)" and "legumes as
- 158 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 USDAeating patterns.
- 161
- 162 The Produce for Better Health Foundation (PBH) conducts its *State of the Plate: America's Fruit* &
- 163 *Vegetable Consumption Trends* report every five years, and for the first time, the 2020 report addressed
- 164 consumption of fruits and vegetables by volume. While there were limitations in The NPD Group's
- volume measurement methodology (NPD Group leads the report data collection and analysis) in that
- 166 only fruits and vegetables eaten "as is" (versus as an ingredient or in addition to another dish) could be
- 167 captured, its fruit and vegetable 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
- 170 just under one cup, and average consumption of vegetables as one eating occasion per day, with the
- 171 average amount consumed at one time as 1.4 cups.<sup>14</sup>
- 172

Table 2.1: Average Daily Amount (Volume) of Fruits and Vegetables Eaten (in cup eq/day) Among Age
 Groups<sup>12</sup>

| Age         | 2+ years      | 2-19 | 2-19 years |      | 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       | 1.5           | 0.9  | 1.0        | 1.7  | 1.6    |
| Vegetables* |               |      |            |      |        |
| 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    |

175 \*Legumes included in total vegetable intake for consistency with MyPlate.<sup>8</sup>

177

|          |                 | Daily Fruit<br>Recommendations <sup>7</sup> | Daily Vegetable<br>Recommendations <sup>8</sup> |
|----------|-----------------|---|---|
| Toddlers | 12 to 23 months | ½ to 1 cup                                  | ⅔ to 1 cup                                      |
|          | 2-4 yrs         | 1 to 1½ cups                                | 1 to 2 cups                                     |
| Children | 5-8 yrs         | 1 to 2 cups                                 | 1½ to 2½ cups                                   |
| <u></u>  | 9-13 yrs        | 1½ to 2 cups                                | 1½ to 3 cups                                    |
| Girls    | 14-18 yrs       | 1½ to 2 cups                                | 2½ to 3 cups                                    |
| _        | 9-13 yrs        | 1½ to 2 cups                                | 2 to 3½ cups                                    |
| Boys     | 14-18 yrs       | 2 to 2½ cups                                | 2½ to 4 cups                                    |
|          | 19-30 yrs       | 1½ to 2 cups                                | 2½ to 3 cups                                    |
| Women    | 31-59 yrs       | 1½ to 2 cups                                | 2 to 3 cups                                     |
|          | 60+ yrs         | 1½ to 2 cups                                | 2 to 3 cups                                     |
|          | 19-30 yrs       | 2 to 2½ cups                                | 3 to 4 cups                                     |
| Men      | 31-59 yrs       | 2 to 2½ cups                                | 3 to 4 cups                                     |
|          | 60+ yrs         | 2 cups                                      | 2½ to 3½ cups                                   |

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179

180 When considering the volume of total fruit consumed by race and ethnicity, non-Hispanic Asians 181 consume the most (1.3 cup eq/day), followed by Hispanics (1.2 cup eq/day); while non-Hispanic whites 182 and non-Hispanic blacks consume less than 1 cup-equivalent daily (Table 2.2). Fruit juice contributes 183 more (0.3 cup eq/day) to total fruit intake among non-Hispanic blacks and Hispanics, with intake being 184 highest among 2- to 5-year-olds (0.8 cup eq/day and 0.6 cup/eq/day, respectively). Fruit juice accounts 185 for an average of 0.2 cup-equivalent per day for non-Hispanic whites and Asians. Two-to-five-year-olds 186 consume the most fruit juice among non-Hispanic whites (0.6 cup eq/day), while 12- to 19-year-olds 187 have the highest intake of fruit juice among non-Hispanic Asians (0.5 cup eq/day).<sup>12</sup> 188

According to 2017-2018 NHANES data, intake of vegetables is highest among non-Hispanic Asians (1.8
 cup eq/day) followed by non-Hispanic whites (1.5 cup eq/day) and Hispanics (1.5 cup eq/day) (Table
 2.2). Non-Hispanic Blacks have the lowest daily intake of vegetables (1.2 cup eq/day). For all race/ethnic
 groups, intake of vegetables increases with age. Other vegetables contribute the most to total vegetable
 intake among non-Hispanic Asians (0.7 cup eq/day), non-Hispanic whites (0.5 cup eq/day), and Hispanics

(0.5 cup eq/day); while starchy vegetables contribute the most for non-Hispanic blacks (0.5 cup eq/day).

195 Intake of dark green vegetables (0.2 cup eq/day) is highest among non-Hispanic Asians with every other

196 race/ethnic group consuming 0.1 cup eq/day. Hispanics and non-Hispanic Asians consume more

197 legumes (0.2 cup eq/day) than non-Hispanic blacks and whites (0.1 cup eq/day).<sup>12</sup>

| Age         | 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       | 1.5      | 1.8                | 1.3                | 1.5                |
| Vegetables* |          |                    |                    |                    |
| 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                |

Table 2.2: Average Daily Amount (Volume) of Fruits and Vegetables Eaten (in cup eq/day) Among
 Race/Ethnic Groups (ages 2+ years)<sup>12</sup>

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

202 Individuals living in households with income below 131 percent of the poverty level (ages 2+ years)

203 consume lower amounts of total fruit (0.9 cup eq/day) and total vegetables (1.3 cup eq/day) than

204 individuals living in households with income above 350 percent of poverty (1.0 cup eq/day and 1.7

205 cup eq/day, respectively). Fruit juice contributes more to fruit intake among those living in households

with income below 131 percent of the poverty level (0.3 cup eq/day) than those living in households

207 with income above 350 percent of poverty (0.2 cup eq/day).<sup>12</sup>

208

209 Vegetable consumption increases with family income. Intake of starchy vegetables ranges from 0.4 to

210 0.5 cup eq/day among the various family income levels, with potatoes contributing more than other

211 starchy vegetables. Individuals living in households above 350 percent poverty consume the most

red/orange (0.4 cup eq/day), dark green (0.2 cup eq/day), and other vegetables (0.6 cup eq/day).

213 Intakes of the red/orange vegetable subgroup and dark green subgroup among lower income groups are

0.3 cup eq/day and 0.1 cup eq/day, respectively. Individuals living in households with income below 131

- percent of the poverty level consume the lowest number of other vegetables (0.4 cup eq/day); and
- those living between 131 and 350 percent of the poverty level consume 0.5 cup eq/day. Intake of
- 217 legumes as vegetables is consistent across all family income levels (0.1 cup eq/day).<sup>12</sup>
- 218 219

### 220 Frequency

### 221 **Overall Consumption Frequency**

222 Frequency data provides invaluable information about fruit and vegetable *habits* among Americans as a

whole and by key demographic groups. Additionally, this frequency data can illuminate trending habits

of these groups over time. Alarmingly, it appears that fruit and vegetable eating occasions have been consistently declining.

226

*PBH's State of the Plate* research indicates that, in 2020, 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%, vegetable and juice occasions

decreased 4% and 8% respectively, between 2015 and 2020, resulting in a 3% net decrease of fruit and

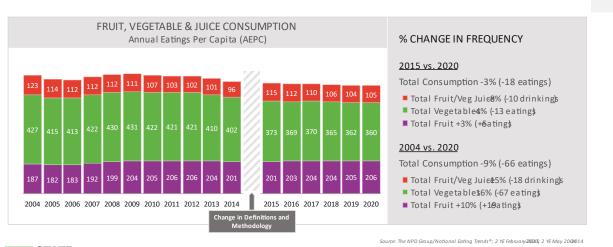
231 vegetable eating/drinking occasions.<sup>14</sup>

- 233 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>14</sup>
- 236
- 237 Infrequent consumption of fruits and vegetables, as well as decreasing intake over time, appear to be 238 secondary to two larger issues: 1) the greatest proportion of Americans are either low frequency eaters 239 of produce or non-action with modium and high frequency fruit and userstable actors proling up and
- of produce or non-eaters, with medium and high frequency fruit and vegetable eaters making up a minority of consumers overall; and 2) over time, historically high frequency consumers of fruits and
- 241 vegetables have begun eating them less often.
- 242

The 2020 *PBH State of the Plate* research classified consumers as low, medium, and high frequency
eaters, based on weekly eating occasions. As stated above, the majority of consumers fell into the "low"

- 245 intake category. For instance, among consumers who ate or drank any fruit, vegetables, or juice during
- the week, just more than 58% of the population were "low" frequency eaters (defined as 1-13 eating
- 247 occasions of fruits, vegetables, and/or juice per week). Conversely, "high" consumers (those with 22 or
- more eating or drinking occasions per week) comprised less than 15% of the total consuming
- 249 population.<sup>14</sup>
- 250

### 251 Figure 2.1 Frequency of Fruit, Vegetable, & Juice Intake<sup>14</sup>



#### 253

### 254 **Fruit**

*PBH State of the Plate* data provide 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) comprise 50% of the consuming population, while "high" frequency eaters (12+ eating fruit occasions per week) account for less than 10% of the consuming population. Average fruit consumption is **5.8 times per week, or less** 

- than once per day.<sup>14</sup>
- 262

263 NHANES 2017-2018 data tells a similar story on frequency of consumption. **On a given day, less than** 

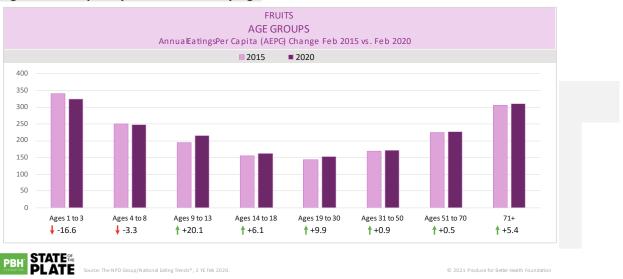
- half of adults eat fruit, with one quarter of adults reporting eating only one type of fruit per day. Fruit
- intake increases with age and income based on frequency reporting among adults. Non-Hispanic Asian
- and Hispanic adults report consuming fruit more frequently and non-Hispanic black adults 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>15</sup>
- 269 270

#### 271 Only about half of individuals 2-19 years of age consume fruit on a given day and intake also increases

- 272 with income. Fruit intake was lowest among black children.<sup>16</sup> In the high school-aged population, the
- 273 percentage who did not eat fruit or drink 100% fruit juice during the week prior to being surveyed
- increased between 1999-2013 and decreased between 2013-2019. That said, the percentage of high
- school-aged children who consumed fruit two or more times per day decreased between 1999 and
- 2019.<sup>16</sup> Unlike in adults, fruit intake decreases with age, with adolescents consuming fruit less often
   than younger children (Figure 2.2).
- 277 278

#### 279 Figure 2.2 Frequency of Fruit Intake By Age<sup>14</sup>



281

### 282 Vegetables

283 Just over half of Americans eat vegetables on a given day and consumption increases with income.

- 284 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
- 286 one-quarter ate two different items on the reporting day. Vegetable intake is reported least often by
- 287 Hispanics, and most often by non-Hispanic Asians and non-Hispanic whites.<sup>17</sup> Similar to adults, female
- children consume vegetables more often than males, except for those 2-5 years of age. Hispanic
- 289 children and adolescents' vegetable consumption is lower than other race/ethnic groups.<sup>18</sup>
- 290

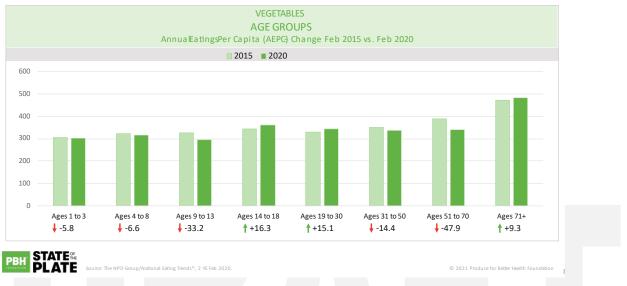
Approximately one-third of all children and adolescents ate one type of vegetable on a given day and less than one-quarter ate two or more. The percentage of high school-aged children who did not consume vegetables during the week prior to being surveyed increased between the **1999-2019** survey periods.<sup>18</sup>

- 294
- Again, *PBH State of the Plate* data is consistent with NHANES, indicating that **average vegetable**
- 297 consumption is about 7.5 times per week, or about once/day. The vast majority of consumers eat
- vegetables at least once in a typical week (95%). Low frequency vegetable eaters (1-7 eating occasions
- 299 per week) account for just more than half of the consuming population (i.e., 55%) while high

#### 300 frequency vegetable eaters (12+ eating occasions per week) make up just over 15% of the consuming

- 301 population. Further, vegetable eating occasions declined between 2015 and 2020 in five of eight age
- 302 groups, with the greatest loss of 47.9 annual eating occasions seen among adults aged 51 to 70 years—
- 303 the second highest consumer group for vegetables (Figure 2.3).
- 304

#### 305 Figure 2.3 Frequency of Vegetable Intake by Age<sup>14</sup>



307

#### **Types Of Fruits & Vegetables Most Commonly Consumed** 308

309 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

310

311 consumer messaging 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 312 313 in policy, guidance, education, and system-wide approaches.

