PART D. CHAPTER 1: CURRENT INTAKES OF FOODS, BEVERAGES, AND NUTRIENTS

INTRODUCTION

Diet is directly related to health, and most Americans suffer from health conditions or suboptimal nutritional status that have the potential to be prevented or ameliorated through diet. The *Dietary Guidelines for Americans* focus on the quality of the overall dietary pattern and food choices, as well as how Americans can meet nutrient and food group recommendations to optimize health. Overweight and obesity remain as epidemic public health challenges directly, as well as indirectly through their role with type 2 diabetes, heart disease, metabolic diseases and health conditions, and some types of cancer. An overview of specific diet-related causes of morbidity and mortality, as well as surrogate measures of these outcomes, are presented in the following sections. Physical activity and social and environmental causes of chronic disease and nutrition risk also are critical dimensions that must be understood and addressed but are not discussed in the context of nutrition in this chapter. Rather, the purpose of this chapter is to provide a comprehensive update on the American diet and health landscape, using information from data sources collected or assessed by the U.S. government.

Although specific questions within this chapter focus on individual "nutrients," the potential health effects of the diet are likely determined by the sum and interaction of many different food components, many of which may not technically be nutrients. The National Academies of Sciences, Engineering, and Medicine (NASEM) defines the term" food component" as being comprised of energy and a range of nutrient and non-nutrient dietary constituents, including but not limited to, macronutrients, micronutrients, fiber, amino acids, fatty acids, sugars, caffeine, and water. To be consistent with the NASEM terminology, this report also will serve to identify potential food components of public health concern.

In this report, the 2020 Dietary Guidelines Advisory Committee considered how intakes of food groups and subgroups and food category sources contribute to intakes of food components across the life course in the United States. The Committee examined various dimensions of eating patterns with a multidimensional lens to understand foods as consumed, referred to as food category sources (e.g., burgers and sandwiches), intakes of food groups (e.g., Vegetables) and subgroups (e.g., dark green leafy), as well as food components consumed (e.g., fiber, nutrients, or energy). Understanding the extent to which the entire population and various subgroups (e.g. age, sex, race and ethnic origin, food security status, income) achieve food group and food component intake recommendations is the foundation for tailoring powerful public health communication strategies focusing first on food-based strategies, but with the recognition that supplementation or fortification may be warranted for certain food components or for certain population subgroups considered to be at potential risk.

Although not specifically addressed in this chapter, many different dietary patterns have been described that can contribute positively and negatively to health (see ***Part D. Chapter 8: Dietary Patterns***). Dietary patterns are shaped by a complex interaction of personal preferences (e.g., taste), social context, culture, structural facilitators and barriers to choices, and behavioral aspects that are formed early in development, play out iteratively across the lifespan, and that may be static or dynamic. It should be noted that the typical American dietary pattern is not currently nor has it ever been aligned with recommendations issued by the *Dietary Guidelines for Americans* since their inception in 1980. Thus, understanding the complexity of changing established patterns of food choice is critical to advancing the mission of the *Dietary Guidelines for Americans*.

Diet quality is examined by comparing intakes of foods and beverages to the Healthy Eating Index (HEI) (see Question 3, Summary of the Evidence, below), which is only possible among those ages 2 years and older. To the extent possible, a life stage[1] approach was used, recognizing the special needs for certain periods of development such as growth, pregnancy, and lactation. Given that this is the first Committee to address birth to age 24 months, existing food group compliance metrics are not available, as they have not been previously developed. Thus, for questions surrounding food group compliance, the focus is generally on Americans ages 2 years and older. When questions focus on nutrients or food components for which Dietary References Intakes (DRIs) have been established, the Committee used the NASEM age grouping that includes toddlers ages 12 to 24 months with the age group of 1 to 3 years. Questions were also examined by population subgroups, including sex, race, and Hispanic origin, and measures of socioeconomic status (e.g., income, food security).

Given the complexity of dietary intakes, the Committee presents data organized by food groups, by nutrients, and by overall dietary quality rather than within each of the 5 specific

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[1] Life Stages:

- Infants and toddlers: These are not overlapping age groupings.
  - Younger infants (ages 0 to 6 months; refers to 0 to age 5.99 months)
  - Older infants (ages 6 to 12 months; refers to ages 6 to 11.99 months)
  - Toddlers (ages 12 to 24 months; refers to ages 12 to 23.99 months)
- Children and adolescents (ages 2 to 19 years)*
- Adults (ages 20 to 64 years)*
- Women who are pregnant (ages 20 to 44 years)
- Women who are lactating (ages 20 to 44 years)
- Older adults (ages 65 years and older)

*Ages vary for some data sources

questions below. Within each question or topic area, a conclusion statement is presented, but it should be noted that these conclusion statements differ from the grading rubric used by the Committee for other questions, which addressed the totality of the evidence of research available from NESR. This chapter focuses on summarizing existing dietary and health-related data from Federal resources.

LIST OF QUESTIONS

1. What is the current prevalence of nutrition-related chronic health conditions?
2. What are the current intakes of food groups?
3. What are the current patterns of food and beverage intake?
4. Which nutrients present a substantial public health concern because of underconsumption or overconsumption?
5. How does dietary intake, particularly dietary patterns, track across life stages from the introduction of foods, into childhood, and through older adulthood?

METHODOLOGY

Questions 1 through 5 in this chapter were answered using data analysis. To address questions on the current status and trends in food and nutrient intakes, and the prevalence of diet-related chronic diseases in the U.S. population, the Committee relied on analysis of data from several nationally representative Federal data sources.

Food and Nutrient Intakes

Many of the questions relied on analysis of data from What We Eat in America (WWEIA), the dietary component of the National Health and Nutrition Examination Survey (NHANES), using either existing data tables or new analyses conducted by the Data Analysis Team (DAT) upon request of the Committee (see ***Part C. Methodology)****.* Complete documentation of the data analysis protocol and the referenced results are available on the following website: https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis. Existing data tables were used when available to answer questions about nutrient intake, food group intake, intake of beverages, and dietary patterns. In some cases, new analyses were conducted by DAT to provide additional information on food or nutrient intake, for example, by specific population groups, such as infants and toddlers and women who are pregnant or lactating. A majority of analyses relied on the most current cycle of WWEIA NHANES 2015-2016; however, data from NHANES 2013-2016 were used when larger samples were needed. Of particular note, data from WWEIA NHANES 2007-2016 were combined for examining intakes of infants and toddlers ages 6 to 12 and 12 to 24 months. The dietary intake data are not without limitations regarding recall bias. Additional limitations related to estimates of intakes among infants and toddlers are noted. Proxy reporting and associated measurement error are not well understood. What may be considered "usual" intakes is difficult to define in such a dynamic portion of the population. The Committee categorized infants into two groups: those with reports of human milk and no infant formula, and those with any reported intake of infant formula. This allowed the Committee to explore differences between the groups, but the limitations of this strategy were considered. The Committee did not evaluate data on nutrient intakes for infants younger than age 6 months. Infants from birth to younger than age 6 months rely on human milk and/or infant formula for a high proportion of energy and nutrient needs. Direct assessment of the volume and composition of human milk consumed is a challenge and imputed estimates have been published elsewhere.[1-3]

Throughout the description of the data, some observed differences are noted though significance testing was not done. These limitations were taken into consideration when drawing conclusions.

Nutrients or Food Components of Public Health Concern

In the process of evaluating risk for potential inadequacy or excess of food components, the Committee developed a decision tree a priori (Figure D1.1) to identify potential food components using the "3-pronged approach" developed by previous Dietary Guidelines Advisory Committees and subsequently endorsed by NASEM.[4] The 3 prongs broadly represent analysis of one, both, or all of the Federal data sources, including (1) dietary intake data (Table D1.1),[4] (2) biomarkers and clinical indicators, and (3) prevalence of health conditions measured directly or indirectly through validated surrogate markers. The Committee utilized the totality of this evidence to the fullest extent possible, plus (1) the extensive scientific efforts of the Food and Drug Administration with regard to labeling standards,[5] (2) specific food components that were addressed posed to the 2020 Committee in questions, and (3) food components previously identified in the 2015 Committee's report. For consideration of potential food components of concern among the birth to age 24 months subgroup, the 3-pronged approach also was augmented with expert opinion from members of the 2020 Committee and guided as detailed below.

Table D1.1. **Framework to begin the process of identifying nutrients and other food components as underconsumed, overconsumed, or of potential public health concern**

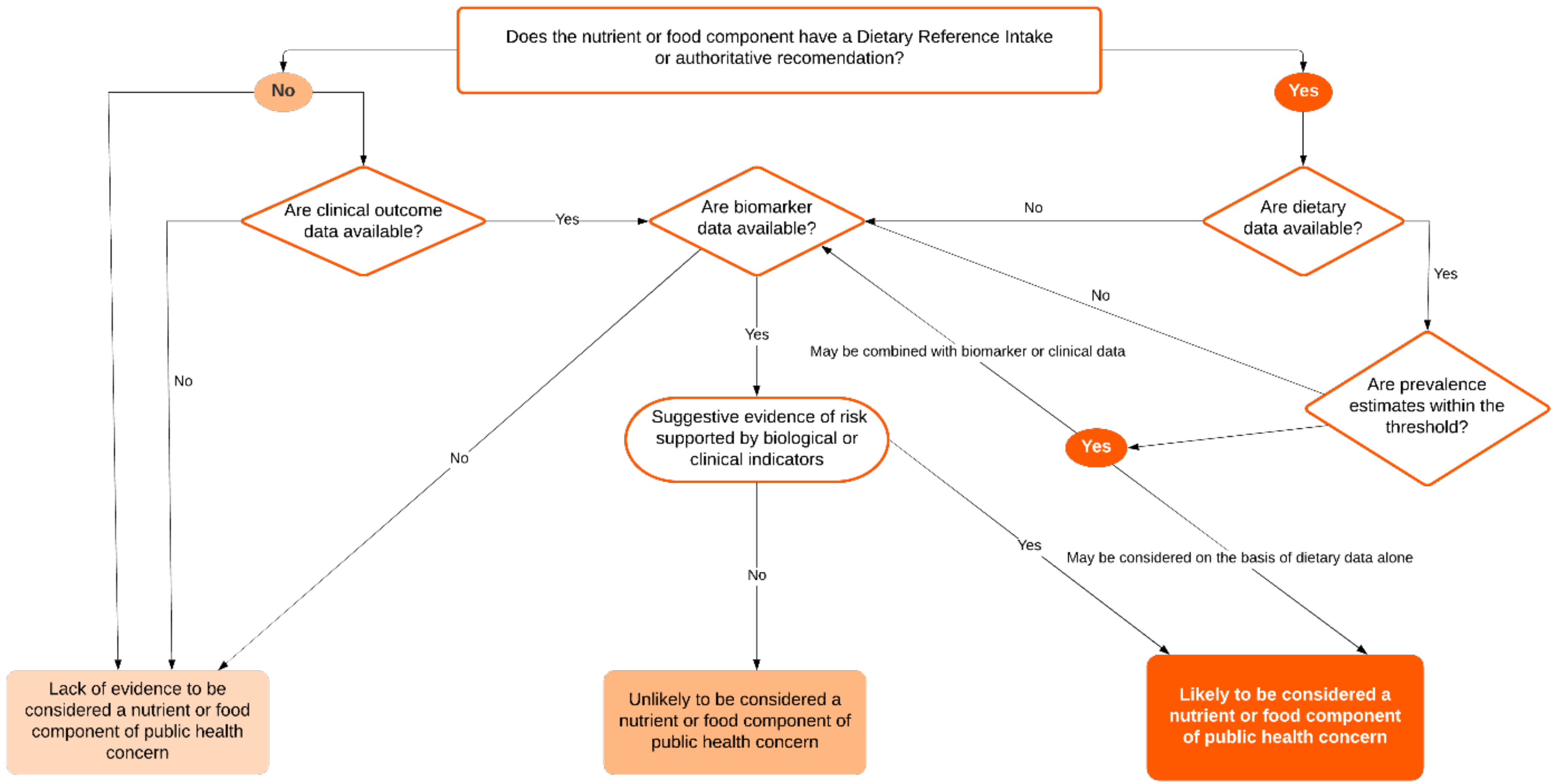
Proposed Term	Proposed Definition
Underconsumed nutrient or food component	A nutrient or food component that is underconsumed by 5 percent or more of the population or in specific groups relative to the EAR, AI, or other quantitative authoritative recommendations from the diet alone.[1,2] Underconsumed is used to replace the term "shortfall nutrient."
Overconsumed nutrient or food component	A nutrient or food component that is consumed in potential excess of the UL, CDRR, or other quantitative authoritative recommendations by 5 percent or more of the population or in specific groups from the diet alone.[1,2]
Nutrient or food component of public health concern	Underconsumed and overconsumed nutrients or food components with supporting evidence through biochemical indices or functional status indicators, if available, plus evidence that the inadequacy or excess is directly related to a specific health condition, indicating public health relevance.
Nutrient or food component that poses special challenges	Nutrient or food component for which it was difficult to identify at-risk groups or for which dietary guidance to meet recommended intake levels was challenging to develop.

AI=Adequate Intake; CDRR=Chronic Disease Risk Reduction; EAR=Estimated Average Requirement; UL=Tolerable Upper Intake Level

[1] Existing authoritative quantitative threshold include existing Federal guidance, inclusive to 10 percent energy recommendations for added sugars and saturated fats from the *2015-2020 Dietary Guidelines for Americans*.[6]

[2] The 5 percent threshold was set to identify potential food components that the Committee should examine further if biomarker or clinical data support the potential for public health concern justification. Note: This does not mean that all food components identified by this threshold are considered by the Committee to be at risk for inadequate or excessive dietary intakes.

Figure D1.1. Decision-making path diagram for identifying nutrients and other food components of public health concern[1]



[1] The starting point on the decision path does not always start with dietary data. For example, dietary data are not available for iodine, but it could be considered in this pathway based on biomarker or clinical data.

Evaluation of Dietary Intake Data

The Committee evaluated means and usual intake distributions of energy, macronutrients, and selected food components in comparisons to the Dietary Reference Intakes (DRIs) published by NASEM or other authoritative recommendations when such standards exist. The Committee first evaluated intakes from foods and beverages alone from NHANES, before also examining the contributions from dietary supplements. When available, it also considered scientific evidence on the relationship between nutrient inadequacy or excess and clinical health consequences (e.g., cardiovascular disease [CVD], cancer) or validated surrogate endpoints such as biochemical indices in addition to dietary intakes of nutrients.

For infants, children, and women who are pregnant or lactating, food components identified by the NASEM report on the Special Supplemental Nutrition Program for Women, Infants, and Children were examined.[7] This NASEM panel prioritized the nutrients that need to be increased to prevent disease and promote health, including: iron and zinc for older breast-fed infants; iron, fiber, and potassium for young children; calcium, iron, vitamin D, fiber, and potassium for young children ages 24 to 59.9 months; and, calcium, iron, folate, vitamin D, fiber, potassium, and choline for women who are pregnant, lactating, or post-partum. The panel also prioritized the nutrients to limit, including sodium and added sugars for toddlers; and sodium, added sugars, and saturated fat for young children ages 24 to 59.9 months and women who are pregnant or lactating.[7]

Nutrition-related Chronic Health Conditions

Information on the prevalence of nutrition-related health conditions came from the U.S. Centers for Disease Control and Prevention (CDC) NHANES data tables and reports, and from Federally authored peer-reviewed literature. To supplement data from NHANES, additional data sources were drawn upon to answer questions on the prevalence of health conditions. These sources included the National Health Interview Survey (NHIS), the National Vital Statistics System (NVSS), and the National Cancer Institute’s Surveillance Epidemiology and End Results (SEER) cancer registry statistics.

Health conditions include:

- Cardiovascular health
- Metabolic syndrome, prediabetes, and diabetes
- Growth, size, and body composition, including overweight and obesity
- Reduced muscle strength and bone mass

- Gestational diabetes mellitus
- Chronic liver disease
- Cancer
- Dental health
- Food allergy

The Committee took the strengths and limitations of data analyses into account in formulating conclusion statements. The grading rubric used for questions answered using NESR systematic reviews does not apply to questions using data analysis. Therefore, data analysis conclusions were not graded.

REVIEW OF THE SCIENCE

Question 1: What is the current prevalence of nutrition-related chronic health conditions?

Approach to Answering Question: Data analysis

Conclusion Statement

Nutrition-related chronic health conditions are common across every life stage of the U.S. population; conditions for which an unhealthy diet is a risk factor, including overweight, and obesity remain highly prevalent among all age groups. There are disparities in the severity of the prevalence, incidence, or mortality rate of chronic health conditions between groups classified by sex, age, race-ethnicity, income level, and weight status. In general, chronic health conditions have become more prevalent over time and are highest among older populations, different racial and ethnic subgroups, and those with lower income levels.

Summary of the Evidence

The following sections summarize findings from the health conditions, and key findings are highlighted with bolding. Data analyses conducted for the Committee are found in the data analysis supplements and are referenced below as the Chronic Health Conditions Data Supplement (CH_DS).

Cardiovascular Health

Elevated blood pressure in childhood is associated with increased risk of CVD later in adulthood.[8] For adolescents ages 12 to 17 years, elevated blood pressure is defined as blood pressure from ≥90th to <95th percentile or systolic blood pressure ≥120 millimeters of mercury (mm Hg). Hypertension is defined as blood pressure in the ≥95th percentile, blood pressure of ≥130/80 mm Hg, or use of an antihypertensive medication. The Committee used 2013-2016 NHANES data on estimated hypertension prevalence. The overall prevalence of hypertension among adolescents ages 12 to 19 years was 4.1 percent. Prevalence increased with age. The prevalence among adolescents ages 12 to 17 years was 3.2 percent vs 7.5 percent among adolescents ages 18 to 19 years. Males ages 12 to 19 years had a higher prevalence of hypertension (5.8 percent) than females (2.4 percent). Non-Hispanic Black adolescents ages 12 to 19 years had the highest prevalence of hypertension (6.27 percent). Adolescents who are classified with a healthy weight and overweight had the same prevalence of hypertension (1.9 percent). **Among children, those with severe obesity had the highest prevalence (14.7 percent) of hypertension.**

Hypertension in adults was defined based on definitions used during the NHANES 2015-2016 examination: having a systolic blood pressure of ≥140 mm Hg, or a diastolic blood pressure of ≥90 mm Hg, or currently taking medication to control blood pressure.[9] The overall prevalence of hypertension among adults ages 18 years and older was 29.0 percent, which was similar to the prevalence of hypertension since 2007-2008 (29.6 percent). **Hypertension prevalence increased with older age groups:** 7.5 percent in adults ages 18 to 39 years, 33.2 percent in adults ages 40 to 59 years, to **63.1 percent in those ages 60 and older.** Before the age of 60 years, men had a higher prevalence of hypertension compared to women. However, among those ages 60 years and older, women (66.8 percent) had a higher prevalence of hypertension than did men (58.5 percent). Non-Hispanic Blacks have the highest prevalence of hypertension at 40.3 percent for both men and women. Non-Hispanic Whites, non-Hispanic Asians, and Hispanics have a prevalence of hypertension at 27.8 percent, 25.0 percent, and 27.8 percent, respectively. Based on results from the 2017 NHIS,[10] the prevalence of hypertension was lower among those with relatively higher levels of education, with the highest prevalence (32.3 percent) occurring among adults without a high school diploma. Hypertensive disorders of pregnancy, including gestational hypertension and preeclampsia, is estimated to be 7.1 percent.[11]

In adults ages 20 years and older, the overall prevalence of high total blood cholesterol (defined as greater than or equal to 240 mg/dL) **has decreased since 2007-2008**

from 14.3 percent to 12.4 percent.[12,13] Women ages 20 years and older have a higher prevalence of high total cholesterol (17.7 percent) than do men (11.4 percent). The prevalence of high total cholesterol peaks between the ages of 40 to 59 years for both men and women. Among those ages 60 and older, women have a much higher prevalence of high total cholesterol (17.2 percent) compared to men (6.9 percent). Non-Hispanic White women have the highest prevalence of high total cholesterol (14.8 percent) compared to other race-ethnicity or sex subgroups. Hispanic males have the highest prevalence of high total cholesterol (13.1 percent) compared to other male race-ethnicity subgroups.

The prevalence of low high-density lipoprotein cholesterol (HDL-C) in adults age 20 years and older has decreased since 2007-2008 (22.2 percent) to 18.4 percent.[12,13] Unlike the prevalence of high total blood cholesterol, compared to women, men have a higher prevalence of low HDL-C. The prevalence of low HDL-C peaks for men between the ages of 40 to 50 years (31.9 percent) and for women between the ages of 20 to 39 years (10.1 percent). Hispanic men (36.2 percent) and women (13.8 percent) have the highest prevalence of low HDL-C compared to other race-ethnicity subgroups. Among adolescents ages 12 to 19 years, the prevalence of low serum HDL-C is approximately 16 percent and high serum low-density lipoprotein cholesterol (LDL-C) is approximately 5 percent. Low HDL-C is more prevalent among adolescents ages 12 to 15 years when compared with those ages 16 to 19 years. However, high LDL-C follows the opposite pattern, being more prevalent in those ages 16 to 19 compared to adolescents ages 12 to 15. Boys have a higher prevalence of elevated LDL-C and low HDL-C than do girls. Youths with obesity have a higher prevalence of abnormal lipid profiles than youths with overweight or normal weight. Non-Hispanic White youths have the highest prevalence of elevated LDL-C and low HDL-C among all race-ethnicity groups.

The age-adjusted prevalence of coronary heart disease (CHD), including coronary artery disease, angina, or heart attack, was estimated based on self-reported data from the 2017 NHIS.[10] Among adults ages 18 years and older, the prevalence of CHD was 5.6 percent. For males, the prevalence of CHD was 7.2 percent while it is 4.2 percent for females. As with the risk factors for CHD, **the prevalence of CHD increases with age.** The prevalence of CHD was 0.9 percent for those ages 18 to 44 years, 6.4 percent for ages 45 to 64 years, 14.0 percent for ages 65 to 74 years, and 23.8 percent for ages 75 years and older. American Indian/Alaskan Natives had the highest prevalence of CHD (9.0 percent) compared to other race-ethnicity groups. As educational attainment increases, a lower prevalence of CHD was observed. The highest prevalence of CHD is among adults without a high school diploma (7.7 percent), followed by those with a high school diploma or General Educational Development (GED) and no college (7.5 percent), those with some college (6.7 percent), and those with a college degree or higher (4.8 percent).

The 2017 NHIS was also used to assess the age-adjusted prevalence of stroke among adults ages 18 years and older.[10] The overall prevalence of stroke in 2017 was 2.9 percent, with a slightly higher prevalence of stroke among men (3.3 percent) compared to women (2.5 percent). The prevalence of stroke also increases with age and was 0.6 percent among those ages 18 to 44 years, 3.3 percent among adults ages 45 to 64 years, 6.4 percent among those 65 to 74 years, and 12.0 percent among adults 75 years and older. By race-ethnicity, non-Hispanic Blacks have the highest prevalence of stroke (4.2 percent). The prevalence of stroke is lowest among those with the highest education: 5.5 percent among those with a high school diploma, 3.2 percent among those with a high school diploma or GED but no college, 3.7 percent among those with some college, and 2.1 percent among those with at least a college degree.

Metabolic Syndrome, Prediabetes, and Diabetes

Prediabetes is defined as a hemoglobin A1c (HbA1c) of 5.7 to 6.4 percent or a fasting plasma glucose of 100 to 125 milligrams per deciliter (mg/dL). Diabetes is defined as an HbA1c of ≥6.5 percent, fasting plasma glucose of ≥126 mg/dL, or use of anti-diabetes medication.

The prevalence of diabetes among adolescents ages 12 to 19 years is 0.5 percent. **The prevalence of prediabetes and diabetes among children ages 12 to 19 years is 23.1 percent.**[14] Data by race-ethnicity were unavailable. The prevalence of prediabetes and diabetes in this age group has been stable since 1999 (21.9 percent).

Among adults ages 18 years and older, the prevalence of prediabetes is 33.9 percent. Data by race-ethnicity were unavailable. As age increases, so does the prevalence of prediabetes. The prevalence of prediabetes is 23.7 percent for ages 18 to 44 years, 40.9 percent for ages 45 to 64 years, and 48.3 percent for ages 65 years and older. Men have a higher prevalence (36.9 percent) than do women (31.1 percent).[14]

A proportion of the diabetes prevalence is in those who are undiagnosed. It is estimated that the prevalence of undiagnosed diabetes among adults ages 20 years and older is 2.8 percent. The prevalence of diagnosed diabetes is 10.2 percent; therefore, the total prevalence of diabetes among adults ages 20 years and older is 13.0 percent. For both diagnosed and undiagnosed diabetes, men (11.0 percent and 3.1 percent, respectively) have a higher prevalence than do women (9.5 percent and 2.5 percent, respectively). The prevalence of all diabetes categories (total, diagnosed, and undiagnosed) increases with age. For ages 18 to 44 years, the prevalence of total diabetes is 4.2 percent. For ages 45 to 64 years, the prevalence of total diabetes is 17.5 percent, and is 26.8 percent for ages 65 years and over. The race-ethnicity group with the highest prevalence of diagnosed (13.3 percent) and total diabetes (16.4 percent) is non-Hispanic Blacks. However, the group with the highest prevalence of undiagnosed diabetes is Asians (4.6 percent).[14] As body weight status increases from normal weight to obesity, the prevalence of all diabetes categories increases as well. The prevalence of total diabetes for those in the underweight or normal weight category is 6.2 percent, 11.8 percent for those in the overweight category, and 20.7 percent for those in the obesity category.

Metabolic syndrome is defined as having 3 or more of the following measurements: abdominal obesity (waist circumference of ≥40 inches or ≥102 centimeters in men, and ≥35 inches or ≥88 centimeters in women); triglyceride level of ≥150 mg/dL; HDL-C <40 mg/dL in men or <50 mg/dL in women; systolic blood pressure of ≥130 mm Hg, diastolic blood pressure of ≥85 mmHg or greater, or use of anti-hypertensive medication; and fasting plasma glucose of ≥100 mg/dL or use of anti-diabetes medication (CH_DS).