314

315 Based on the 2020 Dietary Guidelines Advisory Committee Food Pattern Modeling Report, 73% of fruit

consumed by Americans 2 years and older is in the form of whole fruit and 27% is in juice form. 316

- 317 Proportion of juice intake increases and whole fruit decreases among those 2-18 years of age compared
- 318 to adults. Variability is seen between age groups on specific fruits and vegetables consumed (Table 2.3).

| Food Group            | % Food Group or Subgroup Consumption |           |            |             |           |  |  |  |
|-----------------------|--------------------------------------|-----------|------------|-------------|-----------|--|--|--|
| and Subgroup          |                                      |           |            |             |           |  |  |  |
|                       | 2 years +                            | 2-3 years | 4-18 years | 19-70 years | 71+ years |  |  |  |
| Whole Fruit           | ·                                    |           | ·          | ·           | ·         |  |  |  |
| Apples                | 19.5%                                | 17%       | 23.9%      | 19.3%       | 13.6%     |  |  |  |
| Bananas               | 13.0%                                | 11.2%     | 8.3%       | 14.4%       | 15.1%     |  |  |  |
| Watermelon            | 6.2%                                 | 3.5%      | 5.1%       | 6.7%        | 7.0%      |  |  |  |
| Grapes                | 4.5%                                 | 6.5%      | 4.2%       | 4.4%        | 4.7%      |  |  |  |
| Strawberries          | 4.2%                                 | 2.6%      | 4.8%       | 3.9%        | 5.2%      |  |  |  |
| Oranges               | 3.5%                                 | 3.1%      | 3.7%       | 3.4%        | 4.0%      |  |  |  |
| Fruit Juice           |                                      |           |            |             |           |  |  |  |
| Orange Juice          | 12.9%                                | 6.6%      | 12.3%      | 13.2%       | 14.1%     |  |  |  |
| Apple Juice           | 7.2%                                 | 25.0%     | 14.5%      | 4.3%        | 3.1%      |  |  |  |
| Grape Juice           | 2.7%                                 | 4.5%      | 3.6%       | 2.2%        | 2.9%      |  |  |  |
| Vegetables            |                                      |           |            |             |           |  |  |  |
| Dark Green            |                                      |           |            |             |           |  |  |  |
| Broccoli              | 3.6%                                 | 4.4%      | 3.3%       | 3.9%        | 2.2%      |  |  |  |
| Spinach               | 2.1%                                 | 0.5%      | 1.0%       | 2.4%        | 1.6%      |  |  |  |
| Mixed Greens          | 1.9%                                 | 0.6%      | 0.7%       | 2.1%        | 2.2%      |  |  |  |
| <b>Beans and Peas</b> | 5                                    |           |            |             |           |  |  |  |
| Pinto Beans           | 3.2%                                 | 3.1%      | 3.4%       | 3.4%        | 1.5%      |  |  |  |
| Black Beans           | 1.1%                                 | 3.0%      | 1.2%       | 1.1%        | 0.6%      |  |  |  |
| White Beans           | 1.0%                                 | 1.2%      | 0.9%       | 0.9%        | 1.5%      |  |  |  |
| Red and Orange        | e                                    |           |            |             |           |  |  |  |
| Tomatoes              | 17.2%                                | 16.7%     | 21.0%      | 16.6%       | 17.2%     |  |  |  |
| Carrots               | 4.1%                                 | 6.1%      | 5.2%       | 3.8%        | 4.4%      |  |  |  |
| Starchy               |                                      |           |            |             |           |  |  |  |
| Potatoes,             | 7.4%                                 | 11.8%     | 8.4%       | 6.9%        | 8.8%      |  |  |  |
| Boiled                |                                      |           |            |             |           |  |  |  |
| Potato Chips          | 5.2%                                 | 6.0%      | 10.3%      | 4.5%        | 3.5%      |  |  |  |
| Potatoes,             | 4.3%                                 | 2.6%      | 3.9%       | 4.0%        | 7.5%      |  |  |  |
| Baked                 |                                      |           |            |             |           |  |  |  |
| Other                 |                                      |           |            |             |           |  |  |  |
| Lettuce               | 5.6%                                 | 1.5%      | 3.8%       | 6.0%        | 5.2%      |  |  |  |
| Onions                | 5.5%                                 | 2.8%      | 5.3%       | 5.8%        | 4.2%      |  |  |  |
| Green Beans           | 3.2%                                 | 6.2%      | 3.0%       | 3.0%        | 4.1%      |  |  |  |

#### 319 Table 2.3: Top Fruit and Vegetable Consumption by Age<sup>13</sup>

320

321 USDA's Economic Research Service (ERS) reports availability data (representing the amount grown or

322 produced) of fruits and vegetables in all forms (fresh, frozen, canned, dried, and juice). ERS data from

323 2019 shows the highest availability of apples (fresh, juice); oranges (fresh, juice); bananas; grapes (fresh,

324 juice); pineapple (fresh, frozen, juice); and watermelon (Table 2.4).

325

326 *PBH State of the Plate* frequency data lists bananas as the top fruit consumed followed by berries.

327 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 2.4). Fruit is consumed "as is" (versus as an ingredient), the majority (>80%) of the
- time. When consumed as is, the fruits eaten in the highest quantities at one time include melons (over 2
- cups), apples and peaches (great than 1 cup), and citrus and bananas (just less than 1 cup). It should be
- noted that many of the fruits with declining eating occasions are also those consumed most by
   frequency and/or volume.<sup>14</sup>
- 334

335 Vegetables eaten "as is" and in the highest quantities include lettuce/salads (close to 3 cups), French 336 fries (about 2 cups), and green beans, broccoli, beans/legumes (about 1.5 cups). Eating occasions 337 including avocados and tomato-based products (e.g., sauce, paste, salsa) grew between 2015 and 2020. 338 Potatoes have continued to be a widely consumed vegetable. However, "lettuce and leafy salads", the 339 most popular vegetable type, were the third most declining losing close to 12 eating occasions between 340 2015 and 2020. Other vegetables, including onions, tomatoes, and carrots, also decreased.<sup>14</sup> In 1985, 341 42% of eating occasions included a vegetable side dish. By 2000, there was a decrease to 36% of eating 342 occasions and this level remains steady in 2020. If staples such as salads, vegetable side dishes, and the 343 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 344 345 decline in vegetable eating occasions, demonstrating that those vegetables increasing in frequency 346 are not compensating for those lost. Additionally, consistent declines are seen in vegetable side dish 347 occasions, particularly at dinner, which have the potential to further erode vegetable intake over 348 time.

|            | Availability Data   | State of the Plate   | NHANES  | State of the Plate   |
|------------|---|--|---|--|
|            | (volume) <sup>19</sup>  | (volume) <sup>14</sup> ^   | (frequency)   | (frequency) <sup>14</sup>  |
| Fruits     | <ol> <li>Apples</li> <li>Orange</li> <li>Bananas</li> <li>Grapes</li> <li>Pineapple</li> <li>Watermelon</li> </ol>  | <ol> <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>  | Adults <sup>15</sup> <ol> <li>Bananas</li> <li>Apples</li> <li>Grapes</li> <li>Oranges</li> <li>Fruit Salad</li> <li>Strawberries</li> </ol> <li>Children<sup>16</sup> <ol> <li>Apples</li> <li>Bananas</li> <li>Oranges</li> <li>Grapes</li> <li>Strawberries</li> </ol> </li>   | <ol> <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>                        |
| Vegetables | <ol> <li>Potatoes</li> <li>Tomatoes</li> <li>Onions</li> <li>Carrots</li> <li>Head lettuce</li> <li>Sweet corn</li> <li>Romaine and<br/>leaf lettuce</li> </ol> | <ol> <li>Lettuce/leafy<br/>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<br/>potatoes</li> </ol> | <ol> <li>5. Watermelon</li> <li>Adults<sup>17</sup></li> <li>1. Potatoes</li> <li>2. Salad</li> <li>3. Tomatoes</li> <li>3. Carrots</li> <li>4. Broccoli</li> <li>4. Corn</li> <li>4. String beans</li> <li>4. Mixed         <ul> <li>vegetables</li> </ul> </li> <li>Children<sup>18</sup></li> <li>1. Potatoes</li> <li>2. Salad</li> <li>3. Broccoli</li> <li>3. Carrots</li> <li>4. Corn</li> </ol> | <ol> <li>Potatoes</li> <li>Lettuce/leafy<br/>salads</li> <li>Onions</li> <li>Tomatoes</li> <li>Carrots</li> <li>Beans/legumes<br/>(excluding<br/>green beans)</li> <li>Corn</li> </ol> |

349 Table 2.4: Top Fruits and Vegetables Consumed by Frequency and Volume\*

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

351 ^Only includes fruits and vegetables eaten "as is" and not those used as an ingredient or addition to

352 other foods/dishes.

353

### 354 Sales

355 Unlike the intake data presented above, sales data included in this report is for the 2020 calendar year –

the beginning of the coronavirus pandemic. Examining this data can provide insights into how COVID-19

has impacted consumers' decision making when purchasing and preparing food, including the dramatic

358 decline in dollars spent in foodservice during this time.

359

According to the Food Industry Association's *The Power of Produce* 2021 Report, during 2020, the

361 produce department at retail stores reported \$69.6 billion in sales – a 11.4% increase over the prior

- 362 year. Growing vegetables sales were more dramatic than fruit with 14.7% and 8.6% in increases,
- respectively. Increased use of fruit through more 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>20</sup>
- 365 366

367 While fresh produce is ubiquitous in most households (99% penetration), 44% of shoppers said they consumed fresh produce three times or less per week. At the start of the pandemic, frozen and canned 368 369 produce grew in market share compared to fresh through new buyers and increased purchasing of 370 existing buyers. Comparing to 2019 as a baseline, share of dollars decreased for fresh produce (70% vs. 371 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>, 372 2021. Consumers report that the top three reasons for increasing their purchases of frozen produce 373 included the added meals eaten at-home (39%), as well as a desire to increase shelf life (34%) and 374 minimize trips to the store (36%). Whether this shift in behavior from purchasing more frozen fruits and 375 vegetables endures post-pandemic remains to be seen, with 62% of the shoppers buying more frozen 376 produce saying they will not switch back to previous habits.<sup>20</sup>

377

## 378 The Gap & Trends Over Time

379

#### 380 Table 2.5: Fruit and Vegetable Consumption Gap\*5

|                                 | Adults (20+ years) |         |         | Children (2-19 years)       |         |         |
|---------------------------------|--------------------|---------|---------|-----------------------------|---------|---------|
|                                 | Average            | Average | Average | Average                     | Average | Average |
|                                 | Recommendation^    | Intake  | Gap     | Recommendation <sup>+</sup> | Intake  | Gap     |
| Fruits                          | 1.5-2.5            | 0.9     | 1.1     | 1-2.5                       | 1.1     | 0.7     |
| Vegetables                      | 2-4                | 1.7     | 1.3     | 1-4                         | 0.9     | 1.6     |
| Fruits and vegetables, combined | 3.5-6.5            | 2.6     | 2.4     | 2-6.5                       | 2.0     | 2.3     |

381 \*In cup-equivalents/day

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

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

384

385 When comparing the fruit and vegetable consumption gap via 2013-2014 and 2017-2018 NHANES data,

negligible changes are seen. The fruit gap is unchanged for adults (1.1 cup-eq/day) over this timeframe

and, for children (0.8 cup-eq/day), slightly worsened with a 0.01 cup-eq/day greater gap in 2017-2018.

388 The vegetable gap for adults (1.4 cup-eq/day) slightly worsened with a 0.01 cup-eq/day greater gap in

389 2017-2018 while the vegetable gap for children is unchanged over this timeframe.<sup>21, 22</sup>

390

In total, the net fruit and vegetable intake gap has grown by 0.1 cup-eq/day between 2013-2014 and

392 **2017-2018** with adults consuming slightly less vegetables and children consuming slightly less fruit.

393 The total gap for adults and children, as of 2017-2018, is 2.5 cup-eq/day and 2.4 cup-eq/day,

394 respectively. In other words, Americans will need to adjust their fruit and vegetable intake habits to

395 positively impact overall consumption, whether it be consuming them more frequently and/or in

396 larger quantities, by approximately 2.5 cup-eq/day to meet DGA recommendations for optimal health.

397

# CHAPTER 3: The Exponential Cost Of The Consumption Crisis

## 401 Close To 4 Million Deaths Worldwide In 2017 Were

#### 402 Attributable To Inadequate Fruit & Vegetable Consumption.

403

404 Poor health and increased risk of noncommunicable diseases, which are the leading causes of 405 mortality and morbidity worldwide, are fueled by the fruit and vegetable consumption gap. In fact, the World Health Organization (WHO) counts low fruit and vegetable intake among the top ten risk 406 407 factors contributing to mortality.<sup>23</sup> In all, 3.9 million deaths worldwide were estimated in 2017 to be attributable to the underconsumption of fruit and vegetables.<sup>24</sup> In the United States, just one in ten 408 409 adults meet the daily recommended amount for fruit and vegetable intakes, with young men, young adults, and adults living in poverty being most prone to underconsumption.<sup>25</sup> With seven of the top ten 410 leading causes of death in America stemming from chronic diseases, the fruit and vegetable 411 consumption crisis puts Americans at higher risk for leading shorter lives and bearing soaring medical 412 costs.<sup>25</sup> A recent Government Accounting Office (GAO) report pointed, not only to the direct and indirect 413 414 health consequences, but to the exorbitant cost of diet-related diseases related to health care spending, job absenteeism, productivity, and more.<sup>2</sup> In addition, an often-overlooked consequence is military 415 416 eligibility. More than 30% of those 17-24 years of age do not qualify for military service in our country 417 due to weight status. This accounts for almost half of those who do not qualify.<sup>2</sup> 418 419 An alternate way to look at America's persistent fruit and vegetable consumption crisis is the 420 monumental opportunity it creates to build long-term consumption habits and bolster public health 421 worldwide. Closing the fruit and vegetable consumption gap is considered a lever to lower disease 422 burden in both developed and developing countries, with its impact potentially being greater in developed regions such as the U.S.<sup>26</sup> 423 424 425 [BOX] Diet Related Chronic Disease and Health Care Cost in the U.S.<sup>2</sup> 426 In 2018: 427 Spending to treat cardiovascular diseases, cancer, and diabetes accounted for about one-• 428 quarter (\$386.6 billion) of the approximately \$1.5 trillion in total health care spending among 429 U.S. adults. 430 Of this treatment spending, 54% was shouldered by the government and 46% by private-party 431 payers, including private insurance and out-of-pocket spending by beneficiaries. 432 Government spending on diet-related health conditions increased 30% from 2009 through 2018. 433 This amount is five times greater than the increase experienced by private-party payers, 434 including private insurance and out-of-pocket spending by beneficiaries, over the same period of 435 time. 436 437 Based on data available, three broad health outcomes, guided by previous literature consistently 438 showing protective effects of consuming fruits and vegetables, were selected for close examination in this analysis: coronary heart disease (CHD), stroke, and cancer. Within the U.S., CHD and cancer, 439 440 combined, result in approximately one million deaths annually, while stroke remains the leading cause of serious long-term disability.<sup>27</sup>,<sup>28</sup>,<sup>29Error! Bookmark not defined.</sup> 441

- 443 It should be noted that the economic cost of the consumption gap calculated in this analysis may be a
- 444 vast underestimate due to the lack of commensurate data on the entire spectrum of diet-related
- 445 diseases that have been linked to fruit and vegetable consumption. For example, evidence suggests that
- 446 higher intakes of fruits and vegetables may reduce the risk of obesity, type 2 diabetes, and individual
- types of cancer, <sup>30, 31, 32</sup> yet data summarizing the economic costs associated with these diseases 447
- 448 attributable to low intakes of fruits and vegetables are unavailable.
- 449

450 Overweight and obesity are of significant public health concern – due to rising prevalence, health 451 consequences and associated health care costs. Direct and indirect costs of chronic diseases attributable 452 to overweight and obesity were calculated to be \$1.72 trillion, or 9.3% of the U.S. gross domestic 453 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>33</sup> Between the 1999-2000 and 2017-2018 time periods, obesity prevalence increased 454
- from 31% to 42% and severe obesity prevalence increased from 5% to 9% and continues to grow.<sup>34</sup> 455
- 456

457 While some studies have suggested that there are no significant associations between fruit and 458 vegetable consumption and type 2 diabetes, one meta-analysis in the Journal of Diabetes Investigation 459 reported that a higher intake of fruit, especially berries, as well as green leafy vegetables, yellow 460 vegetables, cruciferous vegetables, or their fiber have protective effects against type 2 diabetes.<sup>35</sup> The 461 economic cost of diabetes in America is \$327 billion and over 90% of cases are type 2 diabetes. Even if 462 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>36,37</sup> 463

- 464
- 465 To put it bluntly, the economic stakes of low intake of fruits and vegetables, even with conservative 466 estimates, are high.

#### More Data Are Needed On Risk Reduction Of Diet-Related 467

#### **Diseases With Recommended Fruit & Vegetable Intake.** 468

469

470 This analysis uses relative risk contributing to the development of CHD, stroke, and total cancer 471 attributable to low intake of fruits and vegetables to calculate the economic cost of the consumption 472 gap in the U.S. In a perfect scenario, this analysis would calculate the economic cost of the fruit and 473 vegetable consumption gap in the U.S. based on the burden of disease resulting from mortality, 474 morbidity, and disability. The analysis would be inclusive of all-cause mortality and all the various 475 chronic health conditions associated with fruit and vegetable intake (overweight, obesity, and severe 476 obesity; cardiovascular disease (CVD) – including coronary heart disease (CHD), stroke, hypertension; 477 type 2 diabetes; and cancer – including head and neck, lung, stomach, colorectal, and breast cancers). 478 However, this is not currently possible due to a lack of burden of disease data specifically related to fruit 479 and vegetable consumption. (See box for data limitations and opportunities for future research.) 480

481 482 [BOX] Notable Data Limitations and Research Needs

483 While data on the global burden of disease (GBD) exist, they are limited in multiple ways. GBD 484 analyses quantify the burden of premature mortality and disability for major diseases or disease 485 groups and use a summary measure of population health, the DALY (disability-adjusted life 486 years), to combine estimates of the years of life lost and years lived with disabilities. The most 487 recent estimates were based on a 2005 study by the World Health Organization that

investigated data from 14 geographical regions, including the United States.<sup>38</sup> In addition to this
 data being outdated, they do not cover all of the associated diet-related conditions associated
 with fruit and vegetable intake.

491 Evidence continues to evolve regarding the types of cancers most impacted by low intakes of 492 fruits and vegetables; dose-response and associated risk reduction; and nutrients contained in 493 produce that confer protection against the development of cancer. For instance, according to 494 the American Institute for Cancer Research and the World Cancer Research Fund in 2018, strong 495 evidence indicates that fruit and vegetable consumption is protective against aerodigestive 496 cancers and that fiber reduces the risk of colorectal cancer. Additionally, limited, but suggestive, 497 evidence indicates that fruit and/or vegetable intake is protective against head and neck, breast, and lung cancers. Further, limited, but suggestive, evidence demonstrates nutrients contained in 498 499 produce (e.g., fiber, beta-carotene, carotenoids, isoflavones, vitamin C) are protective against 500 lung and breast cancers. Conversely, limited, but suggestive, evidence associates low intake of non-starchy vegetables with increased risk of colorectal cancer and low intakes of fruit with 501 increased risk of stomach and colorectal cancers.<sup>39</sup> At this time, relative risk attributable to fruit 502 503 and vegetable intakes are not available for all of the cancer sites above. Further, some models 504 measuring relative risk are more robust than others.

## 505 Current Knowledge Indicates Significant Risk Mitigation

## 506 With Increased Fruit & Vegetable Consumption.

507 The estimates in Table 3.1 represent the reduction of relative risk contributing to the development of 508 CHD, stroke, and cancer associated with the fruit and vegetable consumption gap. When evaluating the 509 risk of mortality attributable to the fruit and vegetable consumption gap, a 2017 meta-analysis observed 510 reductions in all-cause mortality risk (31%) in a dose response manner up to an intake of 800 g of fruits 511 and vegetables, combined, per day. Disease-specific risk of mortality decreased 28% for cardiovascular 512 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, 5.6 513 514 and 7.8 million premature deaths may have been attributable to fruit and vegetable intake below 515 500g/d and 800g/d, respectively, in 2013.<sup>31</sup> 516

| Table 3.1. Relative Risk of Chronic Diseases Attributable to Low Consumption of Fruit andVegetables <sup>31</sup> |                |  |  |  |
|---|----------------|--|--|--|
| Chronic Disease   | Relative Risk* |  |  |  |
| Coronary Heart Disease  | 24%            |  |  |  |
| Stroke  | 33%            |  |  |  |
| Cancer Total  | 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.
- 519
- 520 [BOX] GLOBAL BURDEN OF DISEASE
- 521
- 522 In 2005, WHO estimated that increasing fruit and vegetable intake up to 600 g/day, could reduce the
- 523 total global burden of disease (GBD) (a measurement of the worldwide burden associated with
- 524 premature deaths and living with morbidity and/or disability) by 1.8%. Additionally, WHO calculated that
- reduction in GBD at this level of fruit and vegetable intake would be 31% for CHD, 20% for esophageal
- 526 cancer, 19% for stroke and stomach cancer, 12% for lung cancer, and 2% for colorectal cancer.<sup>38</sup>

## 527 Declining Fruit & Vegetable Consumption Could Cost The

## 528 U.S. **\$124.7 Billion Annually by 2030.**

529

530 The 2015 Gap Analysis calculated the economic cost of disease attributable to the fruit and vegetable 531 consumption gap by following the approach of USDA economist, Elizabeth Frazao's 1999 study in which 532 she multiplied the disease risk associated with diet by the total economic cost of disease. Consistent 533 with this approach, the reduction in relative risk that would occur from the optimal consumption of fruit 534 and vegetables in Table 3.1 were multiplied by the annual economic cost of each disease in the U.S. 535 (Table 3.2) to obtain the total annual cost of those diseases attributable to the fruit and vegetable 536 consumption gap in the U.S. (Table 3.3). The economic cost includes both the direct (e.g., hospital 537 inpatient stays, hospital emergency department visits, and prescribed medicines) and indirect costs 538 (e.g., lost productivity). It should be noted that using relative risk reduction as this basis of the analysis 539 could overstate the total effect in the case of co-morbidities. This should illuminate the need for 540 additional global burden of disease data related to leading chronic diseases in terms of morbidity and 541 mortality, particularly those attributable to dietary factors like the fruit and vegetable consumption gap. 542 543 Tables 3.2 and 3.3 demonstrate the economic burden associated with CHD, stroke, and cancer and the 544 portion of the burden attributable to the consumption gap, respectively. The following are key 545 takeaways: 546 547 The economic burden of the CHD, stroke, and cancer, combined, is anticipated to grow at an • 548 average of 18% every five years between 2015 to 2030; The economic burden of the three diseases, combined, in 2015 (\$437.2 billion) was larger than 549 • the GDP of 182 countries in the same year.<sup>40</sup> This estimate is projected to increase by over 55% 550 551 to \$679.5 billion by 2030; 552 • The economic burden of the consumption gap for the three health outcomes combined (\$83.4 billion) exceeded the annual expenditures of 47 states in 2015.<sup>41</sup> The combined estimate is 553 projected to increase by about 64% to \$137.0 billion from 2015 to 2030 (Table 3.3); 554 In 2015, the combined annual economic costs of all three health outcomes attributable to the 555 • consumption gap were equal to 19% of the total cost of those outcomes in the United States. By 556 557 2030, this estimate is projected to grow to 20%; and