The overall age-adjusted prevalence of metabolic syndrome among adults 20 years and older is 34.9 percent (CH_DS). The prevalence of metabolic syndrome increases with age. Individuals ages 20 to 39 years have a prevalence of 19.5 percent; ages 40 to 59 years have a prevalence of 40.7 percent; and ages 60 years and older have a prevalence of 52.2 percent. Hispanics have the highest prevalence (38.1 percent) compared to other race-ethnicity groups. Non-Hispanic Whites, non-Hispanic Blacks, and non-Hispanic Asians have prevalence of metabolic syndrome of 35.4 percent, 33.7 percent, and 22.7 percent, respectively. Overall, the prevalence of metabolic syndrome is similar between men and women. However, women older than 60 years have a higher prevalence of metabolic syndrome compared to men in the same age group. Among men, Hispanics and non-Hispanic Whites (36.7 percent) have the highest prevalence compared to other men of different race-ethnicity groups. Among women, the race-ethnicity with the highest prevalence is Hispanics (39.2 percent).

Growth, Size, and Body Composition, Including Overweight and Obesity

The World Health Organization's (WHO) sex-specific growth standards, which are recommended by the CDC, were used with NHANES 2015-2016 data to identify the prevalence of low weight-for-recumbent length (-2 z-scores, which corresponds to less than 2.3rd percentile), recumbent length-for-age, and weight-for-age measured among infants and toddlers from birth to age 24 months.[15] Findings included: 1.4 percent of infants from birth to age 24 months have low weight-for-recumbent length, 3.2 percent are low recumbent length-for-age, and 1.7 percent are low weight-for-age. Using CDC's sex-specific growth chart (less than 5th percentile), 3.9 percent of infants from birth to age 24 months are low weight-for-recumbent length, 5.6 percent are low recumbent length-for-age, and 7.3 percent are low weight-for-age.

NHANES 2015-2016 and WHO's sex-specific growth standards, which are recommended by CDC, were used to identify the prevalence of high weight-for-recumbent length (+2 z-scores, which corresponds to greater than 97.7th percentile) among the birth to age 24 months population.[16] Findings included that 8.9 percent of infants from birth to age 24 months of age have high weight-for-recumbent length. Using CDC's sex-specific growth chart (greater than 95th percentile), 9.9 percent of infants from birth to age 24 months have high weight-for-recumbent length.

The prevalence of low birthweight among U.S. infants by race-ethnicity was examined using data from the NVSS 2017.[17] The prevalence of low birthweight (born at less than 2,500 grams) increased to 8.27 percent in 2017 from 8.17 percent in 2016. The prevalence of moderately low birthweight (born at 1,500 to 2,499 grams) was 6.77 percent, and the prevalence of very low birthweight (born at less than 1,500 grams) was 1.40 percent. From 2016 to 2017, the prevalence of low birthweight: increased for non-Hispanic Black women (13.68 percent to 13.88 percent), increased for Hispanic women (7.32 percent to 7.42 percent), and remained relatively unchanged for non-Hispanic White women (6.97 percent to 7.00 percent). Non-Hispanic Black women have the highest prevalence of low birthweight at 13.88 percent, and the highest prevalence reported since the data started being collected in 1993.

Of note from the above data are these key findings:

- Using the CDC recommended WHO growth standards to define low and high weight metrics in infants, and children from birth to age 24 months:
    - 1.4 percent are low weight-for-recumbent length
    - 3.2 percent are low recumbent length-for-age
    - 1.7 percent are low weight-for-age
    - 8.9 percent are high weight-for-recumbent length
- The prevalence of low birthweight (born at less than 2,500 grams) increased to 8.27 percent in 2017 from 8.17 percent in 2016.
- The prevalence of very low birthweight (born at less than 1,500 grams) was 1.40 percent.
- From 2016-2017, the prevalence of low birthweight babies increased for non-Hispanic Black mothers (13.68 percent to 13.88 percent) and Hispanic mothers (7.32 percent to

7.42 percent) but stayed relatively constant for non-Hispanic White mothers (6.97 percent to 7.00 percent).

- The prevalence of low birthweight babies among non-Hispanic Black mothers is the highest prevalence reported since the data started being collected in 1993.

Body mass index (BMI), a calculation of weight in kilograms (kg) divided by height in meters squared (m^2), is the recommended measure used to classify weight status for children and adults. Overweight in children is defined as a BMI ≥85th to <95th percentile of sex-specific BMI-for-age growth charts from the CDC. Children with a BMI at or above the 95th percentile are categorized as having obesity; children with a BMI at or above 120 percent of the 95th percentile are categorized as having severe obesity. Among adults, overweight is defined as a BMI of 25 to 29.9 kg/m^2, while obesity is defined as a BMI ≥30 kg/m^2. Severe obesity in adults is defined as a BMI ≥40 kg/m^2.[18]

Body Weight Status in Children

The prevalence of underweight among all children ages 2 to 19 years is 3 percent, down from 3.7 percent in 2007-2008. Data by race-ethnicity were unavailable. As age increases, so does the prevalence of underweight, particularly among adolescents. Underweight occurs in 2.3 percent of children ages 2 to 5 years, 2.5 percent in ages 6 to 11 years, and 3.7 percent in ages 12 to 19 years. The prevalence of underweight is lower in girls (2.5 percent) than in boys (3.6 percent).[19]

Among children ages 2 to 19 years, 41 percent of children are overweight or obese.[20] The prevalence of overweight is higher in girls ages 2 to 19 (17.6 percent) than in boys (15.7 percent). However, the prevalence of obesity and severe obesity is higher in boys (19.1 percent and 6.3 percent, respectively) than in girls (17.8 percent and 4.9 percent, respectively).

Since 2007-2008, the prevalence of obesity has increased for boys, girls, and 2 of 3 age categories. Overall, the prevalence of obesity has increased from 16.8 percent to 18.5 percent. Girls had an increase from 15.9 percent to 17.8 percent, while boys had an increase from 17.7 percent to 19.1 percent since 2007-2008. Children ages 2 to 5 years had the largest increase, going from 10.1 percent to 13.9 percent; children 12 to 19 years also had an increase in obesity prevalence (18.1 percent to 20.6 percent). However, children ages 6 to 11 years had a small decrease in the prevalence of obesity, from 19.6 percent to 18.4 percent.

The prevalence of obesity in all children increases with age: 13.9 percent for ages 2 to 5 years, 18.4 percent for ages 6 to 11 years, and 20.6 percent for ages 12 to 19 years.

However, the data show that the prevalence of obesity is similar for boys between the age groups 6 to 11 years (20.4 percent) and 12 to 19 years (20.2 percent).

In boys, the race-ethnicity group with the highest prevalence of obesity is Mexican Americans at 29.2 percent, followed by other Hispanics at 28 percent. The group with the lowest prevalence is non-Hispanic Asians, with a prevalence of 11.7 percent. In girls, the race-ethnicity group with the highest prevalence of obesity is non-Hispanic Blacks at 25.1 percent, followed by Mexican Americans at 24.3 percent, and other Hispanics at 23.6 percent. The group with the lowest prevalence is non-Hispanic Asians with a prevalence of 10.1 percent.

The prevalence of obesity among children ages 12 to 19 years decreases as education of the head of household increases: 22.3 percent for high school diploma or less, 18.1 percent for some college, and 11.6 percent for college graduate. The prevalence of obesity among children changes among metropolitan statistical areas (MSA). The prevalence is 17.1 percent in a large MSA and similarly is 17.2 percent in medium or small MSA, but increases to 21.7 percent for non-MSA (i.e., rural areas).[21]

Body Weight Status in Adults

For adults ages 20 years and older, the overall prevalence of underweight is 1.5 percent, a decrease from 2007-2008 (1.6 percent). The prevalence of underweight among adult women (1.8 percent) is higher than the prevalence of underweight among adult men (1.2 percent). The prevalence of underweight is 2.5 percent from ages 20 to 39 years, 0.8 percent from ages 40 to 59 years, and 0.9 percent for ages 60 years and older.[22]

The proportion of adults in the United States that has overweight or obesity is 71.2 percent. The prevalence of overweight has decreased since 2007-2008 from 34.3 percent to 31.6 percent in 2015-2016. However, obesity prevalence has increased from 33.7 percent to 39.6 percent; severe obesity also has increased during this time from 5.7 percent to 7.7 percent. Men have a higher prevalence of overweight (36.5 percent) compared to women (26.9 percent). However, women have higher rates of obesity (41.1 percent) and severe obesity (9.7 percent) compared to men (37.9 percent for obesity and 5.6 percent for severe obesity).[23] Average body weight for men is 197.8 pounds (lbs) (89.7 kg) while mean body weight for women is 170.5 lbs (77.3 kg). The mean waist circumference for men is 40.3 inches (102.3 centimeters (cm)), and the mean waist circumference for women is 38.7 inches (98.4 cm). Although the average body weight and waist circumference have been increasing over time, the mean height for men and women has been relatively stable over time (69 inches or 175.3 cm for men; 63.6 inches or

161.5 cm for women)—consistent with trends in increasing BMI. The mean BMI for men is 29.1 kg/m^2, while the mean BMI for women is 29.6 kg/m^2.[24]

The prevalence of obesity peaks in the 40 to 59 years age group at 42.8 percent. Those who are ages 20 to 39 years have a prevalence of obesity of 35.7 percent, while those who are 60 years and older have a prevalence of 41.0 percent.

In men, the race-ethnicity group with the highest prevalence of obesity is Mexican Americans (46.2 percent) followed by other Hispanics (43.1 percent). In women, the race-ethnicity group with the high prevalence of obesity is non-Hispanic Blacks (54.8 percent) followed by Mexican Americans (52.3 percent) and other Hispanics (50.6 percent).

Some relationship exists between weight status and educational attainment. College graduates have a lower prevalence of obesity (30.3 percent) compared to those with a high school diploma or less (36.2 percent) or those with some college (43.8 percent). Obesity status also varies by smoking status: current smokers have the lowest prevalence at 31.3 percent compared to never smokers at 35.6 percent and former smokers at 42.0 percent. Adults who live in large MSAs have the lowest obesity prevalence of 31.8 percent, while those in a medium or small MSA have a prevalence of 42.7 percent, and those in a non-MSA have a prevalence of 38.6 percent.[25]

Reduced Muscle Strength and Bone Mass

Reduced muscle strength contributes to impaired mobility and mortality in older adults.[26,27] The Committee evaluated NHANES data relative to criteria established by the Foundation for the National Institutes of Health Sarcopenia Project that includes sex-specific criteria to define normal, intermediate, and weak muscle strength based on hand grip measurements that have previously been predictive of gait speed, a proxy measure for mobility impairment.[28]

Among adults ages 60 years and older, NHANES 2013-2014 data indicate **the overall age-adjusted prevalence of reduced muscle strength is 19.2 percent (CH_DS).** The prevalence is higher among those 80 years and older (48.6 percent) than those ages 60 to 79 years (10.9 percent). The prevalence of reduced muscle strength is 19.4 percent among women and 19.0 percent among men. Among those 80 years and older, the prevalence is 49.7 percent among women and 47.1 percent among men. The race-ethnicity group with the highest age-adjusted prevalence of reduced muscle strength is non-Hispanic Asians at 31.4 percent, closely followed by Hispanics at 30.4 percent. Non-Hispanic Blacks have a prevalence of 18.8 percent and non-Hispanic Whites have a prevalence of 17.9 percent.

The NHANES 2013-2014 exam used dual-energy X-ray absorptiometry (DXA) to assess bone mass.[29] Classifications for bone mass status were made using the WHO criteria. Low bone mass is defined as a T-score between -1.0 and -2.5; osteoporosis is defined as a T-score ≤-2.5. The T-score is calculated as the difference between the bone mineral density for the NHANES participant and the mean bone mineral density for the reference group, divided by the standard deviation of the reference group.

The prevalence of low bone mass for all adults ages 50 years and older is 42.8 percent at the femur neck, 27.9 percent at the lumbar spine, and 44.5 percent at either site. Women have higher rates of low bone mass at the femur neck (52.6 percent) and lumbar spine (35.9 percent) compared to men (32.1 percent and 19.2 percent, respectively). Similarly, women have a higher prevalence of low bone mass at either site (52.6 percent) compared to men (35.6 percent). Hispanic women have the highest prevalence of low bone mass (57.0 percent), followed by non-Hispanic Whites (54.6 percent), non-Hispanic Asians (47.0 percent), and non-Hispanic Blacks (40.4 percent). For men, non-Hispanic Asians have the highest rate of low bone mass at 47.7 percent, followed by Hispanics (38.1 percent), non-Hispanic Whites (37.3 percent), and non-Hispanic Blacks (25.7 percent).

The prevalence of osteoporosis among adults ages 50 years and older is 6.3 percent at the femur neck, 7.8 percent at the lumbar spine, and 11.0 percent at either the femur neck or the lumbar spine. Women have more than 3 times the rate of osteoporosis at either site (16.5 percent) compared to men (5.1 percent). The prevalence of osteoporosis at the femur neck is 9.8 percent for women and 2.5 percent for men; at the lumbar spine the prevalence is 11.6 percent for women and 3.6 percent for men. Among women ages 50 years and older, non-Hispanic Asians have the highest rates of osteoporosis at 40.0 percent compared to rates of 17.0 percent for non-Hispanic Whites, 20.5 percent for Hispanics, and 8.2 percent for non-Hispanic Blacks. Among men ages 50 years and older, the prevalence of osteoporosis is highest in non-Hispanic Asians (7.5 percent), followed by 6.0 percent for non-Hispanic Whites, 5.9 percent for Hispanics, and 1.9 percent for non-Hispanic Blacks.[29]

Gestational Diabetes Mellitus

Gestational diabetes is diabetes that develops and is diagnosed during pregnancy. Birth data from the 2012-2016 NVSS provided information on the prevalence of gestational diabetes in the United States by age, race-ethnicity, educational attainment, and pre-pregnancy BMI.[30] The overall prevalence of gestational diabetes among women with a live birth was 6.0 percent in 2018. **The prevalence of gestational diabetes increases with age.** Women younger than age

20 years have a prevalence of gestational diabetes of 1.9 percent, while women ages 25 to 29 years have a prevalence of 5.1 percent, and those ages 35 to 39 years have a prevalence of 9.6 percent. Women ages 40 years and older have a prevalence of gestational diabetes of 12.8 percent. Non-Hispanic Asians have the highest prevalence of gestational diabetes among race-ethnicity subgroups (11.1 percent), followed by American Indian/Alaska Natives (9.2 percent), Native Hawaiian/Pacific Islanders (8.4 percent), Hispanics (6.6 percent), and non-Hispanic Whites (5.3 percent). The race-ethnicity group with the lowest prevalence of gestational diabetes is non-Hispanic Blacks (4.8 percent). The prevalence of gestational diabetes remains relatively stable across levels of education, ranging from 6.2 percent for those with less than a high school education to 5.9 percent and 6.0 percent for those with a college degree or more than college, respectively. The prevalence of gestational diabetes increases with pre-pregnancy BMI. For those with an underweight pre-pregnancy BMI, the prevalence is 2.9 percent. Individuals with a normal weight BMI have a prevalence of 3.6 percent, followed by those in the overweight category at 6.1 percent, obesity class I category (30.0 to 34.9 kg/m^2) at 8.8 percent, and those in the obesity class II category (35.0 to 39.9 $kg/\ m^2$) at 11.2 percent. For those classified with a BMI of obesity class III (40.0 or greater kg/m^2), the prevalence of gestational diabetes is 13.9 percent.

Chronic Liver Disease

Given the pleiotropic functions of the liver and the importance of the liver to nutritional health, the Committee examined data on existing liver disease as well as surrogate markers of liver enzymes. Additionally, cirrhosis was examined, as alcohol was a focus of several Committee questions. Among other etiological factors, cirrhosis can result from alcohol abuse[31] and is not reversible. The NVSS 2016 was used to examine age-adjusted chronic liver disease and cirrhosis mortality in the United States.[32] The total age-adjusted deaths per 100,000 population for males was 14.3 and 7.5 for females in 2016. Rates have increased from 12.1 and 5.8, respectively, in 2006. From 2006 to 2016, mortality rates increased in every age group except for males ages 45 to 54 years. **The age-sex group with the highest mortality rate from chronic liver disease was males ages 55 to 64 years** (45.9 per 100,000); the age-sex group with the lowest mortality was females ages 25 to 34 years.

Elevated serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) may be indicative of underlying liver disease or inflammation. The prevalence of high ALT and AST among adults ages 20 years and older was examined by sex and race-ethnicity using NHANES 2005-2008.[31] The prevalence of high ALT and high AST among adults 20 years and older was

9.7 percent and 16.0 percent, respectively. Men had a higher prevalence of high AST (24.8 percent) than did women (7.2 percent), but women had a higher prevalence of high ALT (10.0 percent) than did men (9.1 percent). Both the prevalence of high ALT and the prevalence of high AST decrease as age categories increase. Hispanics had the highest prevalence of high ALT (16 percent) and high AST (24.4 percent) among all race-ethnicity groups.

The prevalence of self-reported liver disease among adults ages 18 years and older by sex and race-ethnicity were examined using the 2017 NHIS.[33] Self-reported chronic liver disease was lower than actual chronic liver disease. The total prevalence of self-reported liver disease was 1.7 percent. Males have a slightly higher prevalence (1.8 percent) than do females (1.6 percent). The age group with the highest prevalence rate was adults ages 45 to 64 years (2.7 percent); the age group with the lowest prevalence is adults ages 18 to 44 years (1.1 percent). American Indian/Alaska Natives had the highest rates of self-reported liver disease (4.1 percent), and Asians had the lowest prevalence (1.2 percent). Hispanics had a higher prevalence (2.5 percent) than non-Hispanics (1.6 percent). The education level with the highest prevalence (3.2 percent) was less than a high school diploma, and the education level with the lowest prevalence (1.3 percent) is bachelor's degree or higher. People who were not employed but have worked previously have the highest prevalence (3.0 percent) by employment status.

Cancer

The *2018 Annual Report to the Nation on the Status of Cancer, Parts 1 and II: National Cancer Statistics* contains 2015 cancer statistics data which were used for children in this section of the Committee's report.[34,35] On March 12, 2020, the report containing 2017 cancer statistics was released.

Leukemia incidence and death rates among children ages 0 to 19 years were examined using age-adjusted SEER Program 2011-2015 information on cancer statistics. The incidence rate of leukemia among children ages 0 to 19 years is 4.7 per 100,000 and the mortality rate is 0.6 per 100,000. The incidence and mortality rates of leukemia among children ages 0 to19 years is higher among boys (5.1 and 0.7, respectively) than among girls (4.4 0.5, respectively).

Cancer outcomes in adults ages 19 years and older were examined using SEER 2016. All rates noted below are per 100,000 people and are age-adjusted to the 2000 U.S. Standard Population.

The incidence rate of female breast cancer in the United States is 127.5 among all ages, 83.9 among women younger than age 65 years, and 428.7 among women ages 65 years and older. The mortality rate of female breast cancer among women of all ages is 20.6, 10.0 among women younger than age 65 years, and 93.5 among women ages 65 years and older.

The incidence rate of colon and rectal cancer is 38.6 among all ages, 18.3 among those younger than age 65 years, and 178.5 among those ages 65 years and older. The incidence rate is higher in males than in females: among all ages (44.2 and 33.9, respectively), among those younger than 65 years (20.6 and 16.2, respectively), and among those 65 years and older (207.3 and 156.5, respectively). The mortality rate of colon and rectal cancer is 14.2 among all ages and sexes, 4.9 among those younger than age 65 years, and 78.5 among those ages 65 years and older. The mortality rate is higher among males than females: among all ages (16.9 and 11.9, respectively), among people younger than age 65 years (5.8, 4.0), and among people ages 65 years and older (93.9, 66.9).

The incidence rate of esophageal cancer is 4.3 among all ages, 1.7 among those younger than age 65 years, and 21.9 among those ages 65 years and older. The incidence rate is higher in males than in females: among all ages (7.3, 1.8), among those younger than age 65 years (2.9, 0.6), among those ages 65 years and older (38.2, 9.5). The mortality rate of esophageal cancer is 4.0 among all ages, 1.5 among those younger than age 65 years, and 21.3 among those ages 65 years and older. The mortality rate is higher among males than females: among all ages (7.1, 1.5), among those younger than age 65 years (2.6, 0.5), and among those ages 65 years and older (38.3, 8.3).

The incidence rate of prostate cancer is 109.5 among all ages, 44.3 among males younger than age 65 years, and 560.4 among males ages 65 years and older. The mortality rate of prostate cancer is 19.2 among all ages, 1.7 among males younger than age 65 years, and 140.7 among males ages 65 years and older.

The incidence rate of larynx cancer is 3.0 among all ages, 1.5 among those younger than age 65 years, and 13.3 among those ages 65 years and older. The incidence rate is higher in males than in females: among all ages (5.2, 1.1), among those younger than age 65 years (2.3, 0.6), and among those ages 65 years and older (25.0, 4.4). The mortality rate of larynx cancer is 1.0 among all ages, 0.4 among those younger than age 65 years, and 5.2 among those ages 65 years and older. The mortality rate is higher in males than females: among all ages (1.8, 0.4), among those younger than age 65 years (0.6, 0.1), and among those ages 65 years and older (9.6, 1.9).

The incidence rate of lung and bronchus cancer is 54.9 among all ages, 16.4 among those younger than age 65 years, and 320.9 among those ages 65 years and older. The incidence rate is higher among males than females: among all ages (63.0, 48.9), among those younger than age 65 years (17.3, 15.6), and among those ages 65 years and older (378.8, 279.2). The mortality rate of lung and bronchus cancer is 41.9 among all ages, 11.5 among those younger than age 65 years, and 251.6 among those ages 65 years and older. The mortality rate is higher in males than females: among all ages (51.6, 34.4), among those younger than age 65 years (13.3, 9.8), and among those ages 65 years and older (316.4, 204.0).

The incidence rate of oral cavity and pharynx cancer is 11.3 among all ages, 6.7 among those younger than age 65 years, and 43.0 among those ages 65 years and older. The incidence rate is higher among males than females: among all ages (17.0, 6.4), among those younger than age 65 years (10.0, 3.6), and among those ages 65 years and older (65.5, 25.4). The mortality rate of oral cavity and pharynx cancer is 2.5 among all ages, 1.1 among those younger than age 65 years, and 12.1 among those ages 65 years and older. The mortality rate is higher among males than females: among all ages (3.9, 1.3), among those younger than age 65 years (1.8, 0.5), and among those ages 65 years and older (18.7, 7.1).

The incidence rate of pancreatic cancer is 12.9 among all ages, 4.4 among those younger than age 65 years, and 72.0 among those ages 65 years and older. The incidence rate is higher in males than females: among all ages (14.6, 11.5), among those younger than age 65 years (5.0, 3.7), and among those ages 65 years and older (81.0, 65.0). The mortality rate of pancreatic cancer is 11.0 among all ages, 3.2 among those younger than age 65 years, and 64.8 among those ages 65 years and older. The mortality rate is higher among males than females: among all ages (12.6, 9.6), among those younger than age 65 years (3.8, 2.5), and among those ages 65 years and older (73.2, 58.2).

The incidence rate of endometrial cancer is 27.5 among all ages. The mortality rate of endometrial cancer is 4.7 among all ages.

The incidence rate of liver and intrahepatic bile duct cancer is 8.8 among all ages, 4.7 among those younger than age 65 years, and 37.6 among those ages 65 years and older. The incidence rate is higher among males than females: among all ages (13.6, 4.7) and among those younger than age 65 years (7.5, 2.1). The mortality rate of liver and intrahepatic bile duct cancer is 6.5 among all ages, 2.9 among those younger than age 65 years, and 31.8 among those ages 65 and older. The mortality rate is higher among males than females: among all ages (9.6, 3.9), among those younger than age 65 years (4.5, 1.4), and among those ages 65 years and older (44.8, 21.7).

Of note from the above data are these key findings:

- The cancer with the highest incidence rate among all ages is female breast cancer (127.5 per 100,000), followed by prostate cancer (109.5 per 100,000).

- The age group and cancer type with the highest incidence rate is prostate cancer among males ages 65 years and older (560.4 per 100,000).
- The cancer with the highest mortality rate among all ages is lung and bronchus cancer (41.9 per 100,000).
- The age group and cancer type with the highest mortality rate is lung and bronchus cancer among those ages 65 years and older (251.6 per 100,000).
- Males have a higher incidence and mortality rate than females at all ages across all shared cancer types.
- The incidence and mortality rates are highest among those ages 65 years and older for every cancer type.

Dental Health

The prevalence of dental caries among children ages 2 to 19 years was examined by age, race-ethnicity and income using NHANES 2015-2016.[36] **The prevalence of total dental caries (treated and untreated) for children ages 2 to 19 years was 45.8 percent**, while the prevalence of untreated dental caries was 13.0 percent. The prevalence of total caries was lowest in ages 2 to 5 (21.4 percent) and increased in age groups 6 to 11 years (50.5 percent) and 12 to 19 years (53.8 percent). However, untreated dental caries increased with age and decreased again in the 12 to 19 years group (8.8 percent, 15.3 percent, and 13.4 percent, respectively). Hispanic youth are the most likely to have treated and untreated dental caries (57.1 percent), but non-Hispanic Black youth are most likely to have untreated dental caries (17.1 percent). The prevalence of both total caries and untreated caries is highest among low-income groups. Specifically, 56.3 percent of children whose families fell below the Federal poverty threshold had dental caries (treated or untreated) and 18.6 percent had untreated dental caries. By comparison, 34.8 percent of children whose families made 300 percent or more than the Federal poverty level had dental caries and 7.0 percent had untreated dental caries.

A slight downward trend has occurred over time for the prevalence of total dental caries and untreated dental caries among children. In the NHANES 2011-2012, the prevalence of total dental caries in all children ages 2 to 19 years was 50.0 percent (compared to 45.8 percent for 2015-2016), and the prevalence of untreated dental caries was 16.1 percent (compared to 13.0 percent for 2015-2016). However, untreated dental caries increased from 16.1 percent to 18.0 percent in 2013-2014 before dropping to 13.0 percent in 2015-2016.