- 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 consumption gap.
- 561

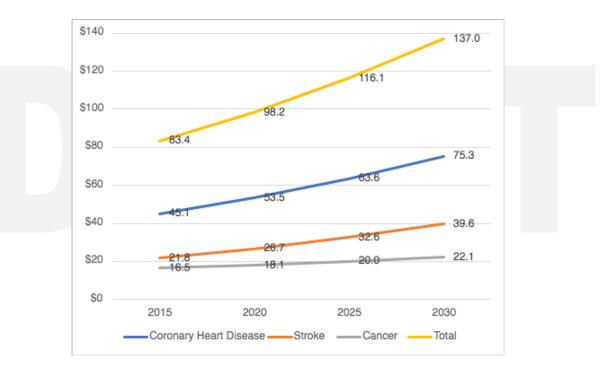
| Table 3.2. Estimated Total Annual Cost of Diet-Related Diseases in the U.S. |       |       |       |       |                                |  |  |
|---|-------|-------|-------|-------|--------------------------------|--|--|
|   | 2015  | 2020  | 2025  | 2030  | Change between 2015 to 2030(%) |  |  |
| Billions of Dollars   |       |       |       |       |                                |  |  |
| Coronary Heart Disease <sup>42</sup>  | 187.9 | 223.0 | 264.8 | 313.6 | 67                             |  |  |
| Stroke <sup>42</sup>  | 66.3  | 80.8  | 98.7  | 119.9 | 81                             |  |  |
| Cancer <sup>43</sup>  | 183.0 | 200.7 | 222.5 | 246.0 | 34                             |  |  |
| Total   | 437.2 | 504.5 | 586.0 | 679.5 | 55                             |  |  |

| Table 3.3. Calculated Estimated Total Annual Cost of Fruit and Vegetable Consumption Gap |      |      |       |       |    |  |  |  |
|--|------|------|-------|-------|----|--|--|--|
| for Diet-Related Diseases in the U.S.  |      |      |       |       |    |  |  |  |
| 2015 <sup>44</sup> 2020 2025 2030 Change between 2015 to 2030 (%)                        |      |      |       |       |    |  |  |  |
| Billions of Dollars  |      |      |       |       |    |  |  |  |
| Coronary Heart   | 45.1 | 53.5 | 63.6  | 75.3  | 67 |  |  |  |
| Disease  |      |      |       |       |    |  |  |  |
| Stroke   | 21.8 | 26.7 | 32.6  | 39.6  | 81 |  |  |  |
| Cancer   | 16.5 | 18.1 | 20.0  | 22.1  | 34 |  |  |  |
| Total  | 83.4 | 98.2 | 116.1 | 137.0 | 64 |  |  |  |

563

566

Figure 3.1. Estimated Annual Cost of Fruit and Vegetable Consumption Gap for Diet-Related Diseases
 in the U.S. in Billions of Dollars



567

568

## 569 **Closing The Current Fruit & Vegetable Consumption Gap Has**

# The Potential To Significantly Improve, Not Only U.S. Public Health, But Also The U.S. Economy.

```
573 The annual economic cost of America's rampant and ongoing fruit and vegetable consumption crisis
574 was an alarming $98.2 billion in 2020 and is projected to grow to $137.0 billion by 2030. Even more
575 concerning, these staggering numbers do not include costs associated with overweight, obesity, severe
576 obesity, pre-diabetes, diabetes, or specific types of prevalent cancers – all conditions that most health
577 professionals would agree can be improved with increased fruit and vegetable intake. If the Federal
```

- 578 government is shouldering the majority of health care costs required to treat cardiovascular diseases,
- 579 cancer and diabetes, and if associated spending has increased 30% just between 2009-2018<sup>2</sup>, how much
- 580 return on investment could be achieved by bolstering funding earmarked for promotion of fruits and 581 vegetables and closing the consumption gap?
- 582

583 Currently, the average adult consumes 1.6 cups of the recommended 2-4 cups/day of vegetables and 0.9 584 cups of the recommended 1 ½ - 2 ½ cups/day of fruit, for a combined total of 2.5 cups/day.<sup>6,7,8</sup> Best estimates indicate protection from CHD, stroke, and cancer at levels of at least 600g/day - 800g/day of 585 fruits and vegetables. This roughly calculates to 3.75 – 5.5 servings of fruits and vegetables, together. 586

587 The average recommended to adults by the Dietary Guidelines for Americans is 3.5 – 6.5 cups/day of

- 588 fruits and vegetables, combined.<sup>5</sup>
- 589

590 Closing the fruit and vegetable consumption gap will require widespread commitment and investment 591 from the highest levels of the government to the American consumer. Supporting Americans in building 592 healthy fruit and vegetable intake habits will be paramount throughout the food system. Subsequent

- 593 sections will examine government spending, across various departments and identify recommended
- 594 steps to mitigate the fruit and vegetable consumption crisis.
- 595
- 596

#### **CHAPTER 4: USDA Spending Shows Opportunity to** 597 **Improve Fruit & Vegetable Projects** 598

599

600 The U.S. Departments of Agriculture (USDA) and Health and Human Services (HHS) have joint 601 responsibility for managing the Federal government's efforts related to food and nutrition, and more 602 specifically the challenges raised by poor dietary quality and associated chronic disease. This chapter 603 focuses on USDA spending to determine if the Department's work coincides with the need to close the 604 fruit and vegetable consumption gap in an effort to improve public health.

#### Considerations 606

607

605

608 When reviewing the findings of the analyses related to USDA spending in this chapter, it is important to 609 consider that the allocation of USDA's resources is the result of policy and spending decisions made by 610 Congress in its multi-year Farm Bill and in annual appropriations bills. The Farm Bill guides the USDA's 611 Food and Nutrition Service (FNS), Food Safety and Inspection Service (FSIS), Agriculture Marketing 612 Service (AMS), Economic Research Service (ERS), Agriculture Research Service (ARS), and National 613 Institute of Food and Agriculture (NIFA). The current legislation, the Agricultural Improvement Act of 614 2018, is in place through 2023.

- 615
- 616 Additionally, other legislation impacts how funds are used to support nutrition standards in federally-
- 617 funded programs. The pending Child Nutrition Reauthorization (CNR) covers school meals (National
- 618 School Lunch Program, NSLP, and School Breakfast Program, SBP), the Summer Food Service Program,
- 619 the Special Milk Program, the Child and Adult Care Food Program (CACFP), the Special Supplemental
- 620 Program for Women, Infants, and Children (WIC), and the related WIC Farmers Market Nutrition

Program. While 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.

623

626

627

Spending that supports the consumption and promotion of the major food groups – vegetables, fruits,
 grains, dairy, and protein foods – was included in the following analyses:

- Food-group-specific purchases by the AMS to support nutrition assistance programs;
- Commodity-specific food and agricultural research, education, and extension; and
- Nutrition education programs targeting Americans participating in Federal nutrition assistance
   programs, especially people with low incomes.
- 630

The data period used in the analyses covers the Federal fiscal years (FY) of 2018 and 2019 for each data source (e.g., AMS purchases by commodity) when available. In the event that data were not available, the two most recent fiscal years were used. All findings reported in the tables in the rest of 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 in 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 for*

639 Americans and the five MyPlate food groups. While USDA spending depends on many factors, for the

purpose of this analysis, the USDA's the *Thrifty Food Plan, 2021* (TFP) was used as a guide to determine

- if USDA spending for each food group aligns with the food group recommendations of the *Dietary Guidelines*.<sup>5,45</sup>
- 643

The TFP created market baskets that contain a variety of commonly consumed foods and beverages that are lower in price and of higher nutrition quality (or nutrient density) to support healthy meals and snacks at home on a limited budget. 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

649 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

- 652 years) and reflect national average retail prices in June 2021.
- 653

We recognize that 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. Thus, these analyses have some limitations and should
be considered informed estimates used to provide insights on USDA priorities by food group.

659

## 660 Spending On Nutrition Assistance Programs

661

The majority of USDA funds is allocated for FNS. In 2018, FNS accounted for 72% of USDA's spending<sup>46</sup>, which decreased slightly to 70% in 2019.<sup>47</sup> FNS' mission is to increase food security and reduce hunger by providing children and low-income people access to food, a healthful diet, and nutrition education in a way that supports American agriculture and inspires public confidence.<sup>48</sup> The agency administers 15 food and nutrition assistance programs including WIC, the SNAP, Child Nutrition Programs (CNP) like the NSLP, SBP, and CACFP, and the Food Distribution Program on Indian Reservations (FDPIR). SNAP

- 668 accounts for the majority of FNS spending followed by the Child Nutrition Programs (e.g., NSLP, SBP, and 669 CACFP) and WIC.
- 670

671 In FY 2018 and 2019 time period, 71% of FNS spending went towards SNAP, 23% towards the Child

- 672 Nutrition Programs, 6% to WIC, and 0.3% to Commodity Assistance Programs (Table 4.1).<sup>46,47</sup> The
- 673 remaining 0.15% was spent on Nutrition Programs Administration, from which USDA's Center for
- Nutrition Policy and Promotion (CNPP), which oversees the development and implementation of the
- 675 *Dietary Guidelines,* is funded.
- 676

Table 4.1 FNS Spending on Nutrition Assistance Programs, FY 2018/2019<sup>46,47</sup>

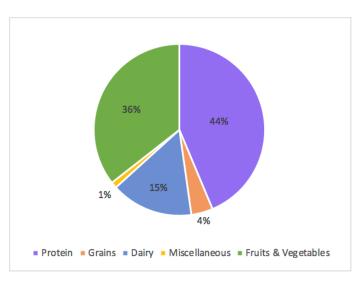
| Program Area                      | Spending (\$)   | % Of Total FNS |
|-----------------------------------|-----------------|----------------|
|                                   |                 | Spending       |
| Nutrition Programs Administration | 157,264,500     | 0.15%          |
| SNAP                              | 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%           |
| Total                             | 104,049,073,500 | 100%           |

678

679 USDA's Agricultural Marketing Service (AMS) purchases a variety of 100% domestically produced and 680 processed commodity food products – collectively called USDA Foods. These purchases are delivered to 681 schools, food banks, and households in communities across the country in support of nutrition 682 assistance programs. As seen in Figure 4.1, protein foods receive the largest portion of funding (44%) followed by fruits and vegetables (36%).<sup>50</sup> Yet, the MyPlate recommendation for following a healthy 683 dietary pattern is to "make half your plate fruits and vegetables".<sup>49</sup> In the MyPlate icon, given the dairy 684 685 food group is not "on the plate" per se, fruits and vegetables do not technically make up 50% of the 686 foods for each eating occasion. Still, even a conservative estimate of fruits and vegetables accounting for 687 40% of foods at each meal would indicate that there is room for improvement in USDA commodity 688 spending on fruits and vegetables.

- 689
- 690

90 Figure 4.1 USDA Spending on Commodity Food Purchases by Food Group/Category, FY 2018/2019<sup>50</sup>



- 694 USDA spending on commodity food purchases for nutrition assistance programs compared to the TFP,
- 695 indicates that USDA substantially overspends on the protein foods group while underspending on grains
- (Table 4.2). Spending on fruits and vegetables is 2% below the TFP cost share percentage, demonstrating
- 697 near alignment with the TFP.
- 698
- 699
- Table 4.2 USDA Spending on Commodity Food Purchases Compared to the Thrifty Food Plan Market
   Basket, FY 2018/2019<sup>45,50</sup>

| Food Groups           | Spending (\$) | % Of Total Spending | TFP Cost Share Percentage |
|-----------------------|---------------|---------------------|---------------------------|
| Fruits and Vegetables | 1,008,932,778 | 36%                 | 38%                       |
| Grains                | 115,785,760   | 4%                  | 16%                       |
| Dairy                 | 440,823,165   | 15%                 | 14%                       |
| Protein Foods         | 1,239,283,295 | 44%                 | 25%                       |
| Miscellaneous         | 32,629,239    | 1%                  | 7%                        |
| All Categories        | 2,837,454,236 | 100%                | 100%                      |

702

## 703 Spending On Research, Education & Extension

704

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.

710

711 The Current Research Information System (CRIS) which provides documentation and reporting for

712 USDA's ongoing agricultural, food science, human nutrition, and forestry research, education, and

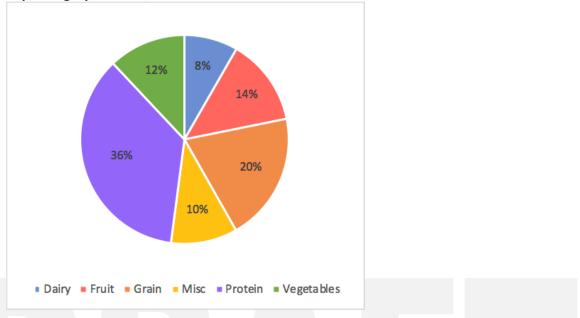
extension activities was used to obtain these data. As seen in Figure 4.2, protein foods receive the

largest portion of funding (36%) followed by grains (20%).<sup>51</sup> Spending on fruits and vegetables each
 account for less than 15% of total spending. Given the MyPlate recommendation for half a plate to be

account for less than 15% of total spending. Given the MyPlate recommendation for half a plate to be
 fruits and vegetables this demonstrates an inconsistency between Federal nutrition messages and

717 government spending.

- 718 Figure 4.2 USDA Spending on Food and Agricultural Research, Education, and Extension Activities by
- 719 **Food Group/Category, FY 2018/2019**<sup>51</sup>



720 721

USDA spending on research, education, and extension activities as captured by CRIS and compared to

the TFP, again indicates that USDA overspends on the protein foods group, grains, and the

miscellaneous category while underspending on fruits, vegetables, and dairy (Table 4.3).<sup>51</sup> Notably, 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
- 727 55%, respectively).<sup>5</sup>
- 728

## 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>51</sup>

|                       | Spending (\$) | % Of Total Spending | TFP Cost Share Percentage |
|-----------------------|---------------|---------------------|---------------------------|
| Fruits and Vegetables | 496,233,500   | 26%                 | 38%                       |
| Grains                | 387,958,500   | 20%                 | 16%                       |
| Dairy                 | 161,797,500   | 8%                  | 14%                       |
| Protein Foods         | 698,012,000   | 36%                 | 25%                       |
| Miscellaneous         | 200,419,500   | 10%                 | 7%                        |
| All Categories        | 1,944,421,000 | 100%                | 100%                      |

731

732 Another indicator of the Federal government's commitment to helping Americans follow a healthy

eating pattern consistent with the *Dietary Guidelines'* - and subsequently close the fruit and vegetable

consumption gap – is the Department's spending on nutrition education. USDA's nutrition education

735 programs target low-income individuals participating in Federal nutrition assistance programs.



- 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; and

- Team Nutrition which oversees nutrition education efforts accompanying the school meals
   programs.
- 744

While other programs like WIC include nutrition education, these are the only programs with clearly
identifiable line items in the Department's and/or FNS' fiscal year budget summaries. Thus, these are
the programs evaluated in this report.

748

As Table 4.4 shows, nutrition education spending represented less than one percent of total spending

for nutrition assistance programs during the FY2018/2019 period.<sup>52,53,54,55</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 nutrition assistance
 programs each year and that the average Healthy Eating Index score (which is an indicator of adherence

to the *Dietary Guidelines*) is 59<sup>5</sup>, this suggests that nutrition education is substantially underfunded.

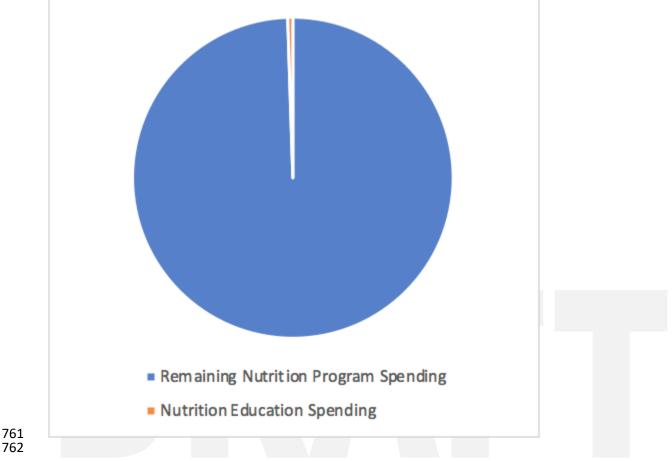
755

## Table 4.4 Proportion of USDA Nutrition Assistance Program Spending on Nutrition Education, FY 2018/2019<sup>52,53,54,55</sup>

| USDA<br>Program   | Nutrition<br>Education<br>Spending (\$) | Total Program<br>Spending (\$)* | Nutrition Education as a % of<br>Program Spending |
|-------------------|---|---------------------------------|---|
| EFNEP             | 68,467,000                              | 1,444,146,000                   | 4.7%  |
| FDPNE             | 998,000                                 | 153,000,000                     | 0.7%  |
| SNAP-Ed           | 427,000,000                             | 73,745,210,000                  | 0.6%  |
| Team<br>Nutrition | 17,004,000                              | 23,697,460,000                  | 0.1%  |
| Total             | 513,469,000                             | 99,039,816,000                  | 0.5%  |

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

760 Figure 4.3 Nutrition Education's Share of USDA's Program Spending, FY 2018/2019<sup>53,54,55,55</sup>



### 763 Summary

764 These analyses indicate inconsistencies between USDA spending and the food group recommendations 765 in the *Dietary Guidelines* and the TFP market basket cost-share percentages. The protein food group 766 dominates USDA spending, despite its comprising less than a quarter of MyPlate recommendations and 767 most Americans meeting or exceeding recommended intakes for this food group. In contrast, the 768 proportion of spending shares of dominant foods in the Dietary Guidelines and on MyPlate – fruits, 769 vegetables, and whole grains – fell far below their shares of recommended daily intakes. Furthermore, 770 although meal standards in Federal nutrition assistance programs are intended to model healthy eating, 771 approximately 0.5% of their combined budgets are allocated to nutrition education and promotion that 772 is intended to sustain healthy behavior beyond program participation (Figure 4.3). Thus, there is an 773 enormous amount of room for expansion of USDA spending on nutrition education and promotion 774 within the nutrition assistance programs. Given the substantial investment by the Federal government 775 in enhancing food access and nutrition security for low-income families, it makes sense to also invest in 776 effective nutrition education programs to ensure that public health priorities are actualized.

# 777 CHAPTER 5: NIH Spending Shows Opportunity To 778 Improve Upon Its Fruit & Vegetable Projects

779

In addition to the USDA, the Department of Health and Human Services (HHS), and in particular two
agencies within it - the National Institutes of Health (NIH) and the Centers for Disease Control and
Prevention (CDC), play critical roles in addressing the relationship between nutrition and health. NIH and
CDC both lie at the heart of America's medical research, funding public health programs and projects
related to disease risk reduction and management. Analyzing the two agencies' spending sheds light on
their current priorities and how these priorities might be shifted to close America's fruit and vegetable
consumption gap.

787

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>56</sup>, an electronic database of NIH-funded research projects. Analyses

791 were conducted for projects related to chronic disease and prevention, and fruits and vegetables,

- 792 specifically.
- 793

For each chronic disease in Table 5.1 (i.e., coronary heart disease (CHD), stroke, and cancer), relevant search terms were used to extract a list of NIH projects from the fiscal years of 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 in the Appendix.

800

801 It must be noted that some search terms extracted projects that were irrelevant to this analysis. For 802 example, when the term "berry" was included in the search for fruit and vegetable research projects, 803 other projects that used the word outside of the context of fruits such as a "berry-like" shape of a tumor 804 were obtained. While the list of search results was carefully reviewed, the total funding amounts for 805 each chronic disease in this analysis should be considered estimates.

806

## 807 Chronic Disease Projects

808

809 Fruit and vegetable research account for less than 4% of all NIH projects. Tables 5.1 and 5.2 show the 810 number of fruit and vegetable projects for diet-related diseases funded by NIH along with the amount 811 spent for each disease category. For CHD and stroke, the percent of spending on fruit and vegetable 812 research projects is much lower than the disease risk from suboptimal fruit and vegetable consumption. 813 Specifically, for CHD and stroke, 24% and 33% of disease risk are attributable to the consumption gap. 814 Yet, only 2.3% and 2.2% of NIH's spending on CHD- and stroke-related research projects, respectively, 815 evaluates fruits and/or vegetables. Similarly, for cancer, the percent of research funds spent on fruit and 816 vegetable projects is lower than the disease risk associated with low intakes (3.2% and 9%, respectively). 817 Figure 5.1 visually demonstrates the incongruence between NIH spending on fruit and vegetable 818 projects for diet-related diseases (CHD, stroke, and cancer) and the risk of disease due to the fruit and 819 vegetable consumption gap for the fiscal years of 2018 and 2019. 820

- 821 As discussed in previous chapters, the risk of developing other diet-related diseases is exacerbated by
- 822 lack of produce consumption. Two prominent examples are obesity and type 2 diabetes both of which
- are also associated with the development of co-morbidities such as CHD and cancer. 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. A total of 8,479 obesity
- research projects were funded by NIH during FY2018 and FY2019, 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 FY2018 and FY2019, of which
- 832 587 were related to fruits and vegetables, comprising 4.1% of funding for projects studying type 2
- 833 diabetes.
- 834

#### 835 Table 5.1 Number of NIH Fruit and Vegetable Projects for Diet-Related Diseases, FY 2018/2019\*

|                             | NIH Research | NIH Fruit and Vegetable | Fruit and Vegetable Projects as a % |
|-----------------------------|--------------|-------------------------|-------------------------------------|
|                             | Projects (#) | Research Projects (#)   | of NIH Projects                     |
| Coronary Heart Disease      | 5,030        | 142                     | 2.8%                                |
| Stroke                      | 6,095        | 183                     | 3.0%                                |
| Cancer                      | 43,658       | 1700                    | 3.9%                                |
| Total of 3 Chronic Diseases | 54,783       | 2,025                   | 3.7%                                |

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

837

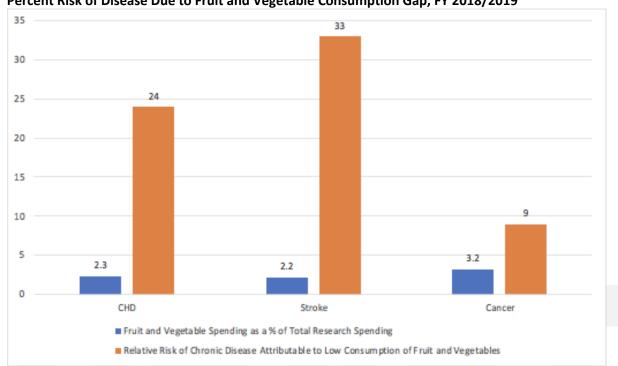
#### 838 Table 5.2 NIH Spending on Fruit and Vegetable Projects for Diet-Related Diseases, FY2018/FY2019\*

|                             | All Research   | Fruit and     | Fruit and         | Relative Risk of     |
|-----------------------------|----------------|---------------|-------------------|----------------------|
|                             | Projects (\$)  | Vegetable     | Vegetable         | Chronic Disease      |
|                             |                | Research      | Spending as a %   | Attributable to Low  |
|                             |                | Projects (\$) | of Total Spending | Consumption of Fruit |
|                             |                |               |                   | and Vegetables**     |
| Coronary Heart Disease      | 2,558,634,167  | 58,493,884    | 2.3%              | 24%                  |
| Stroke                      | 3,163,563,722  | 71,001,175    | 2.2%              | 33%                  |
| Cancer                      | 22,775,940,798 | 727,014,531   | 3.2%              | 9%                   |
| Total of 3 Chronic Diseases | 28,498,138,687 | 856,509,590   | 3.0%              | Data not available   |

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

840 \*\*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.



## Figure 5.1 Percent of NIH Spending on Fruit and Vegetable Projects for Diet-Related Diseases vs. Percent Risk of Disease Due to Fruit and Vegetable Consumption Gap, FY 2018/2019

#### 846

To assess the direction of NIH's fruit and vegetable portfolio over time, Table 5.3 compares NIH prioritization of fruit and vegetable projects for the FY 2012/2013 and FY 2018/2019 periods. The comparison indicates that: 1) fruits and vegetables were very low priorities during both periods; 2) little changed over this six-year period regardless of whether the frame of reference was for overall research projects or disease-prevention projects only for the analysis of spending on CHD and cancer; and 3) spending on stroke research overall and for disease prevention decreased markedly during this timeframe (e.g., 46% and 63%, respectively).

854

## Table 5.3 Changes in NIH Research Portfolio for Diet-Related Diseases (CHD, Stroke, Cancer), FY2012/2013 and FY 2018/2019

| % Dedicated to Fruits and             |                            | ts and Vegetables |
|---------------------------------------|----------------------------|-------------------|
| Spending For                          | FY 2012/2013 <sup>44</sup> | FY 2018/2019      |
| CHD Research Projects*                | 2.4%                       | 2.3%              |
| CHD 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 strategy.