The prevalence of dental caries and tooth loss among adults ages 20 to 64 years and adults ages 65 years and older in the United States was examined by age, race-ethnicity, and income using NHANES 2011-2016. **The overall prevalence of dental caries among adults ages 20 to 64 years was 89.9 percent and 96.2 percent among adults ages 65 years and older, respectively.** Women have a higher prevalence (91.5 percent) than men (88.2 percent) among ages 20 to 64 years, but the prevalence converges among adults 65 years and older (women: 96.3 percent, men: 96.1 percent). Non-Hispanic Blacks have the highest prevalence of untreated dental caries among all race-ethnicity groups. The overall prevalence of complete tooth loss is 2.2 percent among adults ages 20 to 64 years and 17.3 percent among adults ages 65 years and older. Tooth loss may compromise dietary intakes.

Food Allergy

The overall prevalence of food allergy among U.S. infants and children ages 0 to 4 years reported by proxy using NHIS 2017 data is 6.6 percent.[37] However, these data are based on parental self-report, and the degree to which reported food allergies were diagnosed by a health provider (and if so, based on an actual allergic reaction vs testing results), or parental impression, or a combination of factors, cannot be determined from these data.

To access the data analyses referenced above, visit:
https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis

Question 2. What are the current intakes of food groups?

Approach to Answering Question: Data analysis

Conclusion Statements

For Americans ages 2 years and older, intakes of Fruit, Vegetables, Dairy, and Whole Grains are generally below recommended amounts, and intakes of total Grains and total Protein Foods generally meet or exceed recommended amounts for most age-sex groups. Intakes of solid fats and added sugars are above recommended levels for all age-sex groups. Patterns of food group intake have not changed over the last decade.

Breastfeeding initiation rates are high, but exclusive breastfeeding past age 3 months and any duration at age 6 months is 57 percent, with notable differences observed by race and ethnicity. Complementary foods and beverages are introduced before age 6 months for a majority of infants. The timing of introduction, intake patterns, and amount of calories provided by complementary foods and beverages differ by primary feeding mode among infants ages 6 to

12 months. Patterns of food group intakes and sources of food groups among ages 12 to 24 months are similar to those of the U.S. population, ages 2 years and older. A substantial increase in the intake of added sugars is seen when those age 1 year are compared with those younger than age 12 months.

Most women who are pregnant consume diets that are low in Fruits, Vegetables (particularly Dark Green and Red and Orange varieties), Dairy, and Whole Grains and are high in added sugars and saturated or solid fats. Almost half of women who are pregnant consume too little protein on a given day. Intake of seafood and plant-based sources of protein are relatively low among women who are pregnant.

Most women who are lactating consume diets that are low in Fruit, Vegetables (particularly Red and Orange Vegetables), Whole Grains, and Dairy, and are high in added sugars and solid fats. Nearly 1 in 6 women who are lactating consumes total Protein Foods in amounts less than the amounts recommended in the USDA Food Patterns.

Summary of the Evidence

Data analyses conducted for the Committee are found in the data analysis supplements and are referenced below as the Food Group and Nutrient Intakes for Infants and Toddlers Data Supplement (IT_DS), Food Group and Nutrient Intakes for Women Who are Pregnant or Lactating Data Supplement (PL_DS), Intake Distributions Data Supplement (Dist_DS), and Food Category Sources of Food Groups and Nutrients Data Supplement (CAT_DS).

Birth to Age 24 Months

Breastfeeding Initiation and Duration

Using data from the National Immunization Survey 2017-2018, which recorded information among infants born in 2016, the prevalence of breastfeeding initiation was 84 percent.[38] Lower rates of any- and exclusive-breastfeeding were observed at ages 3, 6, and 12 months. Both breastfeeding initiation and the duration of breastfeeding varied by race and ethnicity. Exclusive breastfeeding at 3 months was higher among non-Hispanic White (53 percent) and Asian infants (48 percent) when compared to non-Hispanic Black (39 percent) and Hispanic (42 percent) infants; the Healthy People 2020 goal is 46.2 percent. Overall, exclusive breastfeeding rates were 25.4 percent, and the Healthy People 2020 goal is 25.5 percent at age 6 months, with Asian (32 percent) and non-Hispanic White infants (29 percent) having higher rates than other race-ethnic groups (approximately 20 percent).

Timing of Introduction of Complementary Foods and Beverages

Using data from the National Survey of Children's Health 2016-2018, the prevalence of introduction of complementary foods and beverages (CFB) before age 4 months was 32 percent, which was higher among infants receiving infant formula (42 percent) or a mix of infant formula and human milk (32 percent) than infants fed only human milk (19 percent) (IT_DS).

Types and Amounts of Complementary Foods and Beverages

Although some younger infants (younger than age 6 months) are consuming CFB, the sample size in NHANES was not sufficient to provide a description of intakes. Differences and similarities in the intakes of food groups among older infants and toddlers who have reported only human milk plus CFB and those who have reported any infant formula plus CFB are noted (see Table D1.2). As described in the methods, these data should be interpreted with caution due to limitations in the sample size, and because statistical testing between groups was not done.

Table D1.2. Proportion (%) of infants ages 6 to 12 months with reported intakes of each food group or subgroup, WWEIA, NHANES 2007-2016

		All Infants	HM	FMF
Fruit	Total	84	75	86
	Juice	40	20	45
Vegetables	Total including legumes	80	76	81
	Total starchy	42	37	43
	Total red and orange	64	59	66
	Dark green	6	6†	6
	Other	29	36	28
	Legumes	6	6†	6
Protein foods	Total excluding legumes	47	33	50
	Meat (beef, veal, pork, etc.)	14	7†	16
	Poultry	28	18	30
	Cured meat	7	3†	8
	Total fish and seafood	1†	#	1†
	Eggs	19	17	19
	Peanuts, nuts, seeds	2	3†	2
	Soy products, except soy milk	3	2†	3
Grain	Total	89	81	91
	Whole	59	51	61
Dairy	Total	45	40	46
Oil		57	46	59
Solid fat		60	49	62
Added sugars		63	55	64

Notes:

HM=human milk; FMF=formula or mixed fed

† indicates an estimate that may be less precise than others due to small sample size and/or large relative standard error.

# indicates a non-zero value too small to present. Sample based on age at Mobile Examination Center.

Complementary foods include all foods and beverages except human milk and infant formula.

Milk reporting status determined by the report of human milk on either day 1 or day 2.

Older Infants Ages 6 to 12 Months

At ages 6 to 12 months, infants fed infant formula obtain a larger proportion of food groups from baby food sources than do infants who receive only human milk (CAT_DS). A summary of the proportion of infants with intakes of a food group, mean intakes, and food category sources of intakes are described for each food group. Figure D1.2 and Figure D1.3 illustrate the top food category sources of food groups by infant feeding mode for this age group.

Fruit

Infants ages 6 to 12 months consume most Fruit group foods from 3 distinct categories: baby foods, whole fruit, and beverages (e.g., fruit juices) (CAT_DS). The majority (59 percent) of fruit intake among all infants ages 6 to 12 months comes from baby food, with 26 percent coming from whole fruit and 14 percent from beverages. Most of the fruit came from the Fruit subgroup Other Fruits (e.g., bananas), followed by 100% fruit Juice (IT_DS). Citrus, Melons, and Berries are the smallest contributors to fruit intake among infants.

The category sources of fruit intake vary between infants consuming only human milk vs infants consuming any formula (CAT_DS). (See Figure D1.2.) Infants who receive human milk consume more fruit as non-baby food sources of fruit, with less as baby food and beverages (fruit drinks) compared to infants receiving any infant formula.

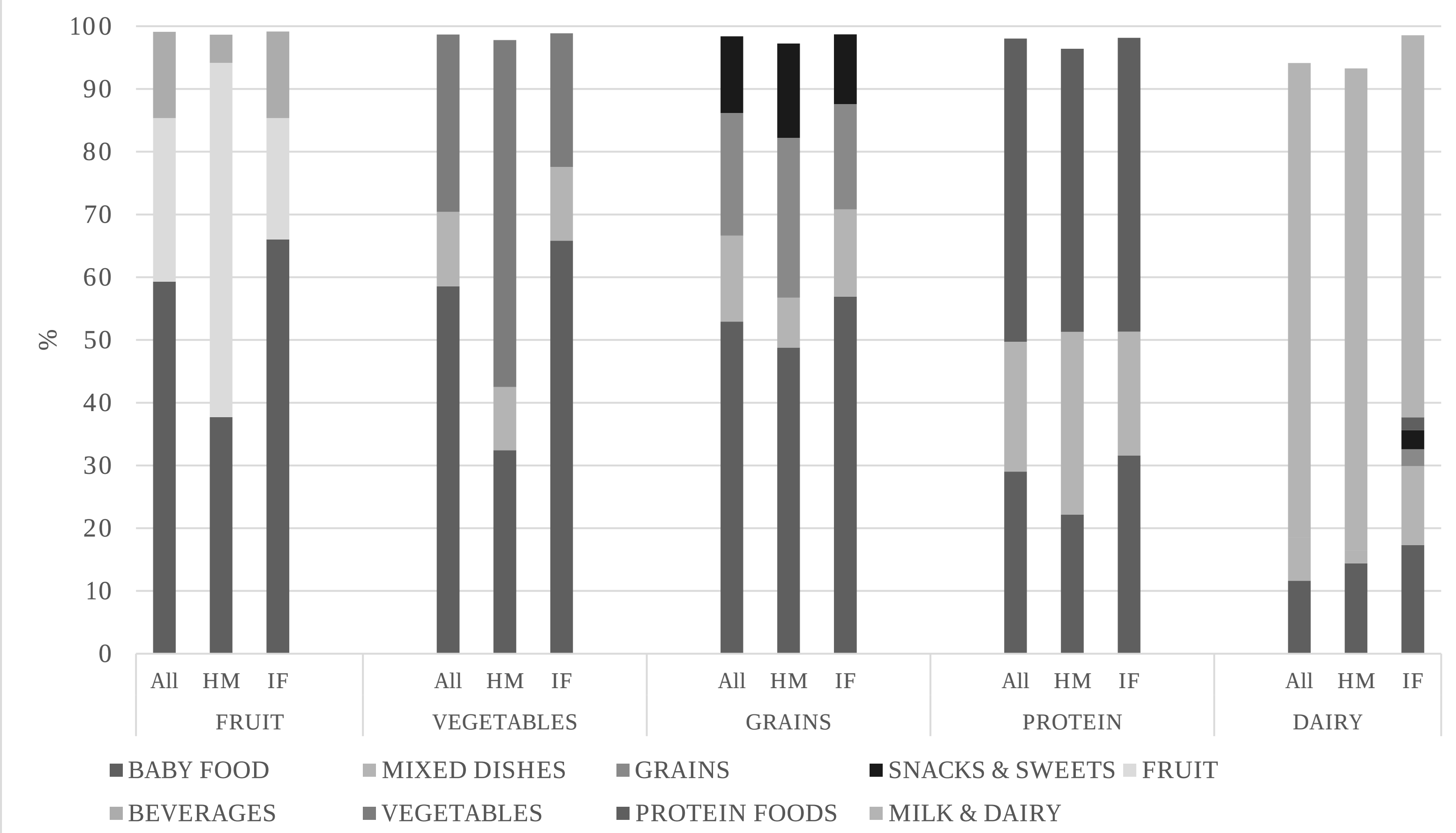
Vegetables

Total intakes from the Vegetable group among those ages 6 to 12 months come primarily from 3 category sources: baby foods, whole vegetables, and mixed dishes (CAT_DS). Although intake from mixed dishes is similar among infants fed human milk vs those fed any infant formula, those receiving human milk received more vegetables as whole vegetables than as baby food sources. (See Figure D1.2.)

About 80 percent of all infants ages 6 to 12 months are provided vegetables on a given day (IT_DS). Other Red and Orange Vegetables (not tomatoes; e.g., carrots) are the most commonly reported (57 percent), followed by other Starchy Vegetables (not potatoes; e.g., green peas) (30 percent), Other Vegetables (e.g., green beans) (29 percent), and potatoes (27 percent). Dark Green Vegetables and Legumes are the least-consumed vegetables, with only 6 percent of infants fed those foods on a given day. Mean intakes of total Vegetables are approximately 0.4 cup equivalents (cup eq) per day (IT_DS).

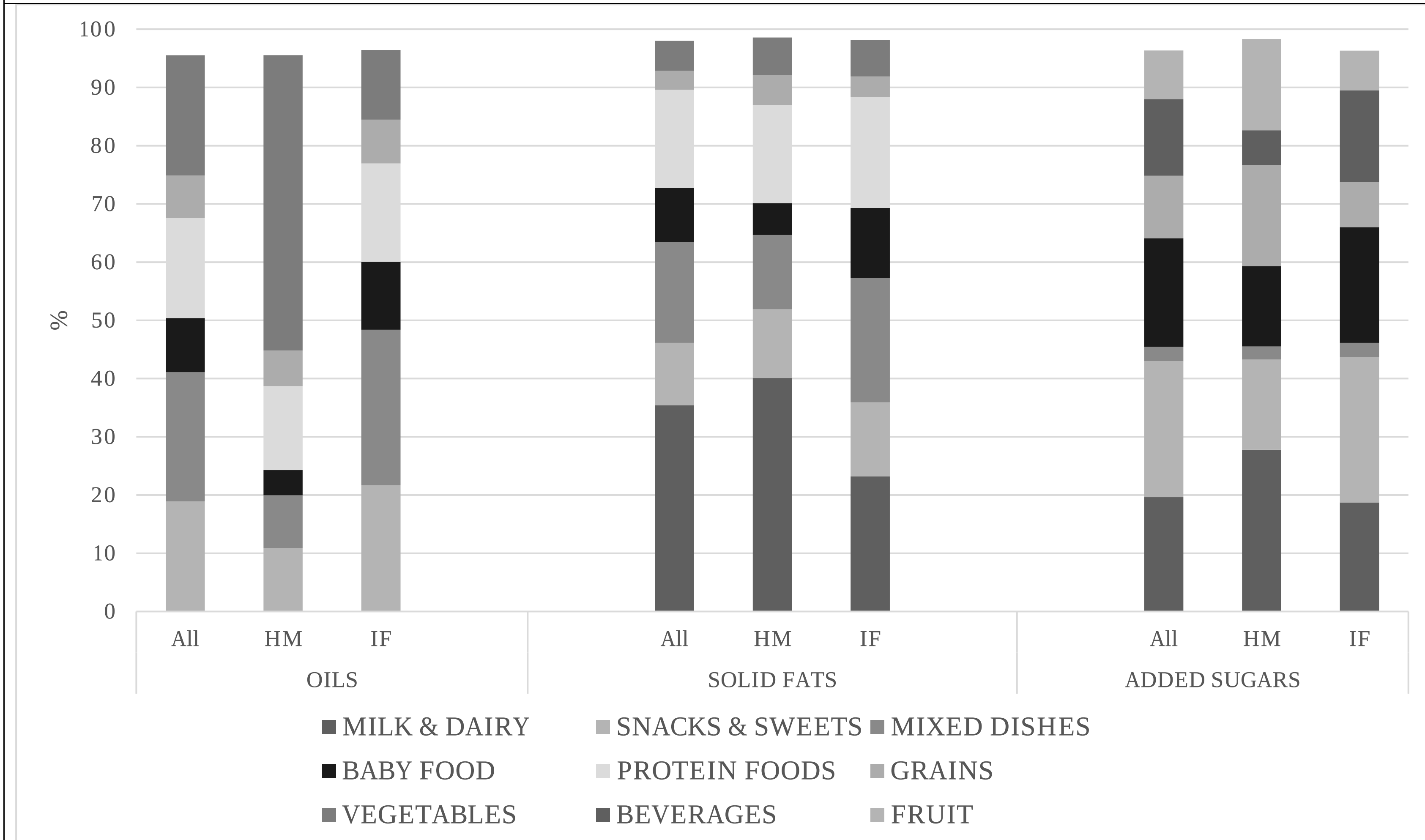
1

Figure D1.2. Top food category sources of Fruit, Vegetables, Grains, Protein, and Dairy, by infant feeding mode, ages 6 to 12 mo, WWEIA, NHANES, 2007-2016



Data Source: Food Category Sources of Food Group Intakes Among Infants and Toddlers [https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis]
HM=human milk; IF=infant formula

Figure D1.3. Top Food category sources of Oils, Solid Fats, and Added Sugars, by infant feeding mode, ages 6 to 12 mo, WWEIA, NHANES, 2007-2016



Data Source: Food Category Sources of Food Group Intakes Among Infants and Toddlers [https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis]
HM=human milk; IF=infant formula

Grains

The majority (89 percent) of infants are fed foods from the Grains food group on a given day (IT_DS). However, only 59 percent of infants receive whole grains. Four main food categories contribute grains in the diets of infants ages 6 to 12 months: baby foods, grains, mixed dishes, and sweets and snacks (CAT_DS). Total grain category sources vary by milk-feeding source, with infants receiving human milk obtaining more grains from snacks and sweets while formula-fed infants received more grains from mixed dishes. Mean total Grain intakes are 1.14 ounce equivalents (oz eq) among those fed any formula and 0.71 oz eq among those receiving only human milk (IT_DS). Whole Grain intakes are less than half of total Grain intakes, with mean intakes of approximately 0.3 oz eq. Note that food category sources of whole grains were not available in this age group. (See Figure D1.2.)

Protein Foods

Foods in the Protein Foods group come from 3 main food category sources in the diets of infants ages 6 to 12 months: approximately half from non-baby food protein foods (such as meats, eggs, fish, plant-based protein foods), 29 percent from baby food, and 21 percent from mixed dishes (CAT_DS). (See Figure D1.2.)

About half of all infants (47 percent) were fed foods from the Protein Foods group on a given day, with disparities by infant milk source; 33 percent of human milk-fed infants received total protein foods compared to 50 percent of infants receiving infant formula (IT_DS). The most commonly reported Protein Foods subgroups consumed by infants ages 6 to 12 months were Poultry (28 percent), Eggs (19 percent), and Meat (14 percent). Only 2 percent of infants reportedly received peanuts and Nuts and Seeds, 3 percent were fed Soy (other than soy beverages), and 6 percent were fed Legumes. Mean intakes of total Protein Foods were 0.28 oz eq among infants in the human milk group and 0.52 oz eq among those in the infant formula group.

Dairy

Less than half (45 percent) of infants ages 6 to 12 months consumed foods from the Dairy group on a given day, with fluid Milk consumed by 34 percent, Cheese consumed by 19 percent, and Yogurt consumed by 11 percent (IT_DS). Infants receiving human milk were more likely to be fed yogurt while those fed formula consumed more dairy as milk and cheese. Mean intakes of total Dairy foods were 0.30 cup eq among those receiving infant formula. Infants in the human milk group had negligible mean intakes of 0.08 cup eq.

Dairy was consumed by infants ages 6 to 12 months through 3 main food categories: milk and dairy, baby food, and mixed dishes (CAT_DS). Among formula-fed infants, a small amount of dairy was also contributed by snacks and sweets, grains, and protein foods (CAT_DS). (See Figure D1.2.)

Other Dietary Components

More than half of infants ages 6 to 12 months consume oils (57 percent), solid fats (60 percent), and added sugars (63 percent) on a given day (IT_DS). The intake of oils, solid fats, and added sugars is more common among infants receiving any formula as compared to those receiving only human milk, though statistical testing between groups was not done.

The main category sources of oils in the diets of infants ages 6 to 12 months include mixed dishes, vegetables, snacks and sweets, protein foods, baby food, and grains (CAT_DS). Condiments and sauces also contribute a small amount of oils in the diets of infants receiving human milk. Category sources of oils in the diets of infants vary greatly by milk source. Infants receiving human milk obtain more oils from vegetables and less from snacks and sweets, mixed dishes, and baby foods than do their formula-fed peers. (See Figure D1.3.)

The main category sources of solid fats in the diets of infants include milk and dairy, mixed dishes, protein foods, snacks and sweets, baby food, vegetables, and grains (CAT_DS). Infants receiving human milk obtain more solid fats from milk and dairy and less from mixed dishes and baby foods than do formula-fed infants. (See Figure D1.3.) Mean intakes of solid fats from CFB are 3 to 4 grams per day (IT_DS).

Added sugars are consumed by infants through a variety of categories, including snacks and sweets (23 percent), milk and dairy (20 percent), baby food (19 percent), beverages (other than 100% juice or fluid milk) (13 percent), grains (11 percent), fruit (8 percent), and mixed dishes (3 percent) (CAT_DS). (See Figure D1.3.) The sources of added sugars among infants vary significantly by milk source. Infants receiving human milk obtain the majority (61 percent) of added sugars through milk and dairy, grains, and fruit, whereas formula-fed infants receive 64 percent of added sugars through snacks and sweets, baby foods, and milk and dairy. Beverages other than 100% fruit juice contribute notably less added sugars to the diets of infants who are fed human milk (6 percent) compared to infants who are fed formula (16 percent). Mean daily intake of added sugars among those in the infant formula group is 1.1 teaspoon equivalents (tsp eq) and 0.7 tsp eq for those in the human milk group (IT_DS).

Toddlers Ages 12 to 24 Months

A summary of the proportion of toddlers with intakes of a food group, mean intakes, and food category sources of intakes are described in the following sections.

Fruit

Almost all (94 percent) toddlers are provided foods from the Fruit group on a given day, with a mean intake of 1.2 cup eq/day (IT_DS). Other Fruit (e.g., apples, bananas) is the most commonly consumed fruit subgroup, followed by 100% Juice (0.56 cup eq/day). Fruit is consumed by those ages 12 to 24 months from the categories of whole fruit (47 percent), fruit juice (41 percent), baby food (4 percent), baby beverages (4 percent), and candy (2 percent) (CAT_DS).

Vegetables

The majority (92 percent) of toddlers consume foods from the Vegetables group on a given day, with a mean daily intake of 0.52 cup eq/day (IT_DS). More than half (56 percent) of toddlers consume Other Vegetables (e.g., green beans) on a given day, followed by tomatoes (53 percent), potatoes (42 percent), other Red and Orange (not tomatoes; e.g., carrots) (34 percent), and other Starchy (not potatoes; e.g., green peas) (27 percent) (IT_DS). Legumes (14 percent) are consumed at about the same level as Dark Green Vegetables (13 percent). Starchy Vegetables and Red and Orange Vegetables each contribute about 0.18 cup eq/day to vegetable intake compared to 0.13 cup eq/day for Other Vegetables, suggesting that quantities of vegetable subgroups served may vary (IT_DS).

Food category sources that provide 5 percent or more of total Vegetable intake among toddlers include vegetables other than potatoes (35 percent), white potatoes (17 percent), grain-based mixed dishes (10 percent), baby foods (8 percent), meat and poultry and seafood mixed dishes (7 percent), soups (7 percent), and savory snacks (5 percent) (CAT_DS).

Grains

Although 99 percent of toddlers consume some type of food from the Grains food group on a daily basis, only 73 percent consume Whole Grains (IT_DS). The mean total Grain intake among toddlers is 3 oz eq/day. Only 0.5 oz eq/day of grains are consumed as whole grains, with intake higher among male compared to female toddlers.

The main category sources which provide 5 percent or more of total Grains include breads and rolls and tortillas (18 percent), grain-based mixed dishes (11 percent), sweet bakery products (10 percent), crackers (9 percent), ready-to-eat cereals (6 percent), savory snacks (5 percent), baby foods (5 percent), and quick breads (5 percent) (CAT_DS). Pizza and Mexican dishes each provide 4 percent of total grains, with sandwiches providing 3 percent. Note that dietary intakes by whole grain source are not available.

Protein Foods

Almost all (95 percent) of those ages 12 to 24 months consumed Protein Foods on the day of assessment (IT_DS). Eggs are reported most commonly consumed (by 57 percent of toddlers), followed by Poultry (47 percent), Meats and cured meats (38 percent each), and peanuts and Nuts and Seeds (22 percent). Fifteen percent of infants are fed Legumes; 8 percent receive Soy (other than soy beverages); and only 6 percent are fed fish or Seafood.

The top food category sources of total Protein Foods include poultry (26 percent), cured meats and poultry (17 percent), eggs (14 percent), meat- and poultry- and seafood-based mixed dishes (10 percent), meats (7 percent), and plant-based protein foods (5 percent) (CAT_DS). Sandwiches provide about 4 percent of total Protein Foods, with seafood providing about 2 percent. Poultry is consumed in greater quantities than meat (0.7 oz eq/day compared to 0.3 oz eq/day) (IT_DS).

Dairy

Dairy foods are consumed by 99 percent of infants, with 96 percent consuming Milk, 66 percent consuming Cheese, and 22 percent consuming Yogurt (IT_DS). Total Dairy intake is about 2.5 cup eq/day among toddlers, with 2.1 cup eq/day coming from Milk, 0.4 cup eq/day from Cheese, and 0.1 cup eq/day from Yogurt (IT_DS). The top food categories that contribute to total Dairy intake include plain milk (73 percent), cheese (8 percent), yogurt (3 percent), mixed dishes (2 percent), dairy drinks and substitutes (2 percent), and flavored milk (2 percent) (CAT_DS).

Other Dietary Components

Toddlers consume a little more than 8 grams (g) of oils per day (IT_DS). Category sources of oils in the diets of toddlers are numerous, with the main contributors including savory snacks (12 percent), poultry (11 percent), crackers (10 percent), white potatoes (9 percent), grain-based mixed dishes (8 percent), plant-based protein foods (8 percent), and breads/rolls/tortillas (5 percent) (CAT_DS).

Toddlers consume almost 25 g of solid fats per day (IT_DS). The top food category sources of solid fats consumed by toddlers include plain milk (43 percent), sweet bakery products (8 percent), cheese (7 percent), cured meats and poultry (6 percent), and grain-based mixed dishes (5 percent). Pizza and Mexican dishes each provide about 3 percent of solid fats per day (CAT_DS).