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

859

## 861 **Prevention Projects**

862

Table 5.4 shows that, even when only NIH *disease prevention* projects are considered, the percentage of NIH spending for fruit and vegetable prevention projects is far below the precent 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 vegetables. The same pattern as in Table 5.1 is observ
- 867 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 17 times as large as the percent
- of spending on fruit and vegetable prevention projects related to stroke in the FY 2018/2019 period. For
- 870 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).
- 872
- As was done for *all* NIH research projects above, 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 FY2018 and FY2019, of which 248 were related to fruits and vegetables. The fruit and
- 876 vegetable projects received 5.7% of all NIH funding for obesity prevention research. NIH funded 4,475
- 877 research projects focused on type 2 diabetes during FY2018 and FY2019, of which 247 were related to
- 878 fruits and vegetables. The projects related to fruit and vegetables received 4.3% of funding for projects
- 879 studying type 2 diabetes.
- 880

| 881 | Table 5.4 Risk and NIH S | pending on Fruit and \ | /egetable Disease P | revention Projects, FY 2018/2019*    |
|-----|--------------------------|------------------------|---------------------|--------------------------------------|
| 001 |                          | penang on marcana v    | egetable Discuse i  | 1 CVCIIII 011110 JCCI3, 11 2010/2015 |

|                             |               |               | ,                   |                      |
|-----------------------------|---------------|---------------|---------------------|----------------------|
|                             | Total         | Fruit and     | Fruit and Vegetable | Relative Risk of     |
|                             | Prevention    | Vegetable     | Prevention          | Chronic Disease      |
|                             | Projects (\$) | Prevention    | Spending as a % of  | Attributable to Low  |
|                             |               | Projects (\$) | All Prevention      | Consumption of Fruit |
|                             |               |               | Spending            | and Vegetables**     |
| Coronary Heart Disease      | 1,064,477,645 | 19,880,440    | 1.9%                | 24%                  |
| Stroke                      | 1,286,533,678 | 24,531,313    | 1.9%                | 33%                  |
| Cancer                      | 6,708,925,005 | 257,662,000   | 3.8%                | 9%                   |
| Total of 3 Chronic Diseases | 9,059,936,328 | 302,073,753   | 3.3%                | Data not available   |

882 \*See Appendix A.2 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.

885

## 886 Summary

887

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 around fruit and vegetables for diet-related diseases, for prevention projects as a whole, and for prevention projects for CHD, stroke, and cancer decreased since the fiscal years 2012 and 2013. These estimates indicate that recent changes are not in line with public health needs or disease risk for CHD, stroke, and cancer attributable to the fruit and vegetable consumption gap.

## Table 5.5 Changes in NIH Research Portfolio for Projects on Diet-related Diseases and Nutrition, FY 2012/2013 and FY 2018/2019

|  | % Dedicated to Fruit and 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 strategy.
- 898 \*\*See Appendix A.2 for the NIH RePORTER search strategy.
- 899 \*\*\*See Appendix A.3 for the NIH RePORTER search strategy.



#### 901 Appendix: Search Terms Used When Searching NIH RePORTER

#### 902 A.1 Spending on Chronic Disease Related Research Projects and Fruit and Vegetable Projects for Diet-

#### 903 Related Diseases, FY2018 and FY2019

| Disease  | All Research Projects                   | Fruit and Vegetable Research Projects                                    |
|----------|---|--|
| Cancer   | Cancer or Malignancy or Tumour or       | ("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and          |
|          | Tumor or Carcinoma or Metastasis or     | Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or     |
|          | "Malignant growth" or Sarcoma or        | "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackberr  |
|          | Melanoma or Lymphoma or                 | or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple or  |
|          | Lymphocytic or myeloma, or neoplasm     | Peach or Applesauce or Fruit Salad or Strawberry or "Orange Juice" or    |
|          | or neurofibroma or Fibromatosis or      | "Apple Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or   |
|          | teratoma or fibroadenoma or             | Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or      |
|          | meningioma or Chemotherapy or           | "Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or      |
|          | Chemoprevention or Immunotherapy or     | Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard   |
|          | Leukaemia or Leukemia or Oncology or    | Cabbage or Potatoes or "Head lettuce" or "sweet corn" or "Romaine        |
|          | Precancerous or "Pre-malignant" or      | lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" |
|          | Cancerous or A33 or A6 or Abemaciclib   | or "Leafy Greens" or "Dark Leafy Greens" or Phytochemical or Antioxida   |
|          | or ABI-007 or "Abiraterone acetate" or  | or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or  |
|          | "Abscopal effect" or "ABT-263" or "ABT- | "Leafy Salads" or "French Fries" or "Mixed Vegetables") AND (Cancer or   |
|          | 510" or "ABT-75" or "ABT-869" or "ABT-  |  |
|          | 888" or "ABVD"                          | 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)          |
| Coronary | "Coronary Heart Disease" or "Ischemic   | ("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and          |
| Heart    | Heart Disease" or "Heart Disease" or    | Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or     |
| Disease  | "Coronary Artery Disease" or "Coronary  | "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackber   |
|          | microvascular disease" or "Heart        | or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple o   |
|          | Attack" or Angina                       | 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 Antioxida   |
|          |   | 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 "Hear   |
|          |   | Attack" or Angina)   |
|          |   |  |
| Obesity  | "Obesity" or "Obese" or Overweight or   | ("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and          |
|          | "Weight Management"                     | Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or     |
|          |   | "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or Blackber   |
|          |   | or Blueberry or Pomegranate or Berry or Citrus or Melon or Pineapple o   |
|          |   | 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 Antioxida   |
|          |   | or Salad or Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or  |

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

| or "Coronary microvascular di  |   |
|--------------------------------|---|
| "Heart Attack" or Angina or "S | itroke" or "Abscopal effect" or ABT-263 or ABT-510 or ABT-751 or ABT-869 or ABT-  |
| "Ischemic Stroke" or "Brain At | tack" or 888 or ABVD or "Coronary Heart Disease" or "Ischemic Heart Disease" or   |
| "Hemorrhagic stroke" or        | "Heart Disease" or "Coronary Artery Disease" or "Coronary microvascular           |
| "Cerebrovascular accident" or  | disease" or "Heart Attack" or Angina or "Stroke" or "Ischemic Stroke" or          |
| "Cryptogenic stroke" or "Brain | stem "Brain Attack" or "Hemorrhagic stroke" or "Cerebrovascular accident" or      |
| stroke" or "intracerebral heme | orrhage" "Cryptogenic stroke" or "Brain stem stroke" or "intracerebral            |
| or "subarachnoid hemorrhage    | " or hemorrhage" or "subarachnoid hemorrhage" or "transient ischemic              |
| "transient ischemic attack" or | "TIA" or attack" or "TIA" or "thrombotic stroke" or "embolic stroke" or "ischemic |
| "thrombotic stroke" or "embo   | lic stroke" attack" or "Obesity" or "Obese" or Overweight or "Weight Management"  |
| or "ischemic attack" or "Obesi | ty" or or "Type 2 Diabetes" or "Type II Diabetes" or "Diabetes Mellitus" or       |
| "Obese" or Overweight or "W    | eight "Adult-onset diabetes" or "Hyperglycemia")                                  |
| Management" or "Type 2 Diak    | petes" or   |
| "Type II Diabetes" or "Diabete | S   |
| Mellitus" or "Adult-onset diab | etes" or  |
| "Diabetes" or "Hyperglycemia   | ")  |

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# A.2 Spending on Disease Prevention Projects and Fruit and Vegetable Disease Prevention Projects, FY2018 and FY2019\*

| Disease  | Total Prevention Projects (\$)          | Fruit and Vegetable Prevention Projects (\$)                          |
|----------|---|---|
| Cancer   | ("Disease Prevention" or "Cancer        | ("Disease Prevention" or "Cancer Prevention" or "Prevention           |
|          | Prevention" or "Prevention Research"    | Research" or "Risk Factor" or "Risk Factors" or "Primary Prevention"  |
|          | or "Risk Factor" or "Risk Factors" or   | or "Secondary Prevention" or "Preventive Interventions" or            |
|          | "Primary Prevention" or "Secondary      | "Screening" or "Prevent harmful exposure" or "Reduce harmful          |
|          | Prevention" or "Preventive              | exposure" or "Prevent disease onset" or "Reduce disease onset" or     |
|          | Interventions" or "Screening" or        | "Prevent disease progression" or "Reduce disease progression") AND    |
|          | "Prevent harmful exposure" or "Reduce   | (Cancer or Malignancy or Tumour or Tumor or Carcinoma or              |
|          | harmful exposure" or "Prevent disease   | Metastasis or "Malignant growth" or Sarcoma or Melanoma or            |
|          | onset" or "Reduce disease onset" or     | Lymphoma or Lymphocytic or myeloma, or neoplasm or                    |
|          | "Prevent disease progression" or        | neurofibroma or Fibromatosis or teratoma or fibroadenoma or           |
|          | "Reduce disease progression") AND       | meningioma or Chemotherapy or Chemoprevention or                      |
|          | (Cancer or Malignancy or Tumour or      | Immunotherapy or Leukaemia or Leukemia or Oncology or                 |
|          | Tumor or Carcinoma or Metastasis or     | Precancerous or "Pre-malignant" or Cancerous or A33 or A6 or          |
|          | "Malignant growth" or Sarcoma or        | Abemaciclib or ABI-007 or "Abiraterone acetate" or "Abscopal effect"  |
|          | Melanoma or Lymphoma or                 | or "ABT-263" or "ABT-510" or "ABT-75" or "ABT-869" or "ABT-888" or    |
|          | Lymphocytic or myeloma, or neoplasm     | "ABVD") AND ("Fruit and Vegetable" or "Fruits and Vegetables" or      |
|          | or neurofibroma or Fibromatosis or      | "Fruit and Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit |
|          | teratoma or fibroadenoma or             | juice" or "Vegetable juice" or Lemon or Grapefruit or Orange or Lime  |
|          | meningioma or Chemotherapy or           | or Blackberry or Blueberry or Pomegranate or Berry or Citrus or       |
|          | Chemoprevention or Immunotherapy        | Melon or Pineapple or Peach or Applesauce or Fruit Salad or           |
|          | or Leukaemia or Leukemia or Oncology    | Strawberry or "Orange Juice" or "Apple Juice" or "Grape Juice" or     |
|          | or Precancerous or "Pre-malignant" or   | "Apples" or Bananas or Watermelon or Grapes or Broccoli or Spinach    |
|          | Cancerous or A33 or A6 or Abemaciclib   | or "Mixed Greens" or "Pinto Beans" or "Black Beans" or "White         |
|          | or ABI-007 or "Abiraterone acetate" or  | Beans" or Tomatoes or Carrots or Lettuce or Onions or "Green Beans'   |
|          | "Abscopal effect" or "ABT-263" or "ABT- | or Garlic or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or |
|          | 510" or "ABT-75" or "ABT-869" or "ABT-  | "Head lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" |
|          | 888" or "ABVD")                         | 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")                      |
| Coronary | ("Disease Prevention" or "Coronary      | ("Disease Prevention" or "Coronary Heart Disease Prevention" or "     |
| Heart    | Heart Disease Prevention" or " Ischemic | Ischemic Heart Disease Prevention" or "Heart Disease Prevention" or   |
| Disease  | Heart Disease Prevention" or "Heart     | "Coronary Artery Disease Prevention" or "Coronary microvascular       |
|          | Disease Prevention" or "Coronary        | disease prevention" or "Heart Attack Prevention" or "Angina           |
|          | Artery Disease Prevention" or           | Prevention" or "Prevention Research" or "Risk Factor" or "Risk        |
|          | "Coronary microvascular disease         | Factors" or "Primary Prevention" or "Secondary Prevention" or         |
|          | prevention" or "Heart Attack            | "Preventive Interventions" or "Screening" or "Prevent harmful         |
|          | Prevention" or "Angina Prevention" or   | exposure" or "Reduce harmful exposure" or "Prevent disease onset"     |