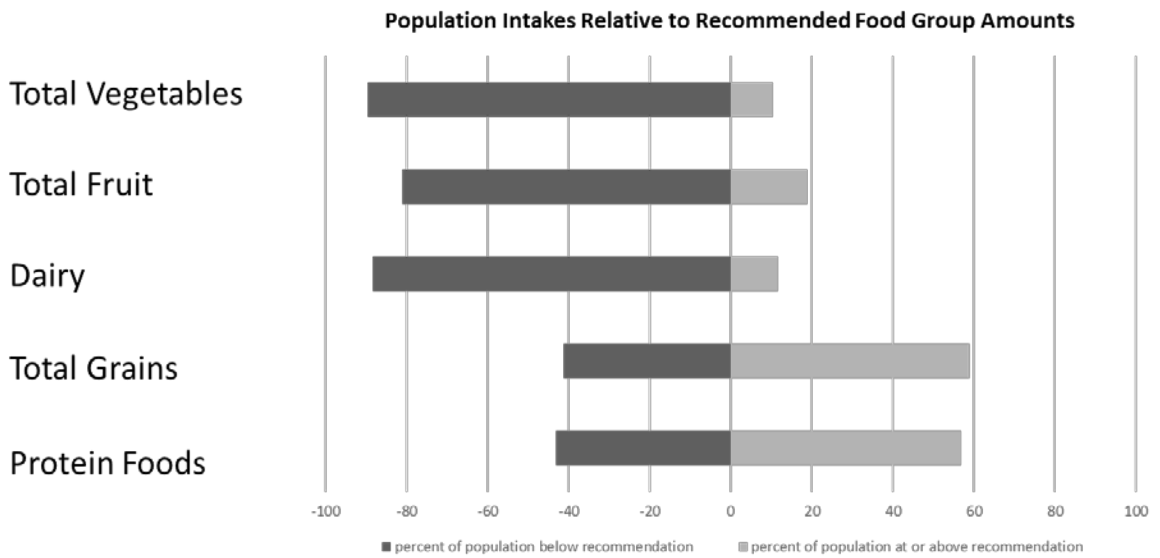
Toddlers consume a little more than 6 tsp eq of added sugars each day (IT_DS). Food category sources of added sugars in the diets of toddlers ages 12 to 24 months include sweetened beverages (27 percent), sweet bakery products (15 percent), yogurt (7 percent), ready-to-eat cereals (6 percent), candy (6 percent), and other desserts (5 percent) (CAT_DS). Sugars and fruits each provide about 4 percent of added sugars, followed by flavored milk, and dairy drinks and substitutes at 3 percent each. Interestingly, from ages 12 to 24 months, patterns of food intake are similar to those among most Americans ages 2 years and older. Among toddlers, added sugars were primarily obtained through sweetened beverages (27 percent), sweet bakery products and other desserts (20 percent), and candy and sugars (10 percent) (CAT_DS).

Individuals Ages 2 Years and Older

Data analysis of NHANES 2015-2016 was first broadly examined as aggregated usual food group and subgroup data on foods and beverages using the USDA Food Patterns Equivalents Database and then refined further by characterizing foods and beverages "as consumed" through the WWEIA Food Categories. Finally, trends over time were examined comparing current intakes (2015-2016) of foods and beverages against a previous NHANES analysis (2003-2004). It is important to note that self-reported dietary patterns (e.g., vegetarian) were not collected in the survey years examined for this report. In this summary of the evidence, some differences and similarities between subgroups in the population are noted, but statistical testing between groups was not done.

Intakes of most food groups have not changed over time.[39] A small increase in whole grains was seen between 2003-2004 and 2015-2016; however, intakes of whole grains are still well below recommended levels. Some changes in food intake were seen among youth, with total dairy intake decreasing among young children and total protein intakes decreasing among adolescents. The percentage of energy from solid fats and added sugars decreased somewhat during the same time period among all age groups.

Figure D1.4. Percent of population below, at, or above recommended food group amounts



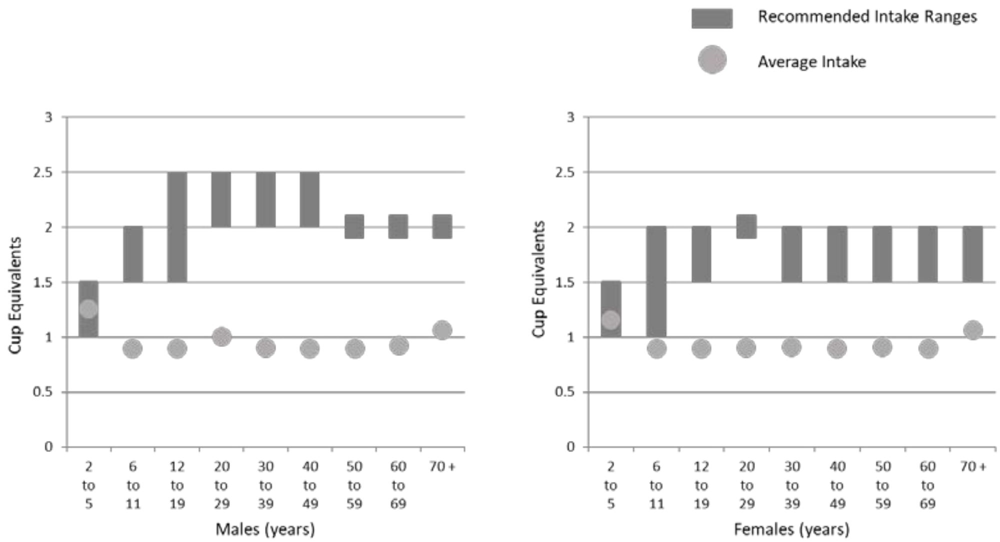
Data Source: Usual Dietary Intakes: Food Group Intake, U.S. Population, WWEIA, NHANESS 2013-16. [DIST_DS at https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis] USDA Healthy U.S.-Style Eating Style recommended intakes, which vary based on age, sex, and activity level for recommended intakes.

Fruit

Recommended intakes of Fruit group foods range from 1 to 2.5 cup eq per day, based on the calorie level of the USDA Healthy U.S.-Style Food Pattern.[6] Dietary intake of fruit is below recommended levels for the majority of the U.S. population (81 percent) (DIST_DS), with the exception of children ages 2 to 3 years, who primarily consume the additional fruit through fruit juice.[40] (See Figures D1.4 and D1.5.)

The mean total Fruit intake for individuals ages 2 years and older is 0.9 cup eq per day.[40] With the exception of preschool-aged children (1 cup eq/day), older adults (1.1 cup eq/day), and women who are pregnant or lactating (1.2 cup eq/day) (PL_DS). Americans on average consume less than 1 cup eq/day of total Fruit.[40] The majority of children ages 2 to 3 years (57 percent of females and 63 percent of males) consume fruit at levels that exceed recommendations (DIST_DS). Between the ages of 4 and 8 years, about half of children fall below recommended intakes, and 10 percent of male and 20 percent of female children exceed recommended intakes. Fruit intake plateaus during the elementary school years and remains at less than 1 cup eq/day through adulthood. Intake increases slightly among older adults to 1.1 cup eq/day.[40] Fruit intake does not vary substantially by sex.

Figure D1.5. Average daily Fruit intake compared to recommended intake



Data sources: What We Eat in America, NHANES 2015-2016 for average intakes by age-sex group. USDA Healthy U.S.-Style Eating Style recommended intake ranges, which vary based on age, sex, and activity level for recommended intakes. 2015-2020 Dietary Guidelines for Americans.

Approximately two-thirds of fruit consumption is whole fruit.[40] Other Fruits (e.g., apples, bananas, grapes) are consumed in larger amounts than Citrus, Melons, and Berries. Approximately one-third of Fruit intake is 100% fruit Juice. Mean fruit juice intake by children ages 2 to 5 years is 0.5 cup eq/day, decreasing with age throughout childhood and remaining consistently small during adulthood.

Food Category Sources of Fruit

Considering food category sources of fruit intakes, the top 4 subcategory sources of fruit intake among Americans of all ages are whole fruit, 100% fruit juice, sugar-sweetened and diet beverages, and desserts and sweet snacks (CAT_DS). Higher fat milk and yogurt is the fifth highest contributor of fruit for children (e.g., fruit in yogurts), while breakfast cereals and bars (e.g., dried fruit as part of a bar) rank fifth among adults.

A few differences in fruit intake by demographic factors are noted.[41] Fruit intake is highest among Hispanic and non-Hispanic Black children between the ages of 2 and 5 years (1.3 cup eq/day) and among non-Hispanic Asian adults (1.3 cup eq/day) compared to other race-ethnic groups of children and adults (0.9 to 1 cup eq/day). Total Fruit intake was not associated with income; mean intakes are 0.9 cup eq/day among the lowest income group and 1.0 cup eq/day among the highest income group.[42] However, fruit Juice consumption displayed an inverse association with income, while Other Fruit and Citrus, Melons and Berries were positively associated with income.

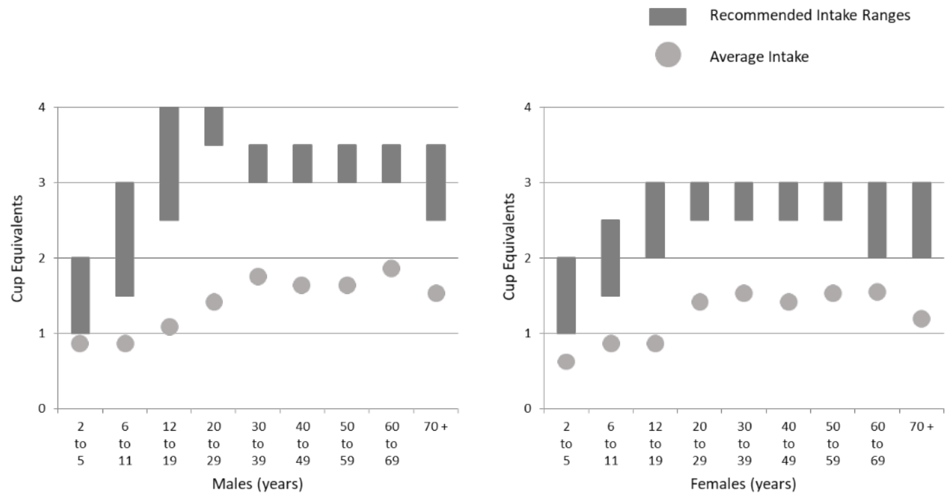
Although the slight decreases in fruit intake over time (NHANES 2015-2016 compared with 2003-2004) are not statistically significant, they do signal dietary changes that bring Americans further away from recommended intakes. This trend should be monitored to see whether it persists over time.

Vegetables

Recommendations for Vegetable intakes range from 1 to 4 cups per day, based on energy level of the diet.[6] The majority (about 90 percent) of Americans report a usual intake below the minimum recommendation for their age-sex group (DIST_DS), with a daily average across all age-sex groups of 1.5 cup eq/day.[40] (See Figures D1.4 and D1.6.) Children report a mean daily intake of less than 1.1 cup eq/day and adults report 1.4 to 1.7 cup eq/day, on average. The largest disparities between recommended and actual intakes of vegetables occur among children ages 4 to 8 years, adolescents, and young adults.

The majority of children (88 percent to 99 percent) and adolescents do not consume vegetables at recommended levels (DIST_DS), with a mean daily intake of total Vegetables of 0.9 cup eq/day.[40] The age group with the highest percentage of individuals with vegetable intakes at or above recommended amounts is children ages 2 to 3 years (DIST_DS). Ten percent of female and 15 percent of male children ages 2 to 3 years consume vegetables within or above recommended intakes. In adolescents, fewer than 2 percent of children ages 14 to 18 years meet or exceed recommend amounts of vegetables. Less than 3 percent of young adult males (ages 19 to 30 years) and less than 7 percent of young adult females meet or exceed recommended intakes of vegetables. Among adults ages 50 years and older, females are more likely than their male peers to meet or exceed recommended vegetable intakes (26 percent compared to 15 percent). The majority of Americans (up to 96 percent of youth and 99 percent of adults) consume too few Dark Green Vegetables and Red and Orange Vegetables relative to recommendations.

Figure D1.6. Average daily Vegetable intake compared to recommended intake



Data sources: What We Eat in America, NHANES 2015-2016 for average intakes by age-sex group. USDA Healthy U.S.-Style Eating Style recommended intake ranges, which vary based on age, sex, and activity level for recommended intakes. 2015-2020 Dietary Guidelines for Americans.

Food Category Sources of Vegetables

More than half of total vegetables are consumed as part of other foods rather than as discreet vegetables, by all age-sex groups, with the exception of older adults (CAT_DS). The top 3 food subcategories that contribute 10 percent or more to vegetable intake for all age groups are non-starchy and starchy vegetables; burgers and sandwiches; and rice, pasta, and other grain-based dishes. Chips, crackers, and savory snacks also provide more than 10 percent of vegetable intake in the diets of children. More than a quarter of total vegetable intake for Americans ages 2 years and older comes from white potatoes alone. Although absolute intake of potatoes is similar across age groups, the proportion of white potatoes to total vegetable intake is highest among children because their intakes of other vegetables are lower.[40] Beans, peas, and legumes are consumed in relatively small amounts, at an average of 0.1 cup eq/day.[40] Intakes of Dark Green and Red and Orange Vegetables are particularly low among all age-sex groups.

Demographic differences in vegetable consumption are seen among Americans. Non-Hispanic Asians report the highest intakes of total Vegetables (1.7 cup eq/day), with the majority of intake among non-Hispanic Asians coming from Other and Dark Green Vegetables.[41] In comparison, the most common source of vegetables for non-Hispanic Black and Hispanic individuals are Starchy Vegetables. Total Vegetable intake is 1.4 cup eq/day in the highest income category and 1.27 cup eq/day in the lowest income group.[42]

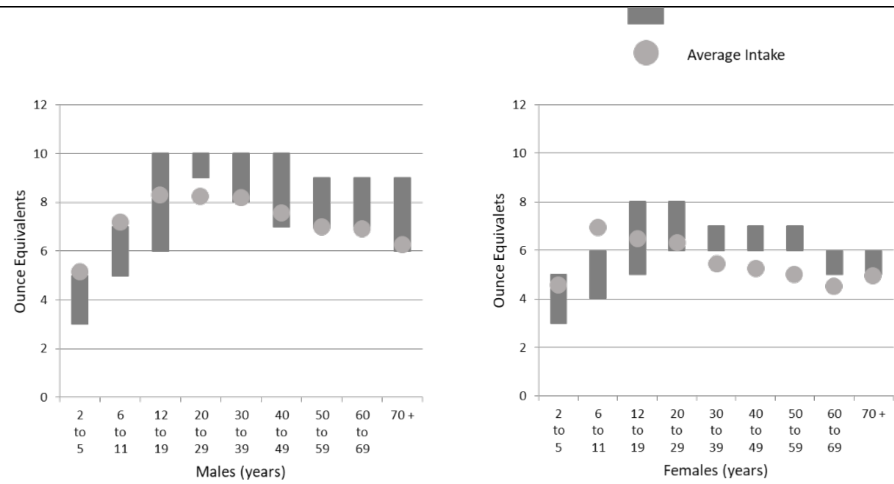
Total Vegetable intake among youth did not change significantly between the 2003-2004 and 2015-2016 NHANES cycles. However, a noticeable decline was seen among those ages 12 to 19 years.[39] Given that this change is contrary to evidence that suggests higher vegetable intakes are a critical component of a dietary pattern needed to promote health, this is a trend that should warrant monitoring.

Total and Whole Grains

The recommended range of total Grains ranges is from 3 to 8 oz eq per day and is based on energy intake.[6] At least half of total Grains, or 1.5 to 4 oz eq/day, should come from whole grain sources. Mean total Grain intake among Americans ages 2 years and older is 6.4 oz eq/day,[40] which is within the recommended range. (See Figure D1.7)

More than 1 in 5 people exceeds recommended levels for total Grains (DIST_DS). However, only 0.9 oz eq/day are consumed from Whole Grains, which is well below recommended intakes.[40] Whole Grain intakes are well below recommended levels in all age-sex groups, with only 2 percent of the population meeting recommendations (DIST_DS).

Figure D1.7. Average daily total Grains intake compared to recommended intake



Data sources: What We Eat in America, NHANES 2015-2016 for average intakes by age-sex group. USDA Healthy U.S.-Style Eating Style recommended intake ranges, which vary based on age, sex, and activity level for recommended intakes. 2015-2020 Dietary Guidelines for Americans

Youth ages 2 to 19 years reported a mean intake of 6.8 oz eq/day of total Grains, of which 0.9 oz eq/day were from Whole Grains;[40] 92 percent to 100 percent in this age group consume Whole Grains below recommended levels. Adults ages 20 years and older reported a mean consumption of 6.3 oz eq/day of total Grains, of which 0.9 oz eq/day were from Whole Grains.

With the exception of males ages 51 years and older, all other age-sex groups have mean usual intakes of Whole Grains less than 1.0 oz eq/day, although the range of the intake distribution among adults is wide (0.1 oz eq/day to 2.7 oz eq/day) (DIST_DS). The mean is higher than the median, suggesting a low intake among the majority of the population. About half of adults consume total Grains in amounts less than recommended levels; however, 16 percent of adult males and 20 percent of adult females exceed recommendations for total Grains. Nearly 75 percent of all Americans exceed recommendations for refined grains and Whole Grains are consumed at less than recommended levels by 98 percent of Americans. Intakes of Grains are higher among women than men.

Food Category Sources of Total and Whole Grains

The top food subcategory contributor to total Grain intake for all age-sex groups is burgers and sandwiches, providing a quarter or more of total Grain intake on an average day (CAT_DS). Among children ages 18 years and younger, rice, pasta, and other grain-based mixed dishes; chips, crackers, and savory snacks; and desserts and sweet snacks each provide more than 10 percent of total Grain intakes. Among adults, yeast breads and tortillas, and rice, pasta, and other grain-based dishes are among the top total Grain contributors.

Sources of Whole Grains tend to be from a narrow array of foods. The top food subcategories that contribute to Whole Grain intakes in the diets of U.S. children and adults include breakfast cereals and bars (33 percent to 42 percent); burgers and sandwiches (17 percent to 21 percent); and chips, crackers, and savory snacks (14 percent to 19 percent). Yeast breads and tortillas are a significant Whole Grain contributor among adults, but not among youth.

The highest intakes of total Grains (7 oz eq/day) are reported in the Hispanic and non-Hispanic Asian communities.[41] The highest intake of Whole Grains occurs within the non-Hispanic Asian community (1.2 oz eq/day). Intakes of Whole Grains are higher among non-Hispanic Asian youth, particularly during adolescence, compared to other youth.

Total Grain intake is consistent across income levels.[42] However, intake of Whole Grains is positively associated with increased income status among Americans ages 6 years and older.

Although total Grain intakes remained steady between NHANES 2003-2004 and 2015-2016, Whole Grain intakes increased significantly among children ages 2 to 19 years but remain below recommended levels.[39]

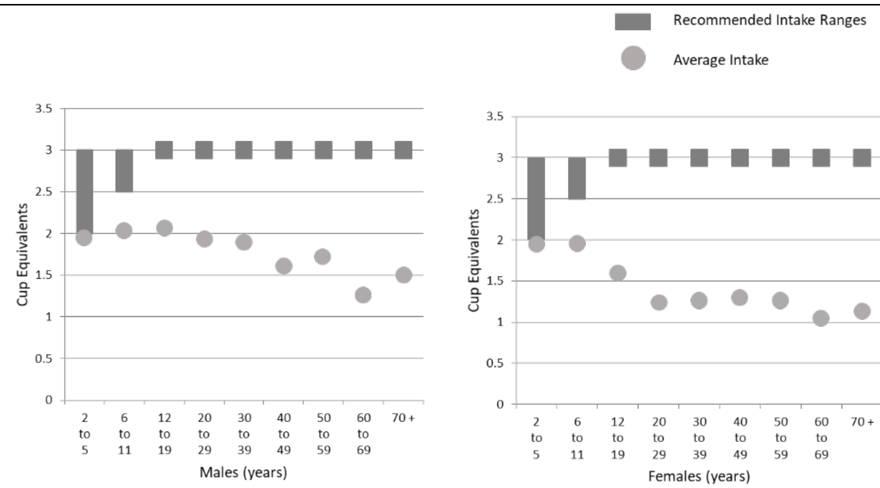
Dairy

Two to 3 cup eq of total Dairy foods are recommended for consumption each day; the recommendation is 3 cups for most age-sex groups, regardless of activity level. However, only 2 percent of the U.S. population meets the recommendation (DIST_DS). Although nearly 10 percent of Americans exceeded recommended intakes, 88 percent consume too little Dairy. Most children ages 2 to 3 years exceed recommended intakes. However, by adolescence, most youth have intakes below recommended amounts (see Figure D1.8).

Dairy intake is highest in young children (2.0 to 2.5 cup eq/day among those ages 1 to 3 years) and decreases with age.[40] The percentage of youth with Dairy intakes below recommended levels increases dramatically starting at age 9 years, with 79 percent or more between ages 9 and 13 years falling below recommended intakes (DIST_DS). However, nearly one-quarter of male teens exceed recommended Dairy intakes. Mean total Dairy intake is higher among youth ages 19 years and younger (1.9 cup eq/day) than among adults ages 20 years and older (1.5 cup eq/day).[40] Women who are pregnant (1.8 cup eq/day) and women who are lactating (1.6 cup eq/day) have somewhat higher total Dairy intakes compared to women who are not pregnant or lactating.[43] Males are more likely than females to exceed the recommendation in every age group (DIST_DS).

Dairy intake has decreased over time among youth, but the only statistically significant change has been among children ages 2 to 5 years.[39] Because Dairy foods (including calcium-fortified soy beverages and fortified cow's milk products) are a significant source of many nutrients, particularly calcium, phosphorous, and vitamin D, this downward trend among youth should be monitored.

Figure D1.8. Average daily Dairy intake compared to recommended intake



Data sources: What We Eat in America, NHANES 2015-2016 for average intakes by age-sex group. USDA Healthy U.S.-Style Eating Style recommended intake ranges, which vary based on age, sex, and activity level for recommended intakes. 2015-2020 Dietary Guidelines for Americans

Food Category Sources of Dairy

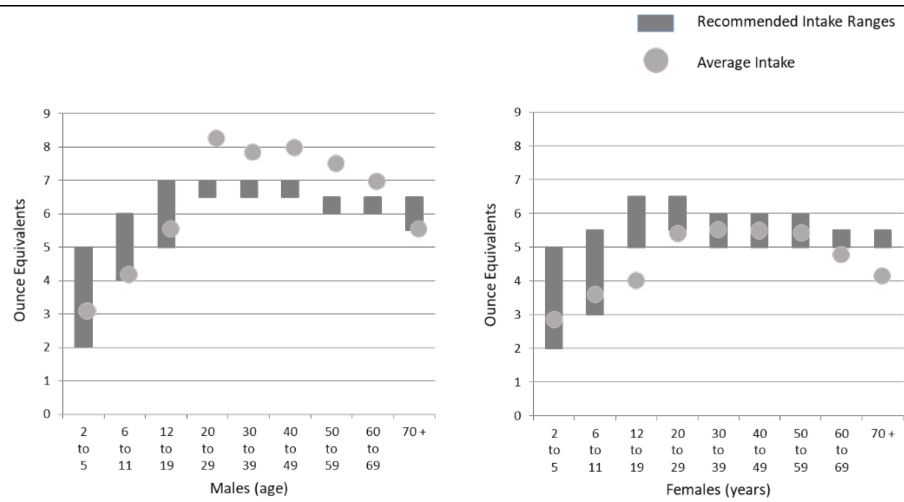
Food subcategory sources of Dairy foods vary by age group (CAT_DS). Higher- and lower-fat milk and yogurt, specifically fluid milk (which includes calcium-fortified soy beverages but not other plant-based milk substitutes), are the primary contributors to Dairy intake in youth. Mean intakes are 1.1 cup eq/day of fluid Milk compared to 0.8 cup eq/day of Cheese and 0.05 cup eq/day of Yogurt.[40] The contribution of fluid Milk to Dairy intake decreases with age during childhood while the contribution of Cheese increases. The food subcategories of burgers and sandwiches and pizza also contribute significantly to total Dairy intake among children and adolescents (CAT_DS). Major food subcategories that contribute 10 percent or more to Dairy intake among adults ages 20 to 70 years include burgers and sandwiches followed by higher fat milk and yogurt and cheese. Among older adults, the top Dairy contributors include higher fat milk and yogurt, burgers and sandwiches, desserts and sweet snacks, and low-fat milk and yogurt. Overall, yogurt contributes only about 2 percent of dairy to the diets of Americans.

Some demographic differences are identified in Dairy intakes. Total Dairy intake is highest among non-Hispanic White and Hispanic individuals and lowest among non-Hispanic Black individuals of all ages.[41] Dairy intake does not vary notably by income.[42]

Protein Foods

Recommended intakes of Protein Foods range from 2 oz eq/day to 7 oz eq/day, depending upon calorie level.[6] Mean total Protein Foods intake (including Seafood, Meat and Poultry, Nuts and Seeds, and Soy Products, but excluding Legumes) by Americans ages 2 years and older is 5.8 oz eq/day, with average intake estimated at 4.1 oz eq/day among youth ages 2 to 19 years and 6.3 oz eq/day among adults.[40] The proportion of males ages 2 to 18 years with Protein Foods intakes below recommended levels increases with age from 23 percent (ages 2 to 3 years) to 64 percent (ages 9 to 13 years) (DIST_DS). The proportion of females ages 2 to 18 years with total Protein Foods intakes below recommended levels also increases with age from 32 percent (ages 2 to 3 years) to 79 percent (ages 14 to 18 years). A little more than half of adult males and one-quarter of adult females 19 years and older have Protein Foods intakes above recommended levels. Conversely, 50 percent of female adults ages 19 years and older consume Protein Foods below recommended levels compared to 31 percent of males. Mean intake of Protein Foods is within the range of recommended amounts for most groups except females ages 12 to 19 years and age 70 years and older (see Figure D1.9). Total Protein Foods intake is higher in males compared to females of all ages. Protein Foods intake has not changed significantly over time (2003-2004 to 2015-2016).[39]

Figure D1.9. Average daily Protein Foods intake compared to recommended intake



Data sources: What We Eat in America, NHANES 2015-2016 for average intakes by age-sex group. USDA Healthy U.S.-Style Eating Style recommended intake ranges, which vary based on age, sex, and activity level for recommended intakes. 2015-2020 Dietary Guidelines for Americans.

Intakes of all Protein Foods subgroups increase with age among children ages 2 to 19 years in all race-ethnic groups.[40,41] Poultry and Meat (i.e., beef, pork, and game meats) (1.2 and 1.0 oz eq/day, respectively), followed by cured meat (0.9 oz eq/day), are the predominant sources of total Protein Foods among youth ages 2 to 19 years.[40] Seafood contributes only 0.2 oz eq/day to Protein Foods intake in this age group. Eggs and Nuts and Seeds subcategories contribute equal amounts to the diets of youth ages 2 to 19 years (0.4 oz eq/day for both). Meat and Poultry are the predominant contributors of Protein Foods among adults (1.6 oz eq/day for both), followed by cured meats (1.0 oz eq/day). Seafood contributes 0.6 oz eq/day of total Protein Foods to the diets of adults and is generally below recommended levels, with only 12 percent meeting or exceeding seafood recommendations. Approximately 20 percent of adults and 6 percent of children consume seafood twice per week.[44] Nuts and Seeds contribute more to Protein Foods in the diets of adults (0.8 oz eq/day) than do Eggs (0.6 oz eq/day), though statistical testing was not done. Animal-based and plant-based sources contribute 86 percent and 14 percent of total Protein Foods, respectively. These proportions do not include contribution from Legumes. However, mean daily intake of Legumes is small, 0.5 oz eq per day in the total population ages 2 and older.

Food Category Sources of Protein Foods

The food subcategories that provide 10 percent or more of Protein foods in the diets of Americans of all ages are burgers and sandwiches (15 percent to 30 percent) and poultry (11 percent to 20 percent) (CAT_DS). Meat, poultry, and seafood mixed dishes also are key sources of Protein Foods for U.S. adults.

Non-Hispanic Black youth have the highest intakes of poultry, while non-Hispanic White youth have the highest intakes of cured meats.[41] Intakes of nuts and seeds and soybean products are higher among non-Hispanic White and non-Hispanic Asian youth than among other race-ethnic groups. A review of intakes of total Protein Foods shows similar findings among adults, with mean poultry consumption higher among non-Hispanic Black adults than other race-ethnic peers, while cured meat consumption is highest among non-Hispanic White adults. Seafood consumption is highest in the non-Hispanic Asian community (1 oz eq/day) and lowest among the non-Hispanic White community (0.5 oz eq/day). Intakes of nuts and seeds and eggs are highest among non-Hispanic White and non-Hispanic Asian groups (0.8 to 0.9 oz eq/day). Legume intake is highest among Hispanic individuals. As income level increases, total protein intake increases, primarily among seafood, nuts and seeds, and soybean products.

Calories from Solid Fats and Added Sugars

USDA Food Patterns do not specify intake recommendations for solid fats or added sugars; rather, to help consumers identify their total intake, a maximum limit in terms of calories from solid fats plus added sugars is provided.[6] This allowance is small, ranging in the 2020 USDA Food Patterns from 137 calories (kcal) per day (for individuals whose total energy intake is only

1,000 kcal per day) to 596 kcal per day (for individuals whose total energy intake is 3,200 kcal or greater per day). The allowance does not include the solid fats that are inherent in food group and subgroup components; those are already calculated and used to determine the allowance for each pattern. For added sugars in particular, recommendations provide a quantitative limit of no more than 10 percent of total energy intake from added sugars. The majority of the population of all age-sex groups exceeds the maximum limit for energy intakes from solid fats and added sugars (DIST_DS).

Data on intakes of added sugars and saturated fats are described in the summary of evidence for Question 4, which addresses nutrients and food components of public health concern. Data on intakes of solid fats are described here.

Solid fat intakes rise with age in U.S. children.[40] Among male children and youth, mean intake is estimated at 28 g per day at ages 2 to 3 years, rising to 41 g/day by adolescence. Among females, estimated mean intake is 24 g/day at ages 2 to 3 years, rising to 32 g/day among those ages 9 to 13 years. Solid fats provide an average of 229 to 307 kcal/day among those ages 2 to 8 years and 288 to 367 kcal/day among those ages 9 to 18 years. Mean solid fat intakes decrease with age among adult males, from 43 g/day at ages 19 to 30 years to 40 g/day at ages 51 to 70 years. Among females, estimated mean intake remains stable at 30 to 31 g/day across adult age groups. Solid fats provide 360 to 384 kcal/day in the diets of adult males and 271 to 280 kcal/day in the diets of adult females. The estimated mean energy intake from solid fats and added sugars combined ranged from 611 kcal/day among older adult males and 481 kcal/day among older females, with a range of 194 to 1,101 kcal/day (DIST_DS).

Food Category Sources of Solid Fats and Added Sugars

The top subcategories of foods that provide solid fats among both adults and children include burgers and sandwiches (12 percent to 22 percent of total solid fat intakes) and desserts and sweet snacks (14 percent to 19 percent of total solid fats intakes) (CAT_DS). Higher fat milk and yogurt provide 19 percent of solid fats in the diets of those ages 2 to 5 years and 11 percent of solid fats among those ages 6 to 11 years.

The most significant food subcategories that provide added sugars among Americans is described in Question 4, which discusses nutrients that present a substantial public health concern.

Women Who Are Pregnant

Dietary intakes of women ages 20 to 44 years from WWEIA, NHANES 2013-2016 were used to assess food intakes of women who are pregnant. In some instances, comparisons to women who are not pregnant or lactating are noted; however, statistical comparison between groups was not made.

Fruit

Most women who are pregnant (64 percent) consume less fruit than is recommended on a given day (DIST_DS). Women who are pregnant report a mean consumption of 1.3 cup eq/day of total Fruit, with 0.3 cup eq/day coming from Citrus, Melons and Berries; 0.8 cup eq/day coming from other whole Fruit; and 0.3 cup eq/day from Juice (PL_DS).

Vegetables

Almost all women who are pregnant (90 percent) report consuming vegetables below recommended intakes (DIST_DS). About 65 percent consume less than recommended levels of Dark Green Vegetables, and 99 percent consume less than recommended levels of Red and Orange Vegetables on a given day. Women who are pregnant report a mean daily consumption of 1.6 cup eq of total Vegetables (excluding Legumes) (PL_DS). Women who are pregnant report a mean daily intake of 0.6 cup eq of Other Vegetables, 0.4 cup eq of potatoes, 0.3 cup eq of Dark Green Vegetables, and 0.2 cup eq of Red and Orange Vegetables (with tomatoes providing a large majority of this category). Legumes are not frequently consumed, with a mean daily reported intake of 0.09 cup eq.

Grains

About 1 in 3 women who are pregnant (31 percent) consumes less than the recommended intake of total Grains, with the remaining 69 percent meeting or exceeding recommended intakes (DIST_DS). Almost all women who are pregnant (95 percent) consume less than recommended intakes of Whole Grains. Mean total Grain intake among women who are pregnant is reported at 7.2 oz eq/day, and usual intakes of Whole Grains among women who are pregnant are 1.3 oz eq/day (PL_DS), which is significantly below the recommendation of 50 percent of total Grains coming from Whole Grain sources.

Dairy

Most women who are pregnant (90 percent) report Dairy intakes below recommended levels (DIST_DS). Mean daily intake of Dairy is estimated at 1.8 cup eq among women who are pregnant, of which 1 cup eq is from Milk and 0.8 cup eq is from Cheese (PL_DS). Yogurt is a small contributor to dairy at about 0.04 cup eq/day.

Protein Foods

Almost half of women who are pregnant (47 percent) consume less than recommended amounts of Protein Foods, and 24 percent consume greater than recommended levels of Protein Foods (DIST_DS). Mean daily total Protein Foods intake among women who are pregnant is estimated at 5.2 oz eq/day, with the majority of Protein Foods (3.9 oz eq/day) coming from Meat, Poultry, and Seafood; Poultry is the largest contributor (1.4 oz eq/day), followed by Meat (1.2 oz eq/day), and cured meat (0.7 oz eq/day) (PL_DS). Fish and Seafood provide 0.6 oz eq/day, with the majority of fish and Seafood coming from low omega-3 sources.[2] Other significant sources of Protein Foods include 0.5 oz eq/day obtained from Eggs, 0.7 oz eq/day coming from peanuts and Nuts and Seeds, 0.4 oz eq/day from Legumes, and 0.1 oz eq/day coming from Soy Products other than soy beverages.

Solid Fats, Added Sugars, and Oils

Virtually all women who are pregnant (99 percent) exceed the maximum limit of energy from solid fats and added sugars (DIST_DS). Mean energy intake from solid fats and added sugars combined is estimated to be 594 kcal/day among females who are pregnant, with a range of 254 to 1,031 kcal/day. Mean solid fat intakes among women who are pregnant are estimated at 36 g/day, with a range of 15 to 58 g/day. Solid fats provide an average of 306 kcal/day to the diets of women who are pregnant. Added sugar intakes among women who are pregnant are estimated at 20 tsp eq/day (range 5 to 37 tsp eq/day) (DIST_DS). Added sugars provide an estimated 288 kcal/day to the diets of women who are pregnant. Women who are pregnant report consuming 28 g of oils per day (PL_DS).

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[2] Cooked seafood containing 500 mg or more of omega-3 fatty acids (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) per 3 ounces was assigned as seafood high in omega-3 fatty acids. ars.usda.gov/ARSUserFiles/80400530/pdf/fped/FPED_1516.pdf

Women Who are Lactating

Dietary intakes of women ages 20 to 44 years from WWEIA, NHANES 2013-2016 were used to assess food intakes of women who are lactating. In some instances, comparisons to women who are not pregnant or lactating are noted; however, statistical comparison between groups was not made.

Fruit

The majority of women who are lactating (78 percent) consume less Fruit than is recommended (DIST_DS). Women who are lactating report a mean daily consumption of 1 cup eq/day of total Fruit, of which 0.2 cup eq are from Citrus, Melons, and Berries; 0.2 cup eq are from fruit Juice; and 0.6 cup eq are consumed as Other whole Fruit (PL_DS).

Vegetables

Most women who are lactating (88 percent) consume less than the recommended intakes of Vegetables, including 46 percent consuming less than the recommended levels of Dark Green Vegetables and 99 percent consuming less than recommended levels of Red and Orange Vegetables (DIST_DS). Women who are lactating report a mean daily consumption of 1.4 cup eq of total Vegetables (excluding Legumes), with 0.2 cup eq from Starchy Vegetables (mostly white potatoes), 0.3 cup eq from Dark Green Vegetables, 0.4 cup eq from Red and Orange Vegetables, and 0.5 cup eq from Other Vegetables (PL_DS). Legumes are infrequently consumed, with an estimated mean daily intake of 0.15 cup eq.

Grains

Most women who are lactating (79 percent) consume more than recommended levels of total Grains (DIST_DL). However, about 1 in 5 women who are lactating consumes less than recommended intakes. Almost all women who are lactating (95 percent) consume less than the recommended intakes of Whole Grains. Mean daily intake of total Grains among women who are lactating is reported at 7.8 oz eq, with usual intakes of Whole Grains among women who are lactating at 1.4 oz eq (PL_DS), which is well below the recommendation of 50 percent of total Grains coming from Whole Grain sources.

Dairy

Nearly all women who are lactating (95 percent) consume Dairy below recommended levels (DIST_DS). Mean daily intake of Dairy is estimated at 1.5 cup eq among women who are lactating, of which 0.7 cup eq each are obtained by Milk and Cheese (PL_DS). Yogurt is infrequently consumed, providing only 0.04 cup eq/day.

Protein Foods

Approximately 16 percent of women who are lactating consume less than recommended amounts of Protein Foods, with the majority of women who are lactating meeting or exceeding recommended Protein Foods intakes (DIST_DS). Mean daily total Protein Foods intake among women who are lactating is estimated at 7.4 oz eq, with 5.0 oz eq coming from Meat, Poultry, and Seafood (PL_DS). Poultry contributes the most Protein Foods at 1.9 oz eq/day, followed by Meat (1.3 oz eq/day), fish and Seafood (1.0 oz eq/day), and cured meats (0.8 oz eq/day). Nearly half of fish and Seafood is from high omega-3 sources.[3] Eggs contribute about 0.6 oz eq/day to Protein Foods intake. Peanuts and Nuts and Seeds provide about 1.2 oz eq/day of Protein Foods in the diets of women who are lactating, Legumes provide about 0.6 oz eq/day, and Soy Products (other than soy beverages) provide about 0.2 oz eq/day.

Solid Fats, Added Sugars, and Oils

Virtually all women who are lactating (99 percent) exceed the maximum limit of energy from solids fats and added sugars combined (DIST_DS). Mean energy intake from solid fats and added sugars combined is estimated at 583 kcal among lactating females, with a range of 236 to 1,069 kcal/day. Mean solid fats intakes among women who are lactating are estimated at 35 g/day, with a range of 17 to 62 g/day. Solid fats provide an estimated 362 kcal/day to the diets of women who are lactating. Mean added sugars intakes among women who are lactating are estimated to be 15 tsp eq/day (range 4 to 32 tsp eq/day), providing about 248 kcal/day. Women who are lactating consume about 33 g of oil in their diets daily (PL_DS).

To access the data analyses referenced above, visit:
https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis

[3] Cooked seafood containing 500 mg or more of omega-3 fatty acids (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) per 3 ounces was assigned as seafood high in omega-3 fatty acids. ars.usda.gov/ARSUserFiles/80400530/pdf/fped/FPED_1516.pdf

Question 3. What are the current patterns of food and beverage intake?

Approach to Answering Question: Data analysis

Conclusion Statements

Dietary Patterns

For those younger than age 2 years, intake dietary patterns evolve substantially over this time period and vary to a large extent based on breastfeeding practices. Patterns of food group intakes and category sources of food groups among those ages 12 to 24 months are similar to those of the U.S. population ages 2 years and older, although intake of Dairy is higher than in older Americans.

For Americans ages 2 years and older, dietary quality, measured by the Healthy Eating Index-2015, is not consistent with the existing recommendations in the *Dietary Guidelines for Americans*. Average diet quality has slightly improved in the past 10 years. Differences in overall Healthy Eating Index scores are seen across age, sex, race-ethnic, and income subgroups and by pregnancy and lactation status, though differences are small and poor diet quality is observed across all groups. Healthy Eating Index scores suggest that intakes are notably misaligned with recommendations for Whole Grains, Fruits, Vegetables, fatty acids ratio,[4] sodium, added sugars, and saturated fats across the population.

For those who are ages 2 years and older, foods and beverages consumed through mixed dishes (e.g., burgers and sandwiches, casseroles, pizza), snacks and sweets, and beverages (other than milk and 100% juice) contribute 50 to 60 percent of total energy intake. Food subcategory source contributions to energy vary by age, sex, race-ethnicity, and income. However, for the total population, the top 5 contributors to energy intakes include burgers and sandwiches; desserts and sweet snacks; rice, pasta and other grain-based mixed dishes; sweetened beverages; and chips, crackers, and savory snacks.

Comparisons of diet quality are not possible from birth to ages younger than 24 months because Healthy Eating Index recommendations do not exist for this age group.

[4] Fatty acids ratio refers to the ratio of poly- and monounsaturated fatty acids to saturated fatty acids in the diet.

Beverages

Beverages account for approximately 15 to 18 percent of total energy intake for Americans ages 2 years and older and for 30 to 60 percent of total added sugars intake. Non-Hispanic Black and Hispanic children have the highest consumption of sweetened beverages and the lowest consumption of water. Non-Hispanic Black children have the lowest consumption of milk. Intake of fluid milk is highest in early childhood and is progressively lower in older age groups. Conversely, the intake of sweetened beverages is progressively higher among older age groups starting from early childhood. Among all adults, alcoholic beverages contribute 21 percent (females; third largest source) and 31 percent (males; second largest source) of total daily beverage calories.

Summary of the Evidence

Data analyses conducted for the Committee are found in the data analysis supplements and are referenced below as Food Category Sources of Food Groups and Nutrients (CAT_DS) and Beverages Data Supplement (Bev_DS).

Dietary Patterns

Infants and Toddlers Younger Than Age 24 Months

Data were examined by primary mode of feeding (i.e., human milk vs formula and mixed-fed infants). “Infant formula” reflects infant formula and mixed-fed for older infants (ages 6 to 12 months). The top food category source of energy from CFB among infants ages 6 to 11 months who consume infant formula is baby foods, which contributes 51 percent of energy (CAT_DS). This is followed by mixed dishes (11 percent); protein foods (7 percent); grains, snacks and sweets, and milk and dairy (6 percent each); and fruit, vegetables, and non-alcoholic beverages (4 percent each). The top food category sources of energy among infants who are fed human milk include baby foods (34 percent), fruit (12 percent), vegetables (11 percent), milk (i.e., cow’s milk) and dairy (10 percent), grains (9 percent), mixed dishes and protein foods (8 percent each), and snacks and sweets (7 percent). Differences between infants receiving human milk only and those receiving any infant formula are noted, but significance testing was not done for this analysis.

Among toddlers ages 12 to 23 months, milk is the largest contributor to energy intake, averaging 23 percent of energy consumed on a given day (CAT_DS). Mixed grain-based dishes provide 6 percent of energy, followed by fruit juice, whole fruit, and sweet bakery products (5 percent of energy, each). Poultry is the largest protein food contributor, with an average of 4 percent of energy, which is similar to the percentage of energy supplied by breads/rolls/tortillas. Baby foods, sweetened beverages, and crackers each supply about 3 percent of energy in the diets of toddlers.

Americans Ages 2 Years and Older

The top major food category of energy intake among all Americans ages 2 and older is mixed dishes, providing an average of 30 percent of total energy (range of 24 percent to 34 percent) (CAT_DS). The second largest category contributor to energy intakes differs by age. Among children ages 2 to 19 years and those 51 years and older snacks and sweets is the second largest contributor to energy intake. The second highest food category source of energy among adults ages 20 to 50 years is beverages (not including milk or 100% fruit juice).

The food subcategory that contributes the most energy to the diets of Americans ages 2 years and older is burgers and sandwiches (including tacos and burritos). This subcategory supplies an average of 15 percent of energy (range of 11 percent to 16 percent). Desserts and sweet snacks are the second highest energy contributing food subcategory for all ages, averaging 8 percent of energy contribution, except for adults ages 20 to 40 years, for which rice and pasta and other grain-based dishes is the second highest contributor to energy, at 7 percent of energy. Sweetened beverages, and rice and pasta and grain-based dishes both contribute about 6 percent of energy to the diets of Americans 2 years and older. Crackers, chips, and savory snacks are the fifth highest contributor of energy in the diets of Americans older than age 2 years.

The top major and subcategory food group sources of energy do not vary by sex Sources of energy are similar among race-ethnic groups with the exception of non-Hispanic Asians, who consume less energy from burgers and sandwiches and more from rice/pasta/other grain-based mixed dishes.

The population total and component HEI-2015 scores were estimated for Americans using NHANES 2015-2016.[45] Food category contributions to total energy intake also were examined to assess contemporary patterns of food and beverage intake. It is important to note that self-reported dietary patterns (e.g., vegetarian) are not collected in the survey years examined for this report. Thus, current patterns of intake can be summarized by adherence to the *2015-2020 Dietary Guidelines for Americans* using the HEI-2015, but the Committee does not have the data to identify other types of distinct dietary patterns (e.g., vegetarian dietary pattern).

The HEI-2015 is a measure of diet quality used to assess how well a set of foods aligns with the *2015-2020 Dietary Guidelines for Americans.*[46] The HEI-2015 includes 13 components[5] that can be summed to a maximum total score of 100 points. The components capture the balance among food groups, subgroups, and dietary elements, including those to encourage, called adequacy components, and those for which there are limits, called moderation components. For the adequacy components, higher scores reflect higher intakes that meet or exceed the standards. For the moderation components, higher scores reflect lower intakes because lower intakes are more desirable. A higher total score indicates a diet that aligns better with the Dietary Guidelines. The HEI-2015 has been demonstrated to be a valid and reliable metric to evaluate compliance with the *2015-2020 Dietary Guidelines for Americans*.[46]

In terms of the total population and by age groups in the United States, HEI scores indicate generally suboptimal diets, with ample opportunities to improve diet quality.[45] The mean HEI-2015 score for Americans ages 2 years and older is 58.7 out of 100 points, and scores have not changed substantially across time since the HEI was developed. Young children (score=61) and older adults (score=64) have slightly higher scores than children ages 6 to 17 years (score=52) and adults ages 18 to 64 years (score=58). All age groups have very low scores for Whole Grains, Fatty Acids, Sodium, and Saturated Fats. The youngest age group achieves at least 70 percent of the highest possible score in only 3 categories: Whole Fruits, Total Protein Foods, and Dairy. Young to middle-age adults, when compared to children, show improvements in intake, with at least 70 percent of the highest possible score in the additional categories of Total Vegetables, Greens and Beans, and Seafood and Plant Proteins. Those who are ages 65 years and older, when compared to young to middle-age adults, show further improvement in diet quality with the addition of higher scores in Total Fruit; they also have better scores for Refined Grains and Added Sugars. Notably, the Dairy score is highest for children (8.0 out of 10 possible points) and then is lower among adults ages 20 to 64 (5.4 out of 10) and older adults (5.6 out of 10).

Average diet quality has slightly improved in the past 10 years. Nevertheless, scores indicate that diet quality is not consistent with recommendations in the *2015-2020 Dietary Guidelines for Americans* (see Figure D1.10). Differences are seen across age groups, sex, race-ethnicity, and income, as well as pregnancy or lactation status, though differences are generally small.

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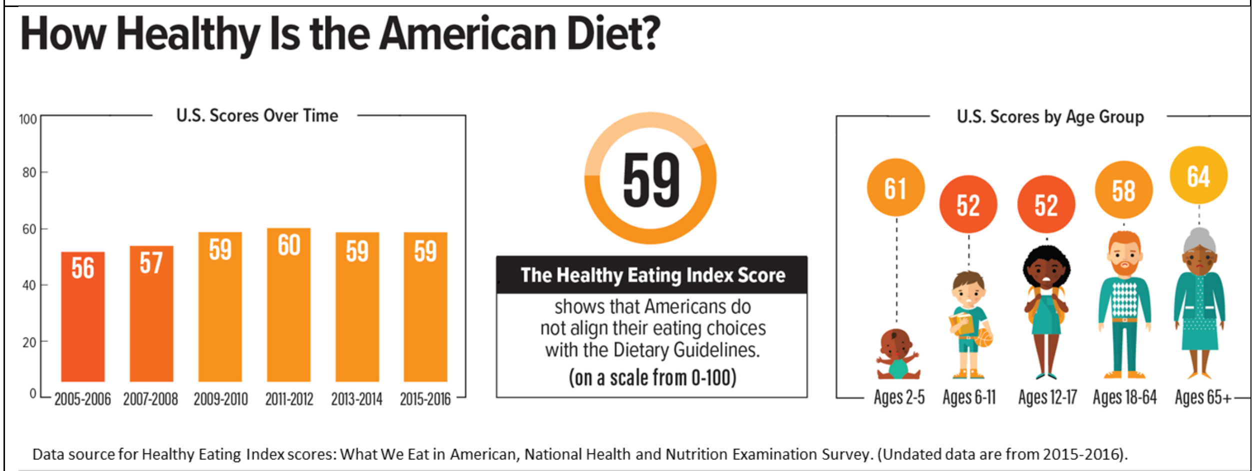
[5] **Adequacy components:** Total Fruits, Whole Fruits, Total Vegetables, Greens and Beans, Whole Grains, Dairy, Total Protein Foods, Seafood and Plant Proteins, Fatty Acids. **Moderation components:** Refined Grains, Sodium, Added Sugars, Saturated Fats.

Figure D1.10. Healthy Eating Index 2015 scores for Americans

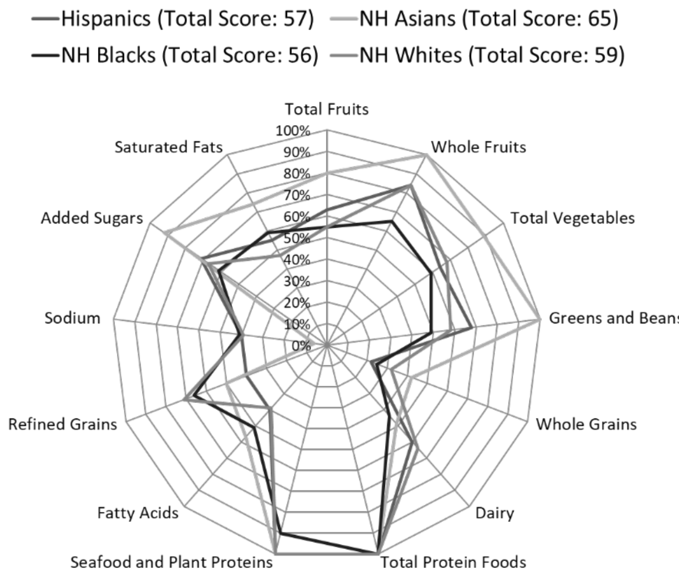


Source: USDA, FNS Center for Nutrition Policy and Promotion https://www.fns.usda.gov/hei-scores-americans

In general, females had a slightly higher average HEI-2015 score (61.0) than males (56.8) overall and in all age categories.[45] This difference was consistent by sex across all age groups. Both males and females had very low scores for Whole Grains, Fatty Acids, and Sodium. For both males and females, scores for Total Fruits and Whole Grains were lower for those ages 20 to 64 years but were higher for those ages 65 years and older, whereas scores for Total Vegetables and Greens and Beans were lower among older age groups. Dairy scores were higher in childhood and lower in older age groups. Males achieved at least 70 percent of the maximum quality score for the categories of Whole Fruits, Total Protein Foods, and Seafood and Plant Proteins. Males had 50 percent or less of the maximum quality score for Sodium and Whole Grains. Females achieved at least 70 percent of the maximum quality score for the additional categories of Total Vegetables and Greens and Beans. Females had 50 percent or less of the maximum quality score for Sodium and Saturated Fats.

When dietary quality is examined using the HEI-2015 by race-ethnic subgroups, it is clear that all groups fall short of meeting dietary guidance from the *2015-2020 Dietary Guidelines for Americans*.[45] Non-Hispanic Asians (score=65.4) and Hispanics (score=63.9) have slightly higher scores than do non-Hispanic Whites (score=59.0) and Non-Hispanic Blacks (score=55.6). However, all mean scores remain well below the recommendations. Total Protein Foods and Seafood and Plant Proteins are consumed in adequate quantities to meet HEI recommendations across all race-ethnic groups. The higher HEI scores among Asian Americans is largely driven by higher intakes of Total Fruits, Whole Fruits, Total Vegetables, Greens and Beans, combined with lower intakes of Added Sugars and Saturated Fats. Non-Hispanic Blacks do not achieve 70 percent or greater of the maximum score for any components other than Protein Foods and have the lowest total HEI score, with especially low scores noted for Whole Fruits relative to other race-ethnic groups (see Figure D1.11).