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

|                               | or "autorophysid bergerthese" or   | luice" or "Cropo luice" or "Applee" or Deserve or Materiae -   |
|-------------------------------|--|--|
|                               | or "subarachnoid hemorrhage" or<br>"transient ischemic attack" or "TIA" or<br>"thrombotic stroke" or "embolic stroke"<br>or "ischemic attack")   | Juice" or "Grape Juice" or "Apples" or Bananas or Watermelon or<br>Grapes or Broccoli or Spinach or "Mixed Greens" or "Pinto Beans" or<br>"Black Beans" or "White Beans" or Tomatoes or Carrots or Lettuce or<br>Onions or "Green Beans" or Garlic or "Brussel Sprout" or Kale or<br>Chard Cabbage or Potatoes or "Head lettuce" or "sweet corn" or<br>"Romaine lettuce" or "Leaf lettuce" or Beans or Legumes or Corn or<br>"String Beans" or "Leafy Greens" or "Dark Leafy Greens" or<br>Phytochemical or Antioxidant or Salad or Cruciferous or Starchy or<br>"Whole Fruit" or "Fruit Juice" or "Leafy Salads" or "French Fries" or<br>"Mixed Vegetables")  |
| Type 2<br>Diabetes            | ("Disease Prevention" or "Type 2<br>Diabetes Prevention" or "Type II<br>Diabetes Prevention" or "Prevention<br>Research" or "Risk Factor" or "Risk<br>Factors" or "Primary Prevention" or<br>"Secondary Prevention" or "Preventive<br>Interventions" or "Screening" or<br>"Prevent harmful exposure" or "Reduce<br>harmful exposure" or "Prevent disease<br>onset" or "Reduce disease onset" or<br>"Prevent disease progression" or<br>"Reduce disease progression") AND<br>("Type 2 Diabetes" or "Type II Diabetes"<br>or "Diabetes Mellitus" or "Adult-onset<br>diabetes" or "Diabetes" or<br>"Hyperglycemia")   | ("Disease Prevention" or "Type 2 Diabetes Prevention" or "Type II<br>Diabetes Prevention" or "Prevention Research" or "Risk Factor" or<br>"Risk Factors" or "Primary Prevention" or "Secondary Prevention" or<br>"Preventive Interventions" or "Screening" or "Prevent harmful<br>exposure" or "Reduce harmful exposure" or "Prevent disease onset"<br>or "Reduce disease onset" or "Prevent disease progression" or<br>"Reduce disease progression") AND ("Type 2 Diabetes" or "Type II<br>Diabetes" or "Diabetes Mellitus" or "Adult-onset diabetes" or<br>"Diabetes" or "Hyperglycemia") AND ("Fruit and Vegetable" or "Fruits<br>and Vegetables" or "Fruit and Vegetables" or "Fruits<br>and Vegetables" or "Fruit and Vegetables" or "Corange or Lime or Blackberry or Blueberry or Pomegranate or<br>Berry or Citrus or Melon or Pineapple or Peach or Applesauce or Fruit<br>Salad or Strawberry or "Orange Juice" or "Apple Juice" or "Grape<br>Juice" or "Apples" or Bananas or Watermelon or Grapes or Broccoli<br>or Spinach or "Mixed Greens" or "Pinto Beans" or "Black Beans" or<br>"Green Beans" or Garlic or "Brussel Sprout" or Kale or Chard Cabbage<br>or Potatoes or "Head lettuce" or "sweet corn" or "Romaine lettuce"<br>or "Leaf lettuce" or Beans or Legumes or Corn or "String Beans" or<br>"Leafy Greens" or "Dark Leafy Greens" or Phytochemical or<br>"Antioxidant or Salad or Cruciferous or Starchy or "Mixed<br>Vegetables") |
| Chronic<br>Diseases,<br>Total | ("Chronic" or "Chronic disease" or<br>"Chronic disorder" or "Chronic<br>condition" or "Chronic infection" or<br>Cancer or Malignancy or Tumour or<br>Tumor or Carcinoma or Metastasis or<br>"Malignant growth" or Sarcoma or<br>Melanoma or Lymphoma or<br>Lymphocytic or myeloma, or neoplasm<br>or neurofibroma or Fibromatosis or<br>teratoma or fibroadenoma or<br>meningioma or Chemotherapy or<br>Chemoprevention or Immunotherapy<br>or Leukaemia or Leukemia or Oncology<br>or Precancerous or "Pre-malignant" or<br>Cancerous or A33 or A6 or Abemaciclib<br>or ABI-007 or "Abiraterone acetate" or<br>"Abscopal effect" or ABT-263 or ABT-<br>510 or ABT-751 or ABT-869 or ABT-888<br>or ABVD or "Coronary Heart Disease" or<br>"Ischemic Heart Disease" or "Heart<br>Disease" or "Coronary Artery Disease"<br>or "Coronary microvascular disease" or<br>"Heart Attack" or Angina or "Stroke" or | ("Chronic" or "Chronic disease" or "Chronic disorder" or "Chronic<br>condition" or "Chronic infection" or Cancer or Malignancy or Tumour<br>or Tumor or Carcinoma or Metastasis or "Malignant growth" or<br>Sarcoma or Melanoma or Lymphoma or Lymphocytic or myeloma, or<br>neoplasm or neurofibroma or Fibromatosis or teratoma or<br>fibroadenoma or meningioma or Chemotherapy or Chemoprevention<br>or Immunotherapy or Leukaemia or Leukemia or Oncology or<br>Precancerous or "Pre-malignant" or Cancerous or "Coronary Heart<br>Disease" or "Ischemic Heart Disease" or "Heart Disease" or "Coronary<br>Artery Disease" or "Coronary microvascular disease" or "Heart<br>Attack" or Angina or "Stroke" or "Ischemic Stroke" or "Brain Attack"<br>or "Hemorrhagic stroke" or "Cerebrovascular accident" or<br>"Cryptogenic stroke" or "Brain stem stroke" or "intracerebral<br>hemorrhage" or "subarachnoid hemorrhage" or "transient ischemic<br>attack" or "TIA" or "thrombotic stroke" or "Brainet ischemic<br>attack" or "Tippe 2 Diabetes" or "Type II Diabetes" or<br>"Diabetes Mellitus" or "Adult-onset diabetes" or "Diabetes" or<br>"Hyperglycemia") AND ("Disease Prevention" or "Prevention<br>Research" or "Risk Factor" or "Risk Factors" or "Primary Prevention"<br>or "Screening" or "Prevent disease onset" or "Reduce disease onset" or<br>"Prevent disease progression" or "Reduce disease progression") AND                       |

| "Hemorrhagic stroke" or                 | ("Fruit and Vegetable" or "Fruits and Vegetables" or "Fruit and  |  |  |
|---|--|--|--|
| "Cerebrovascular accident" or           | Vegetables" or "Fruit" or "Vegetable" or "Juice" or "Fruit juice" or   |  |  |
| "Cryptogenic stroke" or "Brain stem     | "Vegetable juice" or Lemon or Grapefruit or Orange or Lime or<br>Blackberry or Blueberry or Pomegranate or Berry or Citrus or Melon<br>or Pineapple or Peach or Applesauce or Fruit Salad or Strawberry or<br>"Orange Juice" or "Apple Juice" or "Grape Juice" or "Apples" or<br>Bananas or Watermelon or Grapes or Broccoli or Spinach or "Mixed<br>Greens" or "Pinto Beans" or "Black Beans" or "White Beans" or<br>Tomatoes or Carrots or Lettuce or Onions or "Green Beans" or Garlic<br>or "Brussel Sprout" or Kale or Chard Cabbage or Potatoes or "Head<br>lettuce" or "sweet corn" or "Romaine lettuce" or "Leaf lettuce" or<br>Beans or Legumes or Corn or "String Beans" or "Leafy Greens" or<br>"Dark Leafy Greens" or Phytochemical or Antioxidant or Salad or<br>Cruciferous or Starchy or "Whole Fruit" or "Fruit Juice" or "Leafy<br>Salads" or "French Fries" or "Mixed Vegetables") |  |  |
| 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")           |  |  |  |

- 907 \*Search terms were informed by the NIH Office of Disease Prevention: <u>https://prevention.nih.gov/about-</u>
- 908 <u>odp/prevention-research-defined</u>. 57
- 909

| 040 |   |
|-----|---|
| 910 | A.3 Spending on Prevention Projects and Fruit and Vegetable Prevention Projects, FY2018 and |

### 911 FY2019\*

| All Prevention Projects                                    | Fruit and Vegetable Prevention Projects                         |
|--|---|
| "Disease Prevention" or "Prevention Research" or "Risk     | ("Disease Prevention" or "Prevention Research" or "Risk         |
| Factor" or "Risk Factors" or "Primary Prevention" or       | Factor" or "Risk Factors" or "Primary Prevention" or            |
| "Secondary Prevention" or "Preventive Interventions" or    | "Secondary Prevention" or "Preventive Interventions" or         |
| "Screening" or "Prevent harmful exposure" or "Reduce       | "Screening" or "Prevent harmful exposure" or "Reduce            |
| harmful exposure" or "Prevent disease onset" or "Reduce    | harmful exposure" or "Prevent disease onset" or "Reduce         |
| disease onset" or "Prevent disease progression" or "Reduce | disease onset" or "Prevent disease progression" or "Reduce      |
| disease progression"                                       | 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 " |  |  |
|   | 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")  |  |

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# <sup>914</sup> Chapter 6: Assessing Gaps Between CDC Spending & <sup>915</sup> National Public Health Goals

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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>58</sup> Its work on chronic disease prevention includes two main pillars that are applicable to the PBH Gaps Analysis – preventing tobacco use and building healthy dietary patterns.

#### 923 [BOX] CDC in the 21st Century<sup>58</sup>

- On the cutting edge of health security confronting global disease threats through advanced computing and lab analysis of huge amounts of data to quickly find solutions.
- 926
   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.
- 932 Nurturing public health building on our significant contribution to have strong, well-resourced
   933 public health leaders and capabilities at national, state, and local levels to protect Americans from
   934 health threats.

936 Since both diet and tobacco use significantly impact chronic disease-related morbidity and mortality 937 rates in the U.S., this chapter compares spending on these two areas. CDC's Department of Nutrition, 938 Physical Activity, and Obesity (DNPAO) is the primary division behind its initiatives to increase fruit and 939 vegetable consumption and, therefore, is the focus of this analysis. Table 6.1 outlines 1) estimated 940 spending on fruits and vegetables; 2) CDC actual spending on tobacco prevention; 3) percent of risk of 941 three diseases (coronary heart disease [CHD], stroke, cancer) attributable to the fruit and vegetable 942 consumption gap; 4) percent of risk of three diseases (CHD, stroke, cancer) attributable to tobacco use; 943 5) fruit and vegetable spending compared to tobacco spending; and 6) fruit and vegetable risk compared 944 to tobacco risk.

- 945
- 946 Methodologies to calculate the estimates in Table 6.1 are listed below. The average value between fiscal
- 947 years 2018 and 2019 was used to calculate spending and disease risk estimates.

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### 949 Estimated Spending On Fruits & Vegetables

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As stated above, 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 spent on promoting healthy dietary patterns overall and, specifically, promoting increased fruit and vegetable intake. 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 intake:

- 956 1/3\*(Budget for Nutrition, Physical Activity, and Obesity Budget for Farm to School Program) +
   957 Budget for Farm to School Program + 1/3\*(Budget for National Early Child Care Collaborative) +
   958 1/3\*(Budget for Racial and Ethnic Approaches to Community Health)<sup>59</sup>
- 959

960 It should be noted that, in addition to DNPAO's efforts, there are smaller nutrition-related programs led 961 by other divisions within CDC that have fruit and vegetable promotion components, including Sodium 962 Reduction Efforts led by the Division for Heart Disease and Stroke Prevention and the Good Health and 963 Wellness in Indian Country (GHWIC) led by the Division of Population Health. However, due to the smaller 964 size of these programs, together with the challenges associated with isolating fruit and vegetable spending 965 from within them, they were excluded from the calculation. While excluding these programs slightly 966 underestimates actual CDC fruit and vegetable spending, it's likely that these calculations are an adequate 967 estimation for the need to increase appropriations specifically targeted to increasing fruit and vegetable 968 consumption, commensurate with tobacco prevention spending.

969

### 970 CDC Actual Spending On Tobacco Prevention

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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>60,61</sup>

#### 974

# Percentage Of Risk From CHD, Stroke & Cancer Attributable To The Fruit & Vegetable Consumption Gap And Tobacco Use

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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>62</sup> For example, for CHD, the disease risk due to low fruit and vegetable consumption from Chapter 2 was 31%.<sup>5</sup>The average percentage of mortality due to CHD in the U.S. was 23.1% between 2018 and 2019.5 So, 31% was multiplied by 0.231 to obtain 7.161%.