Figure D1.11. Radar plot[1] of Total HEI-2015 scores by race/ethnicity, ages 2 years and older. What We Eat In America, National Health and Nutrition Examination Survey 2015-2016, day 1 recall.

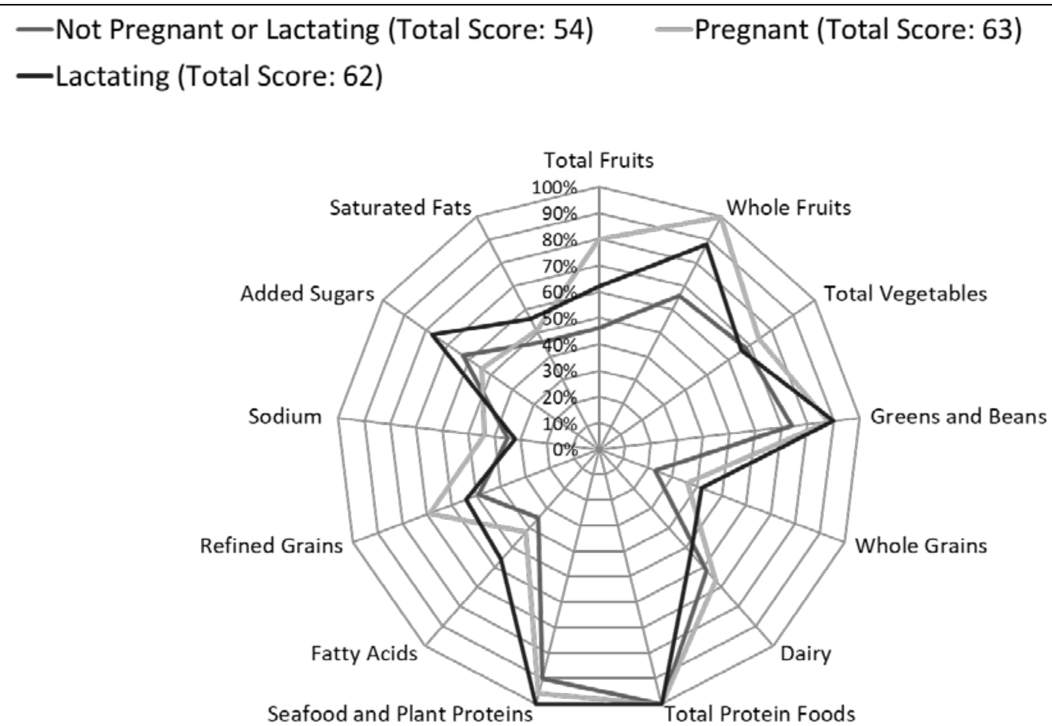


[1] Each component score is plotted along its axis as a percentage of its maximum points. Zero percent is represented by the center dot and the percentages increase to 100% at the most outwardly point. For all components, the outer perimeter of the plot is indicative of the maximum score.

HEI-2015 scores were slightly higher among Americans in the highest poverty-to-income ratio (PIR) group (PIR ≥350 percent; score=61.3) when compared with the middle (PIR 131 to <350 percent; score=56.9) and lower income groups (PIR ≤130 percent; score=57.3).[45] All income levels have low scores for Whole Grains, Fatty Acids, and Sodium, whereas Americans in the highest income category tended to have higher scores for Total Vegetables, and Greens and Beans, Refined Grains and Added Sugars. In general, HEI component scores are higher with increasing age across all income groups, with the exception of a transient decrease in Total Fruits, Whole Grains, Dairy, and Sodium scores in the ages 20 to 64 age group.

Women who are pregnant (score=63) and women who are lactating (score=62) have slightly higher scores relative to women of the same age who are not pregnant or lactating (score=54) (see Figure D1.12). Higher dietary quality in these groups is driven by higher HEI component scores for Total Fruits, Greens and Beans, Whole Grains, Dairy, Fatty Acids, and Seafood and Plant Proteins (only women who are lactating), combined with higher HEI moderation component scores for Refined Grains, Sodium, and Saturated Fats, when compared with those for women of similar ages who are neither pregnant nor lactating. Women who are pregnant have lower component scores than their peers (i.e., women who are neither pregnant nor lactating and women who are lactating) for Added Sugars and the highest HEI scores for Total Fruits, Total Vegetables, Dairy, Refined Grains, and Sodium among the 3 groups of women. Women who are lactating have lower component scores than their peers (i.e., women who are not pregnant or lactating and women who are pregnant) for Total Vegetables, Dairy, and Sodium.

Figure D1.12. Radar plot[1] of total HEI-2015 scores by pregnancy and lactation status, females ages 20-44 years. What We Eat In America, National Health and Nutrition Examination Survey 2013-2016, day 1 recall.



[1] Each component score is plotted along its axis as a percentage of its maximum points. Zero percent is represented by the center dot and the percentages increase to 100% at the most outwardly point. For all components, the outer perimeter of the plot is indicative of the maximum score.

Beverages

Beverage intake patterns are described in the following section. Additional summary of evidence on intakes of beverages is described in ***Part D. Chapter 10: Beverages*** and ***Part D. Chapter 11: Alcoholic Beverages***.

Infants and Toddlers Younger Than Age 24 Months

Aside from human milk and infant formula, plain water and 100% juice are the most frequently reported beverages among infants ages 6 to 11 months (BEV_DS). Beverages other than human milk and infant formula contribute 30 calories per day on average.

Among infants ages 12 to 23 months, 64 percent report whole milk, 23 percent report reduced or low or fat-free milk, 54 percent report 100% juice, 29 percent report sweetened beverages, and 75 percent report plain water (BEV_DS). Milk substitutes (e.g. almond beverage, calcium fortified soy beverage) are reported for 5 percent of toddlers. On average, beverages account for 371 calories per day. Mean estimated energy intakes from sweetened beverages is 60 calories per day.

Children Ages 2 to 19 Years

Beverages provide almost 1 out of every 7 calories consumed by U.S. youth ages 2 to 19 years.[47] Although some beverages can be a source of important nutrients (e.g., calcium, vitamin D, potassium, vitamin C, and magnesium), beverage intake represents more than 40 percent of energy from added sugars and is the chief source of caffeine in the diet. In particular, milk and sweetened beverages account for 75 percent of all calories from beverages. Milk is the predominant source of beverage calories for those ages 2 to 11 years, whereas sweetened beverages are the predominant source of beverage calories for those ages 12 to 19 years.

On any given day, most children (more than 80 percent) ages 2 to 19 years consume water, and by volume, water accounts for about 44 percent of total beverage consumption among U.S. youth, followed by milk (22 percent), soft drinks (20 percent), 100% juice (7 percent), and other beverages (8 percent).[48]

Significant differences in beverage consumption exist by age group. As children grow older, the percent of children drinking milk and 100% juice decreases, while the contribution of water and sweetened beverages, including soft drinks, increases.[47] Sweetened beverages in this analysis include soft drinks, fruit drinks, sports and energy drinks, nutritional beverages, smoothies, and grain drinks. Calorically-sweetened milk, coffee, and tea are not a part of the sweetened beverages category.

Sweetened beverages are consumed on a given day by 44 percent of children ages 2 to 5 years and nearly 50 percent of children ages 6 to 11 years and those ages 12 to 19 years, accounting for about 20 percent of beverage calories among the younger children and 37 to 44 percent of beverage calories among children ages 6 to 19 years.[47] The mean intake in volume is 9 oz for the youngest children and 18 oz for children ages 12 to 19 years. A significantly larger proportion of non-Hispanic Black children consume sweetened beverages than do non-Hispanic Asian and non-Hispanic White children. In particular, more non-Hispanic Black children drink fruit drinks than do any other race-ethnic group.

Adults Ages 20 Years and Older

Among adults, beverages provide approximately 1 out of every 6 calories of daily energy intake, more than half of added sugars intake, and nearly all of caffeine intake, but they also are a substantial source of vitamin C, vitamin D, calcium, and magnesium.[49]

After water, coffee and tea (including sweetened coffee and tea) were the most frequently consumed beverage group on a given day (about 70 percent in both men and women), followed by sweetened beverages (46 percent in men and 38 percent in women).[49] For both men and women, sweetened beverages contribute about 32 percent of beverage calories. Compared with women, a larger proportion of men's total daily calorie intake came from sweetened beverages (i.e., 6.9 percent for men and 6.1 percent for women toward total daily calories) (CAT_DS).

Likewise, alcoholic beverages represent a significant source of beverage calories in adults.[49] Among men, alcoholic beverages rank second (31 percent) as a source of beverage calories, while among women, coffee and tea rank second (25 percent), and alcoholic beverages rank third (21 percent) in terms of beverage calories.[49] Alcoholic beverages contribute approximately 5 to 7 percent of total energy intake among adult males and 3 to 4 percent among adult females (CAT_DS).

Differences in beverage consumption between younger and middle-aged adults ages 20 to 64 years and adults ages 65 years and older were examined using data from NHANES 2013-2016 (BEV_DS). Older adults consume a smaller overall volume of beverages (66 oz per day) than did younger adults (88 oz per day). Fewer older adults consume alcohol than do younger adults, and mean consumption among alcohol consumers is significantly smaller among older adults. Similarly, a smaller percentage of older adults report sweetened beverages, and those who do report consuming them report smaller volumes than do younger adults.

Differences in sweetened beverage consumption by race-ethnicity and income were examined using data from NHANES 2011-2014. In this analysis, sweetened beverages were defined differently than other analyses described[49] and were specifically called "sugar-sweetened beverages." Despite differences in how beverages are categorized, considering differences in intakes by race-ethnicity and income is noteworthy. Asian adults consume the lowest amounts of sweetened beverages compared to other race-ethnic groups.[50] Hispanic men and non-Hispanic Black women have the highest energy intakes from sweetened beverages when examining intakes by sex and race-ethnicity. For both children and adults, family income is strongly associated with prevalence of consumption and caloric intake from sweetened beverages.[51] Mean intakes of alcoholic drink equivalents by race-ethnicity are 0.77 for non-Hispanic Whites, 0.70 for non-Hispanic Blacks, 0.31 for non-Hispanic Asians, and 0.57 for Hispanics.[41]

Women Who are Pregnant or Lactating

Beverage intakes differ by pregnancy and lactation status when compared to women who are neither pregnant nor lactating (BEV_DS). Women who are lactating have the highest total beverage volume intake (87 oz). Women who are pregnant and women who are neither pregnant nor lactating have mean daily reported intakes of 79 oz. Regardless of pregnancy and lactation status, a large majority of women report water consumption. Milk, milk drinks (e.g., kefir), and milk substitutes (e.g., almond milk) were reported by 33 percent of women who are pregnant and 26 percent of women who are lactating. Coffee and tea consumption are lowest among women who are pregnant. Sweetened beverage consumption is less common among women who are lactating (34 percent) than among other women, including women who are pregnant (50 percent). Alcohol consumption is low among women who are pregnant and women who are lactating. Differences are noted, but significance testing was not done for these analyses.

To access the data analyses referenced above, visit:
https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis

Question 4. Which nutrients present a substantial public health concern because of underconsumption or overconsumption?

Approach to Answering Question: Data analysis

Conclusion Statements

Food Components of Public Health Concern: Ages 1 Year and Older

For the population of Americans ages 1 year and older, dietary intake distributions, along with biological endpoints and prevalence of related clinical outcomes, suggest that vitamin D, calcium, dietary fiber, and potassium are underconsumed, and sodium, saturated fat, and added sugars are overconsumed and are of public health concern for all Americans.

Food Components of Public Health Concern: Specific Life Stages

Among **toddlers** (ages 12 to 24 months) vitamin D, calcium, dietary fiber, and potassium are underconsumed, and sodium, saturated fat, and added sugars are overconsumed and are of public health concern.

Based on dietary intake data and serum ferritin levels, iron is of public health concern among **older infants, adolescent females** (20 percent; ages 12 to 19 years), and **premenopausal females** (16 percent; ages 20 to 49 years).

Food components of public health concern among **women who are pregnant or lactating** include those for the entire population older than 1 year. Among women who are pregnant, low iron and iodine also are of public health concern, based on biomarker data that suggest low nutrient status.

Given the high prevalence of inadequate folic acid intakes observed in women who are or are capable of becoming pregnant and that nutrient's relationship to risk of neural tube defects, folate/folic acid should remain of concern among premenopausal **women** in the first trimester of pregnancy, when the neural tube is formed and closed. Folate status appears to be adequate based on biomarker data in women who are not pregnant or lactating.

Food Components that Pose Special Public Health Challenges: Ages 1 Year and Older

The following food components are underconsumed by all Americans ages 1 year and older but do not appear to pose a public health concern, given the present lack of adverse clinical and health outcome data: vitamins A, C, E, and K; magnesium; and choline.

Food Components that Pose Special Public Health Challenges: Specific Life Stages

Certain life stages have specific food components that may pose public health challenges. Proposed nutrients or food components that pose public health challenges for **all infants**, based on low estimated mean nutrient intakes compared to adequate intakes expected from complementary foods and beverages, include potassium, vitamin D, and choline.

Dietary intake data that capture both milk-based feeding sources (human milk or infant formula or mixed-fed) and complementary foods and beverages suggest that iron, zinc, and protein intakes fall below the Estimated Average Requirements for **infants ages 6 to 12 months** whose milk-based feeding source is human milk.

Nutrients that pose public health challenges for **formula-fed infants ages 6 to 12 months**, with elevated mean intakes from formula and complementary foods compared to adequate intakes, include retinol and zinc. High intakes of these nutrients have not been linked directly to adverse health outcomes, so they are not considered nutrients of public health concern. However, they do warrant ongoing surveillance.

Nutrients or food components that pose public health challenges for **toddlers** between the ages of 12 and 24 months include choline and linoleic acid, given that dietary intakes do not approximate recommendations.

Young children ages 1 to 3 years overconsume retinol, zinc, selenium, and copper, relative to the Tolerable Upper Intake Levels. High intakes of these nutrients have not been linked directly to adverse health outcomes, so they are not considered nutrients of public health concern. However, they do warrant ongoing surveillance.

Adolescents ages 9 to 14 years have a constellation of potential nutritional risk factors that are considered a public health challenge. Girls have low intakes from foods and beverages of protein, iron, folate, vitamin B_6, and vitamin B_{12}, and girls and boys have low intakes of phosphorus, magnesium, and choline.

Older adults may be at risk for low intakes and resulting poor nutritional status related to protein and vitamin B_{12}.

Choline and magnesium are underconsumed in the diets of **women who are pregnant or lactating** and should be considered for further evaluation, given limited availability of biomarker, clinical, or health outcome data.

With the use of dietary supplements, **some women who are pregnant** have high intakes of folic acid and iron. Without the supplements these women would be at risk for inadequacy. With the use of supplements, **some women who are lactating** are exceeding recommendations for iron and folic acid. Given that these high intakes have not been directly linked with clinical outcomes, these are not designated of public health concern but warrant monitoring.

Summary of the Evidence

Data analyses conducted for the Committee are found in the data analysis supplements and are referenced below as Food Group and Nutrient Intakes for Infants and Toddlers Data Supplement (IT_DS), Food Group and Nutrient Intakes for Women Who are Pregnant or Lactating Data Supplement (PL_DS), Intake Distributions Data Supplement (DIST_DS), Food Category Sources of Food Groups and Nutrients Data Supplement (CAT_DS), and Beverages Data Supplement (Bev_DS).

Infants Younger Than Age 6 Months

Given the specific nutritional needs of the birth to 24 months age group to support rapid growth and development, understanding current trends in dietary intakes is paramount. The Committee did not evaluate data on nutrient intakes for infants younger than age 6 months. Infants birth to younger than age 6 months rely on human milk and/or infant formula for a high proportion of energy and nutrient needs. Direct assessment of the volume and composition of human milk consumed is a challenge and imputed estimates have been published elsewhere.[1-3]

Infants Ages 6 to 12 Months

Identifying food components of potential concern in infants and toddlers ages 6 to 24 months is challenging because little experimental research is available on nutrient requirements, biomarker data are not available in this population, and assessing dietary intakes is challenging, especially among infants younger than age 1 year. Estimated Average Requirement (EAR) values are needed to appropriately evaluate intakes for adequacy, but for infants ages 6 to 12 months, EARs are available only for protein, iron, and zinc. For other nutrients and food components, an Adequate Intake (AI) is generally available. For identifying nutrients of public health concern, the Committee focused on food components for which EARs have been established in this age group of infants. The macronutrient intakes as a proportion of reported energy are described, as are intakes of nutrients for which an EAR exists. Intakes of other nutrients are considered and described.

Macronutrient Intakes

The proportion of energy from dietary fats is higher in infants younger than age 12 months (approximately 40 to 50 percent) than among older ages (DIST_DS). Energy from carbohydrates is approximately 50 percent for infants ages 6 to 12 months, and energy from protein is approximately 10 percent of reported energy (DIST_DS).

Intakes of Micronutrients and Other Food Components

The proportion of nutrients required from CFB is different for infants receiving human milk vs infants receiving fortified infant formula. Therefore, for ages 6 to 12 months, data were examined by primary mode of feeding (i.e., human milk vs formula and mixed-fed infants; see Methodology).

Iron

Relevance of food component: Iron is relevant for infants, especially under circumstances where infant iron stores may be low.[52] Previous conclusions from the USDA's Nutrition Evidence Systematic Review (NESR) determined "strong evidence suggests that CFB containing iron (e.g., meat, fortified cereal) help maintain adequate iron status or prevent deficiency in the first year among infants at risk of insufficient iron stores or low intake."[53]

Dietary intake data summary: Less than 7 percent of infants in the formula and mixed-fed group have total dietary intakes of iron less than the EAR (all dietary sources, not including dietary supplements) (IT_DS). Infants who do not have compromised iron stores or who receive fortified infant formula with iron likely have adequate intakes or may have intakes that approach or exceed the Tolerable Upper Intake Level (UL).

For infants fed human milk, the proportion with intakes less than the EAR for iron is 77 percent (IT_DS).

Evidence on biomarkers and/or clinical health indicators: Serum ferritin is not measured as part of national nutrition monitoring for children younger than age 12 months. Around 4 percent of children ages 1 to 5 years have low serum ferritin (less than 12 nanograms per milliliter; NHANES 2015-2016).

Designation: Iron is considered a nutrient of public health concern for infants with human milk as the primary feeding mode.

Other Nutrients and Food Components

Slightly more than half (54 percent) of infants in the group fed human milk have dietary intakes from all food sources (human milk and CFB) below the EAR for zinc (IT_DS). No biomarker data or clinical health outcome related to low dietary intakes of zinc among infants ages 6 to 12 months who were fed human milk was available to the Committee. Zinc is considered a shortfall food component among infants fed human milk.

Less than 7 percent of infants in the formula and mixed-fed group have protein intakes below the EAR, however 27% of infants in the human milk fed group underconsumed protein relative to the EAR (IT_DS). No biomarker data or clinical health outcome related to low dietary intakes of protein among infants ages 6 to 12 months who were fed human milk was available to the Committee. Protein is considered a shortfall food component among infants fed human milk.

For all older infants ages 6 to 12 months, regardless of mode of feeding, most other food components are assumed to be adequate with the exception of potassium, vitamin D, vitamin E, and choline (IT_DS).

Retinol and zinc intakes from foods alone exceed the UL for infants older than age 6 months,[1] and these estimates are higher when dietary supplements also are considered.[3] The ULs for infants and young children have been criticized as having been established with too little available data and are considered to be too low for many nutrients.[54]

Nutrient-containing Dietary Supplements

The above summary focused on usual intake distributions of food components, foods, and beverages, but about 18 percent of infants and toddlers report use of dietary supplements.[55] Supplement use tended to be higher in toddlers (23 percent for ages 12 to 24 months) compared with younger infants (15 percent for birth to age 6 months) or older infants (12 percent for ages 6 to 12 months). Vitamin D and multivitamin infant drops were the most commonly reported supplement products for all infants, and multivitamin chewable products were most commonly reported among toddlers.[55] The use of vitamin D-containing supplements among infants may reflect higher breastfeeding rates over time and the American Academy of Pediatrics' (AAP) recommendation for vitamin D supplementation. Among users, the average daily intake of vitamin D from supplements was 7.4 µg per day for both infants (birth to age 12 months) and toddlers (ages 12 to 24 months).[55]

Individuals Ages 1 Year and Older

Usual nutrient and food component intake distributions were examined among Americans ages 1 year and older with a primary emphasis on intakes from foods and beverages alone (i.e., without dietary supplements).[56] Because the emphasis of the *Dietary Guidelines for Americans* is food-based, the Committee focused predominantly on the acquisition of nutrients and food components from foods and beverages, including those that are fortified. However, it should be recognized that dietary supplements reduce the risk of inadequate intake but also increase the likelihood of potentially excessive intakes. A description of estimated energy intake and macronutrient intake distributions is described first. A summary of each nutrient or food component designated as either one of public health concern or of public health challenge follows. For each nutrient or dietary component, the relevance, dietary intake data, biomarker and/or chronic health end point data, and the designation are described.

Energy Intakes

The average caloric intake of U.S. adults is 2,463 and 1,814 calories (kcal) per day for males and females, respectively. Usual energy intakes increase with age in both sexes and are highest among adults ages 19 to 30 years and lowest among adults ages 71 years and older. Energy intakes are consistently higher in males than females in all age groups. Women who are pregnant (2,057 kcal per day) or lactating (2,192 kcal per day) have higher intakes compared to women of similar ages. For the U.S. population ages 1 year or older, average energy intakes are 2,056 kcal per day, with a distribution range of 1,171 to 3,237 kcal per day. Given extensive measurement error for energy intakes, these estimates likely reflect under-reporting. Nevertheless, the majority of the population ages 1 year and older exceeds recommended limits on percent of energy intakes from saturated fats and added sugars (DIST_DS).

Food Components with an Acceptable Macronutrient Distribution Range

For ages 1 year and older, more than 90 percent of children (ages 1 to 18 years) and 58 percent of adult males and 67 percent of adult females (ages 19 years and older) have carbohydrate intakes within the AMDR. For those without caloric intakes within the AMDR for carbohydrate, the proportion falls below the recommendation. Across all age groups, protein intake is within the AMDR. However, more than 10 percent of adults older than age 70 years and 20 percent of females ages 14 to 18 years have protein intakes (in grams) that fall below the EAR. The proportion of the population reporting total fat intakes within the AMDR is approximately 60 percent for children and approximately 50 percent for adults. For those with fat intakes not within the AMDR, the proportion is above the recommendation.

Food Components with an Estimated Average Requirement or Adequate Intake

In general, the majority of Americans are meeting recommended intakes for a number of food components, including most B vitamins, iron (with the noted exception of females of reproductive age), copper, selenium, and zinc.[57] However, many food components are currently underconsumed from foods and beverages, either among all Americans or within certain population subgroups. Food components underconsumed by the entire population include dietary fiber, calcium, magnesium, potassium, choline, and vitamins A, C, D, E, and K. In addition to these underconsumed nutrients among all Americans, iron and folate (females of reproductive age), protein (adolescent girls and older adults), and vitamin B_{12} (older adults) are underconsumed among these specific population subgroups.[57] Adolescents, especially girls, have particularly low intakes of multiple food components.

Several nutrients and food components with EARs or AIs may warrant special attention, as they are commonly underconsumed by Americans across age-sex groups. The public health significance of inadequate intakes, combined with biomarker data showing insufficient status and/or associated poor health outcomes, is discussed here and in specific chapters throughout this report.

Fiber

Relevance of food component: Fiber is defined as an "edible, non-digestible component of carbohydrates and lignin that is intrinsic and intact only in plants."[58] The AI for fiber is based on the association between higher intakes of fiber and reduced risk of coronary heart disease.

Dietary intake data summary: Dietary fiber intake remains below recommendations for all population subgroups with an available AI. Intake of dietary fiber typically ranges from 15.6 to 18.9 grams (g) per day, with a mean of 16.4 g of fiber per day. Only 6 percent of Americans ages 1 year and older exceed the AI for dietary fiber. Females (12 percent) are more likely to exceed the AI for fiber than are males (4 percent). Certain subpopulations, such as non-Hispanic Blacks and those in the lowest income group, are at particular risk for having low dietary fiber intake, with less than 3 percent meeting or exceeding the AI.

Evidence on biomarkers and/or disease outcome: Data described previously in this chapter speak to the high prevalence rates of CVD intermediate outcomes and coronary heart disease. Additionally, the link between dietary fiber intake and colon cancer is considered.

Designation: Although no biomarker data exist to confirm low intakes, the association of fiber with CVD, which is prevalent in the population, provides evidence that low intakes of this food component is of public health concern.

Calcium

Relevance of food component: Calcium is the primary mineral found in the human body, with the vast majority located in bone (99 percent). Although calcium is important across the lifespan, as bone is in a constant state of dynamic remodeling, it is critically needed before and during the period when peak bone mass is achieved, from birth to around age 30 years.[59] Adequate calcium also is needed during periods of more rapid bone remodeling among post-menopausal women. Although the remaining extra-skeletal body reserve of calcium is small (approximately 1 percent), this pool of calcium also performs critical functions in cell signaling, muscle and nerve function, and regulated vasodilation and constriction.[60]

Dietary intake data summary: Intakes of calcium generally range between 852 and 1,074 milligrams (mg) per day, with the average American consuming 972 mg of calcium per day. This level of intake places many Americans (44 percent) at risk of inadequacy, which is notably higher among girls of school age (68 percent below the EAR), adolescent girls (80 percent less than the EAR), and adult women ages 51 years and older (76 percent below the EAR). Non-Hispanic Blacks and Asians (approximately 60 percent below the EAR) have a higher risk of inadequacy than do non-Hispanic White or Hispanic Americans. About 50 percent of lower income Americans are at higher dietary risk for inadequate calcium intake compared to about 40 percent of those with higher incomes.

Evidence on biomarkers and/or disease outcome: No population-level biomarkers exist to reflect calcium status. Serum calcium is tightly regulated by a complex interchange of calcium from the bone to maintain a near-constant level of serum calcium.[60] Prevalence of low bone mass and osteoporosis are noted in the data described earlier in this chapter.

Designation: Calcium is a food component of public health concern based on low intakes and prevalence of low bone mass and osteoporosis in the U.S. population.

Vitamin D

Relevance of food component: Vitamin D is critical for optimal bone health and may have non-skeletal roles.[60]

Dietary intake data summary: Intakes of vitamin D generally range from 4.1 to 5.3 micrograms (µg) per day, with the average American consuming 4.9 µg of vitamin D per day, placing nearly all Americans (94 percent) with dietary intakes below the EAR. Although no differences in vitamin D intakes are observed by income, non-Hispanic Blacks have slightly higher prevalence of risk (97 percent) of inadequacy relative to other race-ethnic groups.

Evidence on biomarkers and/or disease outcome: It should be noted that serum 25-hydroxy vitamin D, a measure of vitamin D exposure, also indicates a large proportion (18 percent) of Americans are at risk for inadequacy.[61] This is salient as vitamin D can be produced exogenously from ultraviolet (UV) exposure though sunlight. The vitamin D EAR is established with an assumed level of UV exposure.

Designation: Vitamin D is considered a nutrient of public health concern.

Potassium

Relevance of food component: Potassium is a mineral that plays a critical role in cellular function, regulation of intracellular fluid and electrolyte balance, and transmembrane electrochemical gradients.[62] Potassium may counteract the impact of high sodium intakes, potentially helping to maintain normal blood pressure. Some data suggest that the dietary sodium to potassium ratio (Na:K) is more strongly associated with an increased risk of hypertension and CVD-related mortality than the risk associated from either elevated sodium or low potassium alone.[63-65] Nevertheless, a moderate strength of evidence indicates a relationship between higher potassium intake (achieved by potassium supplementation) and lower blood pressure.[62]

Dietary intake data summary: Intakes of potassium generally range from 2,323 to 2,988 mg per day, with the average American consuming 2,521 mg of potassium per day. Only 30 percent of Americans exceed the AI for potassium, with little variation in risk of inadequacy noted by sex, race-ethnicity, or income.

Evidence on biomarkers and/or disease outcome: Serum potassium is tightly regulated in individuals without kidney disease and is not assumed to be a good biomarker of status or tissue potassium stores. Urinary potassium is an additional tool to assess potassium intake but is not routinely measured. Thus, no practical population level biomarker of potassium intakes exists. Hypertension is prevalent in the U.S. population among adults and children (see Question 1, Summary of the Evidence).

Designation: Potassium is considered a food component of public health concern.

Food Components Assessed with Chronic Disease Risk Reduction

Sodium

Relevance of food component: Sodium intake is directly related to blood pressure across the lifespan. Hypertension, or high blood pressure, is a validated surrogate endpoint for CVD.[66] Elevated blood pressure contributes to the risk of CVD and stroke, which are both leading causes of morbidity and mortality in the United States.

Dietary intake data summary: Sodium is overconsumed except by infants. Intakes of sodium generally range from 3,001 to 4,100 mg per day, with the average American consuming 3,393 mg of sodium per day. The majority of Americans (approximately 90 percent) exceeds recommended intakes for disease risk reduction across all race-ethnic groups, with marginal differences observed by income. Males have higher intakes of sodium than do females, given their higher caloric intakes but the same CDRR level, resulting in 97 percent of males and 79 percent of females reporting intakes above recommendations.

Evidence on biomarkers and/or disease outcome: The prevalence of hypertension in the U.S. adult population is nearly 30 percent.[9]

Designation: Sodium is designated as a nutrient of public health concern.

Food Components with an Existing Dietary Guidelines Recommendation

The *2015-2020 Dietary Guidelines for Americans* recommends that no more than 10 percent of total energy intake come from saturated fats or added sugars.[6] Solid fats contain more saturated fats than do liquid oils and have lower amounts of monounsaturated and polyunsaturated fatty acids. The intake of solid fats is considered here in the description of saturated fat intakes. The majority of the population of all age-sex groups exceeds recommended energy intakes from saturated fats and added sugars (DIST_DS). Thus, these food components were evaluated for their status of public health concern in the population.

Saturated Fat

Relevance of food component: No DRI values have been established for saturated fatty acids because, unlike unsaturated fatty acids, there is no biological requirement for their intake. However, because saturated fatty acids are consumed by the vast majority of Americans, the *2015-2020 Dietary Guidelines for Americans* provides a quantitative limit on saturated fats of no more than 10 percent of total energy intake.[6]

Dietary intake data summary: For Americans ages 1 year and older, the average amount of saturated fat in the diet is 26.6 g, with only 1 in 4 Americans (23 percent) achieving energy intakes from saturated fat of less than 10 percent. Children younger than age 18 years have a lower prevalence of adherence with the energy recommendation compared to adults. Women who are pregnant (25 percent) or lactating (23 percent) tend to have lower prevalence of meeting saturated fatty acid energy goals than do women who are not pregnant or lactating (28 percent). The proportion of race-ethnic subgroups with energy intakes less than 10 percent from saturated fats varies substantially. Only 57 percent of non-Hispanic Asians, 30 percent of Hispanics, 31 percent of non-Hispanic Blacks, and 17 percent of non-Hispanic Whites report meeting saturated fat intake guidelines. Those with the lowest PIR (<131 percent) have higher compliance (27 percent meet guidelines) than do the middle PIR group (131 to <350 percent), with 20 percent meeting guidelines, while the highest PIR group (>350 percent) has about 25 percent meeting guidelines. The range of percent energy from saturated fat is rather narrow (i.e., within about 5 percent), contributing to differences in population prevalence by race and by income. However, most Americans do not have energy intakes aligned with current Dietary Guidelines guidance for saturated fat.

The top food subcategory sources of solid fats (e.g., animal fats, shortening, and coconut and palm oils) among American adults and children include burgers and sandwiches (12 percent to 22 percent) and desserts and sweet snacks (14 percent to 19 percent) (CAT_DS). Higher-fat milk and yogurt provide 19 percent of solid fats in the diets of children ages 2 to 5 years and 11 percent of solid fats among those ages 6 to 11 years. Concerted efforts to remove *trans* fats from the food supply to reduce LDL-C (a validated surrogate biomarker for CVD risk) have occurred.[67]

Evidence on biomarkers and/or disease outcome: As described earlier in this chapter, the prevalence of cardiovascular intermediate outcomes as well as heart disease as a cause of death are of concern starting in adolescence. In adults ages 20 years and older, the overall prevalence of high total cholesterol is still more than 10 percent.[13] Women ages 20 and older have a higher prevalence of high total cholesterol (17.7 percent) than do men (11.4 percent). The prevalence of low HDL-C in adults ages 20 years and older is nearly 20 percent.[13] Among adolescents ages 12 to 19 years old, low serum HDL-C is about 16 percent.

Designation: Saturated fat remains of public health concern.

Added Sugars

Relevance of food component: The quantitative recommendation in the *2015-2020 Dietary Guidelines for Americans* for added sugars is to consume less than 10 percent of energy from added sugars.[6] The 2015 Committee examined data from dietary intakes as well as food pattern modeling to determine how much added sugars could be accommodated in a healthy diet while meeting food group and nutrient needs.[68] This 2020 Dietary Guidelines Advisory Committee is advising that the recommendation be decreased from 10 percent to 6 percent of energy from added sugars.

Dietary intake data summary: Added sugar in the U.S. diet is quantified in teaspoon equivalents, representing 4.2 grams[69] (see ***Part D. Chapter 12: Added Sugars***, Question 1). The average usual intake of added sugars by Americans ages 2 year and older is nearly 17 tsp eq per day (about 267 kcal) (DIST_DS). For ages 1 year and older, 37 percent of the population have 10 percent or less of their energy intakes from added sugars; thus, 63 percent exceed the 10 percent recommendation (DIST_DS). Added sugar intake increases with increasing age among both boys and girls. Mean intake by males ranges from 11 tsp eq per day for ages 2 to 3 years (4 to 20 tsp eq per day) to 21 tsp eq per day for ages 14 to 18 years (6 to 45 tsp eq per day). Among females ages 2 to 3 years, mean intake is 9 tsp eq per day (3 to 18 tsp eq per day), rising to 17 tsp eq per day (5 to 34 tsp eq per day). Added sugars provide a mean intake of 148 to 168 kcal per day to the diets of children ages 2 and 3 years (49 to 318 kcal per day), rising to 267 to 344 kcal per day for ages 14 to 18 years (78 to 724 kcal per day). Added sugars intakes fall with age among adults of both sexes, with mean intake ranging from 18 to 21 tsp eq per day among males and 14 to 16 tsp eq per day among females. The range for adults is 5 to 44 g per day. Added sugars provide 284 to 334 kcal per day to the diets of adult males and 220 to 254 kcal per day among adult women. The mean percent energy contributed by added sugars was 12.7 percent for the population ages 1 year and older. Among children ages 4 to 18 years, energy from added sugars ranges from 13 to 15 percent. Among adults, the percent of energy is approximately 13 percent for those ages 50 years and younger and 12 percent for those older than age 50 years (DIST_DS). The percent of the population with 10 percent or less of energy from added sugars is 50 percent for ages 1 to 3 years. A smaller proportion of children ages 4 to 8 years achieve the goal: 21 percent of boys and 22 to 25 percent of girls. Nearly 30 percent of adolescent boys and 24 percent of adolescent girls achieve the goal. Among adults, approximately 40 percent achieve the goal.

Mean intake of added sugars is lowest among non-Hispanic Asian Americans (9.6 tsp eq) when compared with Hispanic (15.6 tsp eq), non-Hispanic White (16.6 tsp eq), and non-Hispanic Black (17.7 tsp eq) Americans, when all age groups (ages 2 years and older) are combined.[70] Differences were noted, though significance testing was not done for this analysis.

Designation: High intakes of added sugars is designated as a food component of public health concern.

Considerations for Specific Life Stages: Adolescents and Older Adults

In addition to the food components of public health concern noted for all Americans ages 1 year and older, adolescents and teenagers have dietary intakes that do not provide recommended intakes for several nutrients. This age group has a constellation of dietary risks, including low dietary intakes of protein (girls), iron (girls), folate (girls), vitamins B_6 and B_{12} (girls), phosphorus, magnesium, and choline (both boys and girls). For adolescents and teenagers, there is a higher prevalence of risk of dietary inadequacy across multiple nutrients relative to younger and older age groups, and the use of dietary supplements is also lowest during this life stage.[71] Although very few Americans are at risk of inadequate dietary intake of iron (6 percent are below the EAR), iron deficiency is especially problematic among adolescent girls and women of reproductive age, given that approximately 20 percent of this population subgroup is at risk of inadequate dietary iron based on biomarker data.

Older adults have low intakes of protein when compared with the EAR. Given the high prevalence of sarcopenia and reduced muscle strength (see Question 1, Summary of the Evidence), dietary protein should be further examined. Additional work may be needed to set optimal guidance for maintaining muscle strength.

About 1 in 4 older women (23 percent) has at-risk dietary intakes of vitamin B_6. Previous NHANES analyses identified 13 percent of older women with low pyridoxal 5'-phosphate, an indicator of vitamin B_6 status.[72] Similarly, vitamin B_{12} has been related to cognitive function. Although the Committee did not specifically address cognitive health data and biomarker data from NHANES, 8 percent of older women have low dietary intakes. Future Committees may wish to examine optimal nutrition for prevention of cognitive decline.

Considerations for Specific Life Stages: Pregnancy and Lactation

Although the HEI scores of women who are pregnant or lactating are slightly higher than for women of similar ages, food components of public health concern exist, in addition to those highlighted across all age groups. During pregnancy, increased requirements for some food components and energy exist.[73,74] Although this increased nutrient intake should preferably come from food sources, even within countries ranked as high on the Human Development Index,[75] it is unlikely that women who are pregnant meet their needs through foods alone, especially for iron.[76] Indeed, more women who are pregnant or lactating use dietary supplements than do women of similar ages who are not pregnant or lactating.[77,78]

The Committee reviewed NHANES 2013-2016 data on the dietary intakes of women who are pregnant.[79] The sample size was too small to estimate the proportion of the population with intakes below the EAR. Thus, the Committee reviewed an analysis of U.S. women who are pregnant (n=1,003; ages 20 to 40 years) from the NHANES 2001-2014 that included estimates of intakes from food, beverages, and dietary supplements. More than 10 percent of women who are pregnant had total usual intakes, inclusive of dietary supplements, below the EAR for: calcium (13 percent), folate (16 percent), iron (36 percent), magnesium (48 percent), zinc (7 percent), and vitamins A (16 percent), B_6 (12 percent), C (12 percent), D (46 percent), and E (43 percent). Similarly, few women who are pregnant exceeded the AI for choline (8 percent), potassium (42 percent), and vitamin K (48 percent).[76]

The requirements for iron increase during pregnancy to accommodate fetal requirement, the expansion of blood volume, and increased tissue and storage of iron.[80] Mean iron intake from food and beverages among women who are pregnant is 14.5 mg. However, the sample size using NHANES 2013-2016 was too small to estimate with confidence the proportion of women with intakes below the EAR. When using NHANES 2001-2014, 36 percent of women who are pregnant (and 95 percent without the use of a dietary supplement) have iron intakes from food, beverages, and dietary supplements below the EAR.[76] Biomarker data were not available for women who are pregnant, but the prevalence of low iron among women of similar ages who are not pregnant was considered. Biomarker data, together with dietary data, for women of similar ages who are not pregnant suggest that iron is of public health concern during pregnancy.

In addition, based on high risk of neural tube defects, folate/folic acid should remain of concern, given the high prevalence of dietary inadequacy among women who are pregnant (first trimester only).

Iodine needs increase by more than 50 percent during pregnancy to meet demands for neurological development and fetal growth.[81] Inadequate iodine during pregnancy is related to impaired neurological and irreversible behavioral development. Although dietary data are not available for iodine, median urinary iodine concentrations of women who are pregnant remain below the WHO cut-off for “insufficiency” (less than150 µg per liter [L]). Depending on survey years used, it is 144 µg/L[82] or 148 µg/L.[83] Dairy consumption and use of dietary supplements containing iodine are among factors related to status; most prenatal products do not contain iodine.[83,84] Urinary iodine concentrations and soy consumption (potential goitrogen) varies by race and ethnicity.[85] Given the severity of risk of low iodine during pregnancy, together with biomarker data, iodine should be considered as a potential area of public health concern, especially for women who are pregnant and not using iodine-containing prenatal supplements.

Choline and magnesium should be considered for further evaluation based on high estimates of inadequacy based on dietary data alone.

Most women who are pregnant or lactating exceed the UL for sodium (more than 90 percent). Given the role of sodium in blood pressure and the severity of risk of preeclampsia and hypertension, sodium remains of public health concern during pregnancy and lactation, respectively. Some women who are pregnant exceed the UL for calcium (3.0 percent), folic acid (33.4 percent), iron (27.9 percent), and zinc (7.1 percent), but this is mainly related to dietary supplement use.[76] However, without dietary supplements, nutrient goals are difficult to achieve. Thus, dietary supplements used in pregnancy should provide adequate but not excessive amounts of the critical food components discussed in this section (see ***Part D. Chapter 2: Food, Beverage, and Nutrient Consumption During Pregnancy***).

Lactation is a life stage that requires higher energy intakes to support milk production, with increases in requirements for 8 nutrients. However, iron needs of women who are lactating are considerably lower than requirements in pregnancy. Some data suggest that women who are lactating continue to use dietary supplements that provide high amounts of iron. Thus, caution is warranted about continued use of prenatal supplements high in iron during lactation, but given higher requirements for other nutrients, it is not advised to discontinue use of multivitamin-minerals that do not provide prenatal levels of iron (see ***Part D. Chapter 3: Food, Beverage, and Nutrient Consumption During Lactation***).

Other Population Subgroups

Marginal differences in intakes were observed for more than 10 different nutrients when examining intakes by race or Hispanic origin and/or family income status. Most notably, non-Hispanic Black Americans were at greater risk of inadequate intake of magnesium, phosphorous, and vitamins A and D when compared with other race or Hispanic origin groupings. Similar findings were apparent when evaluating the proportion of the population exceeding the AI by race-ethnic group. Less than 3 percent of non-Hispanic Blacks exceeded the AI for dietary fiber, while 7 percent or more of non-Hispanic Whites, non-Hispanic Asians, or Hispanic Americans did so. A higher prevalence of inadequate intakes was observed among Americans living in low income (<131 percent of the poverty level) than those living in households >350 percent of the poverty level, especially for calcium, magnesium, phosphorous, and vitamins A and C. Americans living in low income (<131 percent of the poverty level) households also had a lower prevalence of intakes exceeding the AI for dietary fiber and vitamin K when compared with those in households >350 percent of the poverty level.

To access the data analyses referenced above, visit:
https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis

Question 5. How does dietary intake, particularly dietary patterns, track across life stages from the introduction of foods, into childhood, and through older adulthood?

Approach to Answering Question: Data analysis

Conclusion Statement

Diet quality is higher among young children and older adults than other life stages but does not align with existing dietary guidance. Food category sources of food groups and nutrients differ across life-stage groups. Fluid milk as a beverage decreases starting in early childhood, while the intake of sweetened beverages increases. Fruit and vegetable intakes decline through adolescence and adulthood but increase among older adults. Intakes of burgers and sandwiches contribute to most food groups, nutrients, and food components that fall outside of recommended ranges.

Summary of the Evidence

Data described have been summarized for the questions “Describe/evaluate current dietary patterns and beverages.” The summary here describes how the data provide insight into differences and similarities in dietary patterns from infancy through older adulthood using cross-sectional data from the WWEIA, NHANES.

Data analyses conducted for the Committee are found in the data analysis supplements and are referenced below as Food Category Sources of Food Groups and Nutrients Data Supplement (CAT_DS) and Beverages Data Supplement (Bev_DS).

Dietary Intakes for Birth to Age 24 Months

The Committee’s analyses of existing NHANES 2007-2016 data suggest that infants who are exclusively fed human milk may be fed differently compared to their peers receiving infant formula. Differences are noted, though statistical testing between the groups was not done for the analysis described. Infants receiving infant formula are more likely to obtain Fruits, Vegetables, and Protein Foods from baby food, whereas infants fed human milk are more likely to receive these foods from non-baby food sources (CAT_DS).

By food pattern equivalent amounts, grains (likely infant cereals) are the primary contributor to CFB among younger infants (IT_DS) (see Table D1.3).

Table D1.3 Mean daily food group intakes among infants, toddlers, and young children

	6 to 12 mo[1]	12 to 24 mo[1]	2 to 5 yrs males[2]	2 to 5 yrs females[2]
Fruit, cup eq	0.6	1.3	1.2	1.2
Vegetables, cup eq	0.4	0.6	0.7	0.7
Protein foods, oz eq	0.5	1.9	3.1	2.9
Grains, oz eq	1.1	3.1	5.3	4.5
Dairy, cup eq	0.3	2.6	2.0	1.9
Oil, grams	1.7	8.4	17.6	15.9
Solid fat, grams	3.3	24.7	27.5	25.1
Added sugars, tsp eq	1.0	6.2	11.3	9.8

[1] What We Eat In America (WWEIA), National Health and Nutrition Examination Survey (NHANES) 2007-2016, individuals ages 6 to 12 months and 12 to 24 months
[2] WWEIA, NHANES 2015-2016, individuals ages 2 to 5 years

The largest change in food group intakes occurs around age 12 months, generally when "table foods" or the food that caregivers consume are provided, with less intake of human milk and infant formula. Starting at age 12 months, intake of Fruits and solid fats are stable and consistent with intakes of older children ages 2 to 5 years. A marked increase is seen in both solid fats and added sugars between older infants and toddlers ages 12 months and older. The HEI applies only to those ages 2 years and older, so dietary patterns are examined using food category sources of energy, food groups, and nutrients (CAT_DS). The food subcategories that are significant sources of energy, food groups, and nutrient intakes among toddlers ages 12 to 24 months and preschool-aged children (ages 2 to 5 years) include high-fat dairy, burgers and sandwiches, starchy vegetables, sweetened beverages, desserts and sweet snacks, rice and pasta and grain-based dishes, chips and crackers and savory snacks, poultry, meat, and cured meats. Food group intakes that are notably small among this age group include Seafood, total Vegetables, Red and Orange Vegetables, Dark Green Vegetables, Whole Grains, and Legumes.

As children progress from the toddler years through the preschool years, diet quality is measured by the HEI-2015.[45] Diet quality is low across all life stages (see Figure D1.10). It appears that dietary intake of many food categories, particularly subcategory sources of energy and food components, tracks across life stages (CAT_DS). Examining food category sources of energy and food components gives context for how foods are consumed (e.g., added sugars as beverages; whole grains as breakfast cereals and bars). Trends of particular interest include the high intake of added sugars from sweetened beverages and sweets and desserts that begins early in life, and the low intakes of fruit and vegetables that are seen from the introduction of solid foods throughout the lifespan. Food groups that show the most variation by age include Dairy (which decreases from early childhood onward), Protein Foods (which vary by age-sex group in terms of sources and total amount), and added sugars and solid fats (which increase from early childhood onward until a slight decrease occurs in later adulthood).

Although fruit is consumed at recommended levels by the majority of children ages 3 years and younger (DIST_DS), fruit consumption decreases during early childhood. By late childhood (ages 9 years and older) Fruit intake recommendations are met by less than 1 in 5 children, a pattern that continues throughout the lifespan, evidenced by food group intake distributions compared to food group recommendations. The majority of fruit is consumed as whole fruit (CAT_DS).

Vegetables are consumed at levels below recommendations starting in infancy and continuing throughout the lifespan (DIST_DS). Starchy Vegetables (mainly white potatoes) are the top source of vegetables for children and adolescents, with non-starchy vegetables becoming the most commonly consumed vegetables during adulthood (CAT_DS). Intakes of Red and Orange and Dark Green Vegetables are particularly low across all age-sex groups throughout the lifespan. Among those ages 2 and older, most vegetables in the diet are not consumed as distinct vegetables, as part of burgers and sandwiches, or as components of rice and pasta and other grain-based dishes (CAT_DS). This pattern is consistent across the rest of the lifespan.

Total Grains are consumed at or above recommended levels by youth (DIST_DS). However, about half of adults ages 20 years and older do not meet recommended intakes of total Grains, including one-third of women who are pregnant and 1 in 5 women who are lactating. Whole Grains are consumed at much lower than recommended levels by all age-sex groups throughout life. Burgers and sandwiches are the primary contributor of total Grains from early childhood throughout the rest of the lifespan (CAT_DS). Breakfast bars and cereals are the primary contributor of Whole Grains, followed by burgers and sandwiches, and chips and crackers and savory snacks across all life stages.

Protein Foods are consumed below recommended levels by more than one-third of infants, one-quarter of children, two-thirds of adolescent males, three-quarters of adolescent females, one-third of adult males, and half of adult females (including women who are pregnant) (DIST_DS). Burgers and sandwiches are the main category contributor to Protein Foods in the diets of all age-sex groups, followed by poultry, and meat and poultry and seafood mixed dishes (CAT_DS). Meat and poultry are the primary Protein Foods subgroups consumed by all age groups. Mean intakes of Seafood are small among infants, children, and adolescents and larger during adulthood. Intake of seafood, particularly high omega-3 sources,[6] is lowest among those with low income. Non-animal sources of protein, including Legumes and Nuts and Seeds, are not consumed in large quantities by any age group. Eggs contribute more protein to the diets of children than of adults. Though differences are noted, significance testing was not done.

Dairy intake is highest during early childhood. However, more than one-third of children younger than age 3 consume less than recommended levels (DIST_DS). Dairy intake drops significantly throughout childhood, with only 1 in 4 male and 1 in 10 female adolescents meeting recommendations. More than three-quarters of adults consume inadequate amounts of Dairy. Food sources of Dairy shift throughout the lifespan, with fluid milk providing the majority of intake in the first 3 years of life (CAT_DS). Cheese surpasses milk as the main source of dairy as people age. Burgers and sandwiches become a more significant source of Dairy during adolescence and adulthood. Yogurt contributes a small percentage of Dairy intake at all ages.

Intakes of solid fats and added sugars exceed recommended levels at all ages. Intakes increase with age, peaking during adolescence and young adulthood, then decreasing but remaining higher than recommended throughout the rest of the lifespan. Sweetened beverages are the largest contributor of added sugars at all ages, followed by desserts and sweet snacks, and sweetened coffee and tea among children and adults. Burgers and sandwiches are the most significant source of solid fats for ages 2 years and older, followed by desserts and sweet snacks. Higher-fat milk and yogurt are a significant source of solid fats for young children but decrease in other age categories concomitant with the decrease in Dairy intake.

Among older children and adolescents, the food subcategories that provide the majority of foods, energy, and nutrients include burgers and sandwiches, sweetened beverages, starchy vegetables, rice and pasta and grain-based dishes, chips and crackers and savory snacks, desserts and sweet snacks, poultry, meat, sweetened coffee and tea, and pizza (CAT_DS). Food subcategories that are notably low compared to recommendations include seafood, fruit, vegetables (particularly red and orange and dark green varieties), whole grains, legumes, and dairy.

The food subcategories that provide the majority of food, energy, and nutrients to the diets of adults include burgers and sandwiches, sweetened beverages, yeast breads and tortillas, meat, poultry, sweetened coffee and tea, rice and pasta and grain-based dishes, and snacks

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[6] Cooked seafood containing 500 mg or more of omega-3 fatty acids (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) per 3 ounces was assigned as seafood high in omega-3 fatty acids. ars.usda.gov/ARSUserFiles/80400530/pdf/fped/FPED_1516.pdf

and sweets (CAT_DS). Among older adults, breakfast cereals and bars and meat and poultry and seafood mixed dishes also are significant contributors to energy and nutrient intakes. Food subcategories that are consumed in particularly low quantities include fruits, vegetables, dairy, whole grains, and legumes. Alcoholic beverages provide a significant amount of energy in the diet of many adults and contribute to intakes of added sugars without helping adults meet recommended intakes of food subcategories. Women who are pregnant and lactating consume diets that are somewhat closer to meeting recommendations for dairy, fruit, and vegetables intake. However, intakes of these foods are still below recommended levels for most women who are pregnant and lactating.