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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 2); and the average percent of mortality
 for each between 2018 and 2019 in the US was 5.2% and 21.1%, respectively.<sup>62</sup>

988

The percent risk of developing CHD, stroke, and cancer due to tobacco use was carried over from the 2015
 PBH Gap Analysis.<sup>63</sup> There has not been an update of the report supporting that calculation since the 2015
 analysis. Therefore, this percent risk estimate was applied to a weighted average of current mortality data.

### 993 Table 6.1: Risk-based Analysis of CDC Spending on Tobacco and Fruit and Vegetables, FY 2018/2019

|  | Spending<br>(Millions of Dollars) | Contribution to Risk of<br>Coronary Heart Disease,<br>Stroke, and Cancer | Ratios |
|--|-----------------------------------|--|--------|
| (1) Estimated spending on fruits and vegetables  | 38 <sup>60</sup>                  |  |        |
| (2) CDC actual spending on tobacco prevention  | 210 <sup>61,62</sup>              |  |        |
| (3) Percent of risk of coronary<br>heart disease, stroke, and cancer<br>attributable to fruit and vegetable<br>consumption gap |                                   | 8.5%   |        |
| (4) Percent of risk of coronary<br>heart disease, stroke, and cancer<br>attributable to tobacco use                            |                                   | 28.4%  |        |
| (5) Fruit and vegetable risk<br>compared to tobacco risk = (3)/(4)   |                                   |  | 0.30   |
| <ul> <li>(6) Fruit and vegetable spending<br/>compared to tobacco spending =<br/>(1)/(2)</li> </ul>                            |                                   |  | 0.18   |

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#### 995 Analysis: CDC Spending on Tobacco Prevention Efforts Significantly Exceeds Fruit & Vegetable 996 Consumption Promotion Actions

996 997

998 In FY2018 and FY2019, CDC's appropriations for tobacco prevention were almost six times those for 999 promoting fruit and vegetable consumption. According to this analysis, funding earmarked for fruit and 1000 vegetable consumption is about 18% of that for tobacco prevention. However, tobacco's contribution to 1001 CHD, stroke, and cancer risk was only 3.3 times the disease risk attributable to inadequate fruit and 1002 vegetable consumption gap. Given the relative risks of the two causal factors, these estimates indicate 1003 that money appropriated to CDC by Congress disproportionately underfunds healthy eating, and 1004 specifically intake of fruits and vegetables, compared to tobacco prevention. In fact, in order to bring 1005 fruit and vegetable spending more in line with tobacco prevention efforts, the former would need to 1006 increase to approximately 30% (\$63 million) of tobacco prevention spending (at \$210 million) – almost 1007 double the current level (\$38 million).

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# Chapter 7: Bridging The Gap Between Federal Fruit & Vegetable Spending & National Public Health Goals

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# Federal Nutrition Policy On The Health Benefits Of Eating Fruits & Vegetables Is Definitive

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The food and nutrition policy that guides all government programming and initiatives, including food
 assistance, labeling, and education is very clear. According to the 2020-2025 *Dietary Guidelines for Americans* (DGA)<sup>5</sup>:

- Consistent evidence demonstrates that a healthy dietary pattern is associated with beneficial outcomes for all-cause mortality, cardiovascular disease, overweight and obesity, type 2 diabetes, bone health, and certain types of cancer (breast and colorectal).
  - Common characteristics of dietary patterns associated with positive health outcomes include relatively higher intake of vegetables, fruits, legumes, among other foods.
- Most Americans do not follow a healthy dietary pattern. Almost 90% of the U.S. population does not eat recommended amounts of vegetables, and approximately 80% does not meet fruit recommendations.
  - All forms of fruits and vegetables, including fresh, canned, dried, frozen, and 100% juice, in nutrient-dense forms, can be included in healthy dietary patterns.

# 1030 The Connections Among Fruit & Vegetable Policy &

### 1031 Consumer Research, Food Assistance, Education &

## 1032 Promotion Must Be Strengthened

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While all governmental programs must be consistent with the DGA, federal nutrition policy also has a
trickle-down effect on non-governmental initiatives in the private sector, including food production,
manufacturing, and innovation. The Social-Ecological Model featured in the 2015-2020 DGA is an
effective illustration of the interplay between social and cultural norms, sectors, settings, and individual
factors affecting Americans' diet and physical activity choices.

1039

1040 Consistent evidence shows that implementing multiple changes at various levels of the Social-Ecological 1041 Model results in healthier eating and physical activity behaviors. For example, strong evidence indicates 1042 an association between school-based policies that lead to increased intake of nutrient-dense foods and 1043 improved diet quality among children during the school day. 1044

- The 2020-2025 DGA stops short of suggesting policies that will result in healthy dietary patterns containing recommended amounts of fruits and vegetables. It does provide several examples of how to increase fruit and vegetable intake in individuals. Vegetable recommendations include increasing total vegetable intake and from all vegetable subgroups, shifting to nutrient-dense forms, and increasing vegetable variety. Strategies highlighted include increasing the vegetable content of mixed dishes or eating less of a main dish to allow for more vegetables as side dishes—keeping these nutrient- dense.
- 1051
- 1052 Strategies highlighted to increase fruit intake include choosing more whole fruits in meals and snacks.

1053 The core question addressed in this Fruit & Vegetable Gap Analysis: Bridging The Disparity Between 1054 Federal Spending & America's Consumption Crisis as well as in the 2010 and 2015 analyses that came 1055 before is: If fruits and vegetables are so critical to public health, and Americans aren't consuming 1056 enough, shouldn't more government spending be earmarked for research, food assistance, nutrition education and promotion to help facilitate increased consumption? Yet, we see that federal funding 1057 1058 for healthy eating is lacking compared to the prevalence of diet-related chronic diseases, corresponding 1059 public health issues, and resulting economic costs. Further, very few programs earmark appropriations to specifically target increasing fruit and vegetable intake. The mere fact that it is so difficult to tease out 1060 1061 spending earmarked specifically for improving fruit and vegetable consumption in this analysis is both a 1062 finding in and of itself, but also an opportunity for improvement given the significance of fruit and 1063 vegetable consumption to public health and their rampant and persistent underconsumption. 1064 In this analysis, we provided three case studies on spending from three main departments and agencies 1065 for fiscal years 2018 and 2019 – the United States Depart of Agriculture (USDA), National Institutes of 1066 Health (NIH), and Centers for Disease Control (CDC):

USDA. Analyses of USDA spending for fiscal years 2018 and 2019 demonstrated inconsistencies between
 the allocation of funds, the Thrifty Food Plan market basket cost-share percentages, and the food group
 recommendations in the Dietary Guidelines. Overall, the protein food group prevailed in terms of USDA
 spending while funds for fruits, vegetables, and grains were below their shares when using dietary
 recommendations as a proxy. Additionally, the nutrition assistance programs that provide nutrition
 education, allocated less than 0.5% of their combined budgets to nutrition education.

NIH. In fiscal years 2018 and 2019, the spending and number of NIH projects related to fruit and
 vegetables for diet-related diseases, for prevention projects overall, and for prevention projects for
 CHD, stroke, and cancer decreased from the fiscal years 2012 and 2013. These estimates indicate that
 recent changes are not in line with public health needs or disease risk for CHD, stroke, and cancer
 attributable to the fruit and vegetable consumption gap.

1078

1079 CDC. CDC's appropriations for tobacco prevention were almost six times those for promoting fruit and 1080 vegetable consumption. Further, funds earmarked for fruits and vegetables account for only 18% of 1081 those aimed at tobacco prevention. With tobacco's contribution to coronary heart disease, stroke, and 1082 cancer risk being only 3.3 times the disease risk attributable to inadequate fruit and vegetable 1083 consumption gap, it appears that the money appropriated to CDC by Congress disproportionately 1084 underfunds healthy eating, and specifically intake of fruits and vegetables, compared to tobacco 1085 prevention. Clearly, funding both tobacco prevention and increased fruit and vegetable consumption are 1086 critical and consistent with public health goals and needs and, in fact, tobacco prevention efforts have 1087 been extremely successful over time. A commensurate and proportional funding model must be

- 1088 achieved by increasing fruit and vegetable funding to approximately 30% of tobacco prevention
- 1089 funding or, in other words doubling the current budget for fruit and vegetable promotion.
- 1090

## 1091 Nutrition Spending & The Impact Of COVID-19

Government funding for food and nutrition security can be divided into two discrete points in time – before the COVID-19 pandemic and after. Many have been advocating for years that, in order to increase fruit and vegetable consumption domestically, and around the world, more must be done to ensure that all Americans have sufficient access, funds to purchase, and adequate skills to select and prepare fruits and vegetables that are easy enough to fit into their lifestyle, and enjoyable such that consumption leads to long-term habits. In 2020, 10.5% of all households were food insecure, meaning that at times, they were uncertain that they would have enough food to meet the needs of all membersof the household, due to resource constraints.

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1101 COVID-19 caused a level of disruption in our society not seen in current generations' lifetime – including 1102 widespread and sudden unemployment; childcare shortages; unprecedented rates of severe illness and 1103 death; isolation; food supply chain failures; and more. Further, many of these disruptions are still in 1104 effect at the time this report was written. The U.S. government responded by not only increasing access 1105 to food, but by also incentivizing the purchase of fruits and vegetables. In 2020-2021:

- Congress passed five major pieces of legislation, appropriating approximately \$35 billion in specific funding for programs that are key to addressing food access challenges related to COVID-19.
- Waivers and flexibilities were authorized in implementing the federal nutrition programs and increasing access [e.g., being able to sign up for Women, Infants and Children (WIC) remotely].
  - Foods approved to be purchased with WIC benefits were expanded at the state level.
  - Specific WIC increase for fruits and vegetables
- Al school children were eligible to receive breakfasts and lunches at no cost throughout the
   2020-2021 school year.
- Supplemental Nutrition Assistance Program (SNAP) allotments were expanded to include a grocery benefit, and these benefits could be used for online grocery purchases.
  - Families were provided fresh fruit, vegetables, dairy, and meat products via the Farmers to Families Food Box Program (May 2020 May 2021).
  - The Thrifty Food Plan, 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).
- 1122 1123

Further, at the September 2021 United Nations 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."

1131

## 1132 Prevention VS. Treatment: An Integral Funding

### 1133 Consideration

1134 In the US, healthcare expenditures substantially outpace prevention or risk reduction measures. This
1135 was made abundantly clear in the November 2, 2021 hearing of the Senate Subcommittee on Food and

1136 Nutrition, Specialty Crops, Organics, and Research on The State of Nutrition in America 2021. At this

1137 hearing, there was bipartisan agreement that too much of the federal budget is spent on healthcare

- 1138 and disease treatment, rather than disease prevention. Experts shared that good nutrition drives
- 1139 prevention and risk reduction of chronic diseases and needs to be prioritized through systematic change
- and addressed not only at a national level, but also on a state and community level. Recommended
- 1141 strategies included prescriptions for fruits and vegetables, enhanced reimbursement for registered
- dietitians, catalyzation of business innovations and promotion of food sovereignty and local and
- 1143 traditional foods. Simply put, more can and should be done to fund programs focused on increased

1144 fruit and vegetable promotion and consumption to reduce the risk of and ultimately, prevent diet-1145 related diseases at all levels of government in the United States.

1146 1147

1148 In an effort to be inclusive, thoughtful and provocative as well as further informed and impactful, part of

- 1149 the report development process includes an open comment period for all interested parties to
- 1150 contribute pertinent expertise and perspectives. Public comments will be considered for integration into
- 1151 the report's final analysis, results and recommendations, which will be issued later in 2022. 1152
- 1153 All vested stakeholders committed to improving public health through fruit and vegetable
- 1154 consumption are encouraged to review the report and submit comments, either in the body of an
- email or as an attachment (with all relevant scientific research and references also attached to
- support perspectives as necessary) to <a href="mailto:gaps@pbhfoundation.org">gaps@pbhfoundation.org</a> by Friday, February 4, 2022. NOTES:
- 1157 When submitting your comments, please reference both the report page number and line number with
- 1158 your corresponding comment and/or references. Data will only be considered if references are
- 1159 provided.
- 1160 We look forward to receiving your comments and insights! Thank you for sharing them with us!
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<sup>1</sup> The State of Obesity: Better Policies for a Healthier America. Trust for America's Health. (2021.) Accessed at <u>https://www.tfah.org/wp-content/uploads/2021/09/2021ObesityReport\_Fnl.pdf</u>.

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