The food subcategory that is the most significant source of food, energy, and nutrients in the diets of Americans ages 2 years and older is burgers and sandwiches (CAT_DS). This category is the second highest source of energy and nutrients in the diets of toddlers and preschool-aged children, following high-fat dairy intake. Sweetened beverages are the second most common food subcategory source of energy in the diets of Americans ages 2 and older and is the fourth highest source of energy among toddlers and preschoolers. Sweetened coffee and tea are a notable contributor of energy among Americans ages 9 years and older, contributing as much as 10 percent of energy among adults. Starchy vegetables, desserts and sweet snacks, rice and pasta and grain-based dishes, chips and crackers and savory snacks, and poultry are other food subcategories that are common among all age groups. Food subcategories that are notably low among all age groups include seafood, total vegetables (especially red and orange and dark green vegetables), whole grains, and legumes. Dairy intake is low among all age groups except infants and toddlers.

To access the data analyses referenced above, visit:
https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis

DISCUSSION

Consistent and well-conducted Federal monitoring and surveillance have provided valuable insights into the health and nutritional status of Americans. Not surprisingly, most Americans have one or more chronic health conditions that are related to dietary intake across the life course, including overweight and obesity, heart disease, stroke, type 2 diabetes, hypertension, liver disease, certain types of cancer, dental caries, and/or metabolic syndrome. In many instances, overweight and obesity may be the earliest manifestation of energy imbalance and poor nutritional status, and many of the chronic conditions that the Committee examined develop as a consequence of overweight and obesity. Given that most Americans and overweight or obese this is quite concerning. This Committee has taken a life-course approach to understand current patterns of dietary exposures, considering the data on existing chronic disease risk. Age has strong relationships with chronic disease. Although young children have the lowest incidence of all chronic diseases, children are not immune to chronic disease, with this report suggesting a high prevalence of cardio-metabolic disorders, dental caries, and a difficult-to-quantify but emerging concern about food allergy and related conditions (such as asthma). Older adults are at greater risk of all chronic diseases than are other age groups, and sarcopenia, osteoporosis, and cancer disproportionately affect this life stage. Unfortunately, the prevalence of chronic diseases in America has increased over time, often disproportionately among some subgroups, leading to health disparities and changes in life expectancy. Although some of the reduced life expectancy is driven by mid-life mortality[86] unrelated to chronic disease, chronic diseases remain the chief causes of mortality in the United States.

Racial and socioeconomic status disparities exist with regard to chronic diseases.[87] Racial variation exists for almost all the health conditions the Committee examined, including during pregnancy. Asian Americans have a relatively lower prevalence of most chronic health conditions examined, though pregnant Asian women have the highest prevalence of gestational diabetes. Low birth weight among non-Hispanic Blacks is at the highest level in more than 25 years. Chronic liver disease has increased in America, along with its associated mortality rates, and can result from obesity, alcohol misuse, metabolic syndrome, and hepatitis. Most U.S. adults report alcohol use, and among those who drink, about half report binge drinking (see ***Part D. Chapter 11: Alcoholic Beverages***). Chronic liver disease is highest in American Indians and Alaska Natives. Across all age groups, non-Hispanic Asian Americans have higher diet quality than other race-ethnic groups and have lower risk for most chronic diseases.

Poverty and health inequalities are persistent and increasing within the U.S. population.[88] Understanding how dietary intake can reduce risk or aid in the treatment of chronic diseases is complex but never has the time to optimize the American diet to modify disease risk through primary and secondary prevention strategies been more salient.

Few Changes in the Dietary Landscape Over Time

The American dietary landscape has not changed appreciably in recent decades. Across the life course, it is characterized by a persistent overconsumption of total energy (i.e., calories), saturated fats, salt, added sugars, and alcoholic beverages among a high proportion of those who choose to drink. Whole-grain intakes remain extremely low across most of the population; whole grains are mainly consumed as part of breakfast foods or in snack foods (chips, crackers). Intakes of fruits and vegetables are lower than current recommendations, with most Americans consuming less than 1 cup of whole fruit per day. Less than half of vegetables are consumed “alone” or as a distinct raw or cooked portion, meaning that they are largely being consumed when incorporated into another food type (i.e., as part of a sandwich or crackers). After early childhood, dairy intakes decrease over the life course, except for a small uptick in older adults. However, this increase is largely driven by ice cream and sweet desserts, which provide fewer key nutrients and more saturated fats relative to other foods in the dairy category. Though the diets of women who are pregnant or lactating are higher in key food groups, they still fall below recommendations.

These trends in food intake have ramifications on nutrient intakes and status throughout life for all Americans. Low intakes of fruits and vegetables contribute to the underconsumption of nutrients and food components such as vitamins A, C, and K; potassium; and fiber. Inadequate intakes of dairy may contribute to low intakes of protein, calcium, phosphorous, magnesium, and vitamins A and D. Intakes of fiber are also decreased when intakes of whole grains and legumes are low. Iron and vitamin B_{12} status may be affected if intakes of poultry, meat, seafood, dairy, and eggs are low. Eggs also supply additional choline and vitamin D, two nutrients with notably low intakes relative to recommendations. Similarly, patterns of food group intakes across the life course contribute to higher than recommended intakes of food components of public health concern, such as added sugars, sodium, and saturated fats.

New Findings on Infants and Toddlers

For the first time, the Committee reviewed evidence on the diet and health of infants and toddlers. The period between the start of pregnancy until the infant reaches age 24 months, or the first 1,000 days of life, is thought to be the most critical window for optimizing nutritional exposures relative to neurocognitive development.[89] The data reviewed by the Committee suggest that while HEI scores were higher in pregnancy and lactation than in women of similar ages, many dietary deficits were noted. Iron deficiency is estimated to be present in 1 in 10 women who are pregnant in America, with estimates highest in the third trimester (approximately 25 percent), and being more prevalent in Hispanic, Mexican, and non-Hispanic Black women.[90] Very limited biomarker data are available that is national in scope to adequately describe the nutritional status of American women who are pregnant or lactating.

For some nutrients, human milk composition does not change based on maternal diet, though for other nutrients, the quality of human milk varies based on maternal status. Within this report, the Committee made many assumptions about the energy and nutrient composition of human milk. However, much more research is needed to develop an accurate database of representative values. The Committee's findings should be considered with that caveat in mind.

Among infants, breastfeeding initiation and duration have improved over time, and rates of exclusive breastfeeding differ substantially by race and ethnicity.[91] From all data sources examined, breastfeeding rates are lowest among non-Hispanic Blacks. Baseline data suggest that breastfeeding rates are lower among low birth weight infants (less than 2,500 grams).[92] The average dietary intake of younger infants (younger than age 6 months) is able to meet recommendations for most food components, with caution needed for vitamin D among those exclusively breast-fed.

Among infants who are fed formula, cow's milk (68.9 percent) formula is the predominant formula source, with lower percentages receiving soy (11.6 percent), specialty (6.3 percent), and "gentle/sensitive, or lactose-free/reduced formulas" (5.4 percent). Although it is not recommended by the AAP,[93] approximately 13 percent of U.S. infants were reported to consume cow's milk before age 12 months.[94] Cow's milk consumption before age 12 months varies by household education and income levels. Transition from sole consumption of human milk and/or infant formula to include nutrient-dense complementary foods is recommended at about age 6 months,[95] depending on the development of the child (see ***Part D. Chapter 5: Foods and Beverages Consumed During Infancy and Toddlerhood)***.

Most U.S. infants are introduced to CFB before age 6 months. After age 6 months, most children consume CFB. However, the primary mode of feeding is associated with the timing of introduction of CFB and the types of foods and beverages that are consumed. Formula-fed infants are more likely to be introduced to CFB at earlier ages; moreover, formula-fed infants are more likely to be consumers of various food components that could be perceived as lower in nutritional quality (i.e., added sugars, solid fats, oils), and are more likely to consume protein foods that are rich sources of iron and zinc. A higher percentage of fruit juice consumption was noted among formula-fed (45 percent) than in older infants fed human milk (20 percent). The AAP does not recommend fruit juice intake before age 12 months, at which point no more than 4 oz per day is recommended.

Notable differences are also observed in the sources of energy by primary feeding type (i.e., human milk, infant formula). Although the proportion of energy from protein foods and snacks and sweets is similar among infants who are fed human milk or formula, infants fed human milk receive more energy from fruits, vegetables, milk and dairy and grains and less from mixed dishes. For older infants fed human milk, special considerations are warranted, given the limited set of EAR values for this age group, for iron, zinc, and protein. Though iron biomarker data are not available for older infants, prevalence of iron deficiency among U.S. toddlers ages 12 to 24 months in NHANES 2003-2010 was 15 percent.[90] Protein and zinc are also low relative to reference standards, but the dietary estimates are not supported by biochemical, clinical, or health consequences to date in older infants. Relative to the AI for older infants, potassium, vitamin D, and choline intakes were low and could be enhanced by inclusion of fruits, vegetables, yogurt, eggs, and legumes during the transition from milk-based to table-food feedings (see ***Part D. Chapter 7: USDA Food Patterns for Children Younger than Age 24 Months***).

During the ages of 12 to 24 months, rapid devolution occurs in terms of meeting food component recommendations. This period of time generally is when the child is exposed to foods consumed by parents and caregivers. During this time between infancy and toddlerhood, large increases in added sugars and solid and saturated fats are observed. Patterns of food group intakes and sources of food groups among toddlers ages 12 to 24 months are similar to those of the U.S. population ages 2 years and older; however, it should be noted that dairy milk intake is higher in toddlers ages 12 to 24 months and represents about 43% of solid fat intake. Nutrients or food components that pose special challenges for children between the ages of 12 and 24 months include choline and linoleic acid. These nutrients are found in foods, including eggs, nuts, seeds, and meats, that are generally not consumed in high amounts by many infants and toddlers.

Dietary Patterns Through the Life Course

As children progress from the toddler years through the preschool years, dietary intakes change and HEI scores drop, indicating lower overall diet quality. The search for a sense of autonomy and desire for independence in many areas of life that occur during this developmental stage often manifest through selective or “picky” eating, food neophobia, or food “jags” (eating only 1 or a few foods for periods of time). Even though these behaviors usually resolve by the end of the preschool years, the dietary habits acquired during these years tend to persist throughout the life span.

Changes in dietary patterns in young children lead to decreases in dietary quality. These changes tend to have consistent themes for all children, but differences in patterns of intake for fruits and vegetables suggest that non-Hispanic Black children have the lowest intake of whole fruit and highest intake of fruit juices.[96] Decreases in fluid milk as a beverage appear to be replaced with sweetened beverages as children age. These changes culminate to a constellation of dietary risk in adolescents. In addition to those shortfall food components notably low in all Americans, older children also have additional nutrients of concern, especially girls. Intakes of dairy, dark green vegetables, legumes, poultry, and eggs should be encouraged among pre-teens and adolescents, particularly girls.

Although older adults have higher relative HEI scores, additional concerns for vitamin B_{12} and protein are observed and warrant consideration for tailoring specific guidance. About 1 in 4 older women (23 percent) have at-risk dietary intakes of vitamin B_6. Previous NHANES analyses identified 13 percent of older women with low pyridoxal 5'-phosphate, an indicator of vitamin B_6 status. Similarly, vitamin B_{12} has been related to cognitive function. Though the Committee did not specifically address cognitive health data and biomarker data from NHANES, it noted that 8 percent of older women have low dietary intakes of food sources of vitamin B_{12}. Future Committees may wish to examine optimal nutrition for prevention of cognitive decline. Osteoporosis and sarcopenia are chief concerns for older Americans, especially women.

Race and ethnicity and income also were associated with differential intakes of food groups, nutrients, and food components. This report contains information on race-ethnic and income differences for food components of public health concern, but it should be noted that similar disparities in dietary intakes also exist across most of the shortfall nutrients (DIST_DS) and food components of public health concern (see Table D1.4).

Dietary Patterns and Food Security

The 2015 Committee described a need to understand how food security shapes dietary intakes. Data on dietary patterns and intakes of nutrients and food components by food security status were not available to this Committee. However, as reviewed by others outside this Committee, a food secure status has been associated with higher diet quality and nutrient intakes among adults [97,98] and children [99,100] when compared with those who are food insecure. Future work to understand how overall income and food security status interact to predict dietary intakes and the resulting diet quality is needed.

Ensuring Lifelong Healthy Dietary Choices

The work of Dietary Guidelines Advisory Committees since 2010 and present have clearly identified associations between dietary patterns and health outcomes, more so than with any one nutrient or food component. The analytical framework the Committee used compared dietary intakes to the HEI. This strategy permitted the Committee to examine how well existing diets conform to recommendations. Dietary intakes have never aligned with recommendations. The Committee can identify areas in which Americans need to make improvements, but the charge of the committee does not extend to reviewing factors that impact our ability to change behaviors to improve dietary intakes. In the future, Committees may need to include a review of public health-based strategies that have been successful in promoting higher quality dietary intakes, especially in key populations that are at high risk and/or disadvantaged.

Even without systematic reviews on how to effectively shift the population at large to healthy dietary intakes, the Committee can identify opportunities within each life stage to provide specific advice about critical food components that provide key nutrients for individuals by age-sex subgroups at that particular stage of life. Opportunities also exist to think about healthy food intake patterns that should be carried forward into the next stage of life. Lastly, the Committee can easily identify substitutions of food components that can help improve diet quality while also being favorable to energy balance. This approach recognizes that nutrient needs vary over the life course and intakes at later life stages are likely influenced by intakes at earlier life stages.[101,102] Although raising the general dietary quality is important, individuals and healthcare providers may be more attuned to small changes related to specific needs at a given life stage.

In addition to establishing optimal dietary patterns early in life, efforts should continue to ensure energy balance early in life and maintain energy balance over the life course. The Committee's review of the available data pointed to some major deficiencies in dietary intake for key demographic groups within the U.S. population. Using the life-course approach, the Committee recognized that pre-teens and adolescents may be at particular nutritional risk. Overweight and obesity are highly prevalent, and Americans need to make shifts in their diets that do not add calories but make substitutions with nutrient-dense foods or beverages with lower contributions to energy. For example, most adults consume 2 or more sweetened beverages each day. Replacing 1 or both of those per day with water or other beverages that do not contribute energy, all other dietary intakes being consistent, could reduce total energy intakes and help contribute to reduced energy balance (see ***Part D. Chapter 14: USDA Food Patterns for Individuals Ages 2 Years and Older***, ***Part D. Chapter 10: Beverages***, and ***Part D. Chapter 12: Added Sugars***). Eating occasions should be viewed as opportunities to make better choices. Snacks, especially in young children, could be a way to promote intakes of fruit and vegetables, rather than foods high in sodium, added sugars, and saturated fats (see ***Part D. Chapter 13: Frequency of Eating***). Ultimately, to improve diet quality, it is essential that

Americans eat more of key food groups and consistently displace other choices of lower dietary quality and higher energy density. Otherwise, efforts to improve dietary quality without displacement will lead to excess energy intakes and limited impact on chronic disease risk.

Among Americans ages 2 years and older, the top food categories and subcategories that contribute to energy intake remain remarkably stable across the life span. The majority of energy comes from burgers and sandwiches, snacks and sweets, and mixed dishes. The top sources of energy intake come from a limited number of food categories, with burgers and sandwiches dominating as a primary source of energy across most age groups. The consistent appearance of some food categories over the life course suggests that these foods are an integral part of the American food context and culture. As such, these key food categories make substantial contributions to shaping, either positively or negatively, the nutritional status of most Americans. Therefore, shifts in the nutritional composition of several food subcategories could have significant effects on the nutritional status of the population. For example, if changes in food choice, the food supply, and preparation techniques were strategically made, burgers and sandwiches could become a major way to increase the consumption of many food components and nutrients that are currently underconsumed, such as whole grains (fiber), vegetables, dairy, fish and seafood, and legumes. Changes in this food category could also decrease intakes of added sugars, saturated fats, and sodium. Small declines in added sugars and saturated fat intakes during the past decade suggest the needle has moved in positive ways. Leveraging the typical intake patterns of Americans to improve the quality of food components that make up usual choices in the diet could be the way to continue that progress across life stages.

Key Considerations

Beverages provide a considerable proportion of energy to the American diet, and high consumption of sweetened beverages has been related to lower diet quality and lower intakes of key food components. Given their extensive contribution toward added sugars intakes across all life stages, limited quantities of sweetened beverages, including not adding sugars to coffees and teas, should be encouraged. Excessive sodium is noted among all age-sex groups of Americans, primarily coming from “mixed dishes.” No one food is responsible for excessive sodium intake. Rather, it is the ubiquitous patterns of intakes from food subgroups high in sodium that are contributing to this issue. Sodium used in the processing of foods is the chief contributor to sodium, rather than sodium added by the consumer.

Understanding the context of eating is an important strategy to target behavior change. Most Americans consume 2 or 3 meals and 1 or 2 snacks on a given day (see ***Part D. Chapter 13***).

The timing of these eating occasions appears to coincide with traditional mealtimes and affects diet quality, but a paucity of data exists relative to chrono-nutrition. Previous research has associated temporal dietary patterns, or the distribution of energy and intake of food components over time,[99] to also have associations with diet quality. Indeed, in the Committee's review, late night eating occasions appear to be associated with intakes of foods or beverages that should be limited, such as added sugars, saturated fats, sodium, and alcoholic beverages. Adolescents and teenagers have notable differences in the timing and frequency of eating occasions. Given that this population is a subgroup with a high proportion of low nutrient intakes, future work is needed to help understand the relationships between timing and frequency of eating and diet quality.

SUMMARY

Diet is a modifiable factor that is critically relevant to the primary and secondary prevention of most non-communicable chronic diseases that are the leading causes of disability and death affecting Americans. Dietary intake also is an important determinant of body weight and risk of overweight and obesity. Development of overweight and obesity begin early in life and trigger development of the risk factors that such as hypertension, elevated blood glucose, insulin resistance and dyslipidemia that remain public health problems in all age groups.[101,102] Overweight and obesity are both a health outcome and a contributor to risk for most of the health outcomes that the Committee examined. Although increases in adiposity may have stabilized in the United States, overweight and obesity remain highly prevalent and a pressing public health challenge. The diet is quite complex, and the implications of dietary intake on risk of disease in the moment or later in life can be difficult to quantify. To both encourage and facilitate a healthy diet, the focus needs to be not only on what Americans choose to eat, but also on the social, economic, and environmental contexts that determine dietary patterns. These contexts also drive dietary, and consequently, health disparities that exist in the United States.

The 2020 Committee has come to realize that each individual life stage also holds unique implications for dietary intake and the risk of disease. In terms of life stages, while young infants appear to be generally well-nourished, some gaps exist. The risk of chronic disease begins early in life, with important health consequences for the fetus based on the dietary intake of the mother and subsequent feeding behaviors. Early life nutritional exposures have emerged as an etiological risk factor associated with later-life chronic disease risk. For example, breastfeeding has been associated with various patterns of intake that differ from infants receiving formula, and though infants appear to be generally well-nourished, these differences in feeding patterns leave room for improvement. Non-Hispanic Black infants are the least likely to be breastfed and have differential fruit and vegetable intake patterns starting early in life and continuing throughout the life course. This cumulative difference in feeding behavior for Black infants may set a course for higher risk of nutrition-related chronic disease that underpins many of the disparities seen today. Indeed, non-Hispanic Asian breastfeeding rates are higher and duration is longer; higher diet quality was observed among non-Hispanic Asians across all age groups examined. Differences in feeding are related to many factors that determine if or how long a woman breastfeeds a child. Data reviewed by the Committee did not include the context of such factors, but future research to better understand what drives the differences is of interest. Thus, concerted efforts to advance progress made in breastfeeding initiation and duration should continue, and culturally specific food recommendations are needed across the life course.

Diet quality is higher in young children but tends to decline with age throughout childhood and into adolescence. The poor diets of adolescent females are quite concerning, both at the individual level and for the potential intergenerational impacts. This life stage is associated with optimizing peak bone mass, which is one of the primary modifiable factors for risk of later life osteoporosis, which is highly prevalent in the United States. Moreover, as women transition into childbearing years, pre-pregnancy nutrition status relates to fetal health and nutrition. The interaction between the nutrition status of the mother and the health of the child is an important area for future research development. Risk of iron deficiency anemia among women who are pregnant and how that affects infant iron stores and cognitive development should be an area of priority, as most breastfed infants do not meet iron requirements from the diet alone and may depend on innate iron stores early in life. A noted lack of sample size from NHANES for women who are pregnant or lactating is an identified research need, as is the very limited availability of current biomarker data on women of reproductive age to address other food components that are of public health concern during pregnancy and lactation. Understanding how the diets of women who are pregnant or lactating shape dietary preferences of offspring is also an area for further investigation. Furthermore, a need exists for nationally-representative longitudinal data of mother-child dyads to fully understand the complexities of early life exposures to inform future editions of the *Dietary Guidelines for Americans*. More broadly, longitudinal data with multiple assessments of intake over time in the same population are needed to understand and characterize how patterns of intake at one stage of life influence or carry over into other stages. With this type of research, a better understanding could be gained of how to tailor initial dietary patterns to foster acceptance of fruits, vegetables, and whole grains, echoing the *2015-2020 Dietary Guidelines for Americans* recommendations.

The Committee identified several life stages that are at increased risk for suboptimal dietary intakes. Several key themes in existing food patterns could be addressed to optimize healthy choices. First, given the limited set of foods that provide energy and food components to limit, specific guidance to consumers to help shift typical choices toward more nutrient-dense versions should be a starting point. Second, given the differential patterns within food groups by age, race-ethnicity, and income, messages could be tailored to “meet people where they are” to help them make small, positive shifts. Inherent in this is that there is no one diet, or food group, or individual food to consume or avoid, but rather that it is possible to make any number of changes to move toward a similar healthy end. The Committee also recommends that the *2020-2025 Dietary Guidelines for Americans* provide very specific messaging around beverage intakes, with a focus on sweetened beverages and alcoholic beverages. Current food pattern modeling exercises typically do not include or address beverages, and consumers may be confused by a lack of specific guidance surrounding beverage choices. Lastly, because of investments in research that provide data on dietary intakes of Americans across the life course, the Committee can identify opportunities to use typical intake patterns that are part of the American cultural food context to improve the nutritional intake of the population. Changing the production of commonly-consumed foods to improve diet quality and nutrient density while decreasing excess energy is a strategic path towards improving population nutrition. These and other efforts to enhance dietary adherence to the dietary pattern recommendations deserve careful, quantitative evidence-based investigation during these next 5 years.

Table D1.4 Food components of public health concern — summary by life stage

Food Component (life stages)	**Dietary Intake Metric**	**Biochemical or Clinical Indicator**	**Associated Health Condition**	**Major food categories contributing to intake[1]**	**Food sources that are good sources[2]**
Fiber (ages 1 yr and older, including pregnant or lactating women)	% >AI	No reliable biochemical marker exists	Coronary heart disease	Mixed dishes (burgers/sandwiches), vegetable (non-starchy, starchy), grains (breakfast cereals/bars)	Vegetables, fruits, whole grains
Vitamin D[3] (ages 1 yr and older, including pregnant or lactating women)	% <EAR	Serum 25(OH) vitamin D concentrations	Impaired peak bone mass accrual; low bone mass and osteoporosis	Dairy (milk, yogurt), mixed dishes (burgers/sandwiches), and protein foods (eggs)	Some seafood, UV exposed mushrooms, fortified milk
Calcium[3] (ages 1 yr and older, including pregnant or lactating women)	% <EAR	No reliable biochemical marker exists	Impaired peak bone mass accrual; low bone mass and osteoporosis	Mixed dishes (burgers and sandwiches), dairy (milk, yogurt), beverages other than milk or 100% juice (waters)	Yogurt, fortified orange juice, cheese, sardines, milk
Potassium[3] (ages 1 yr and older, including pregnant or lactating women)	% >AI	24-hour urinary excretion	Hypertension and cardiovascular disease	Mixed dishes (burgers/sandwiches), vegetable (non-starchy, starchy), beverages (coffee/tea)	Apricots, lentils, prunes, squash, raisins
Sodium (ages 1 yr and older, including pregnant or lactating women)	% >CDRR	24-hour urinary excretion	Hypertension and cardiovascular disease	Mixed dishes (burgers/sandwiches), protein foods (poultry), vegetables (non-starchy)	
Saturated Fat (ages 2 yr and older, including pregnant or lactating women)	% >10 % TE	Total cholesterol; LDL cholesterol	Cardiovascular disease	Mixed dishes (burgers/sandwiches), desserts and sweet snacks, high fat dairy	
Added Sugars (ages 1 yr and older, including pregnant or lactating women)	% >10 % TE	No reliable biochemical marker exists	Overweight and obesity and related comorbidities	Sweetened beverages, desserts and sweet snacks, and coffee and tea	
Iron[3] (Infants fed human milk; adolescent, pre-menopausal, pregnant women)	% <EAR	Serum ferritin, soluble transferrin receptor, hemoglobin	Iron deficiency and iron deficiency anemia	Various heme and non-heme dietary sources of iron are consumed. Iron requirements are higher for vegetarian diets.	Meat, poultry, seafood, and fish, fortified breakfast cereal, legumes and pulses
Iodine (pregnant women)	% <EAR[5]	Urinary iodine concentrations	Impaired neurocognitive development	Goitrogens in the diet are relevant.	Seaweed, cod, yogurt, iodized salt, milk
Folic Acid (pregnant women, 1st trimester)	%<EAR	Serum and RBC folate	Neural tube defects	Vegetables (dark green), grains,	Spinach, liver, asparagus, Brussels sprouts, enriched grains.

AI=Adequate Intake; CDRR=Chronic Disease Risk Reduction; EAR=Estimated Average Requirement; RAF=reproductive-aged females; TE=total energy intakes.
[1]See Food Category Sources of Food Groups and Nutrients Data Supplement [https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis]
[2]Based on reference values provided in FoodData Central; values obtained at https://fdc.nal.usda.gov/ and based on the percent DV per serving
[3] FDA's designation as a nutrient of "public health significance."
[5] Iodine dietary data are not currently available in FNDDS

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