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# Data analysis protocols for the 2020 Dietary Guidelines Advisory Committee

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# DESCRIBE AND EVALUATE CURRENT DIETARY PATTERNS AND BEVERAGE CONSUMPTION: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: Describe and evaluate current dietary patterns and beverage consumption.

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency data analysis team.

This document includes details about the methodology as it was applied to the data analysis as follows:

- The [analytic framework](#) describes the overall scope of the question and approach used to describe food group and nutrient intakes
- The [analytic plan](#) details the data and subsequent included analyses
- The Advisory Committee's [analytic results](#) are summarized within Part D, Chapter 1 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report>
  - In addition, online-only supplements were prepared by the data analysis team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis>

## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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**Question:** Describe/evaluate current dietary patterns and beverage consumption.

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Dietary patterns will be described and evaluated in the following ways:

- The Healthy Eating Index – 2015 (HEI-2015) will be used to assess eating patterns of Americans ages 2+
  - Average HEI-2015 total and components scores
  - Distribution of HEI-2015 scores
- Food category contributions to total energy intake by age, sex, race and income

Beverage consumption will be described and evaluated in the following ways:

- Types of beverages consumed and their contribution to total beverage consumption
  - Percent of U.S. population consuming types of beverages on a given day
  - Volume of beverages consumed on a given day
  - Variations in beverage consumption by age-sex groups
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- Variations in beverage consumption by race-ethnicity
  - Variations in beverage consumption by income
  - Percent of energy and nutrients from beverage types
    - Energy (and percent of energy from macronutrients)
    - Macro/Micro nutrients
    - Other food components: e.g. added sugars, caffeine
- 

**Population:** Nationally representative sample of the U.S. population.

Life stages:

- Infants and toddlers (birth to <24 months)
- Children and adolescents (ages 2-19 years)
- Adults (ages 20-64 years)
- Pregnant women (20-44 years)
- Lactating women (20-44 years)
- Older adults (ages 65 years and older)

Note: Exceptions to age groupings will be specified.

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Demographic subgroups:

- Sex
  - Race-ethnicity
  - Socioeconomic status (e.g. income, education)
  - Food security status
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Data source:

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES); cross-sectional, nationally representative dietary intake data.

Data years:

The most recent cycle of WWEIA, NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. For some analyses, multiple cycles of data will be combined to describe “current” intakes (e.g. 2013-2016).

For analyses looking at change in dietary intake over time: the WWEIA 2003-2004 cycle will serve as the years for comparison, with exceptions noted to these data years.

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Key definitions:

**Stage of life** – The age groups defined by the NHANES sampling weights or by the DRI age-sex groups.

**Socioeconomic status** – Indicators of socioeconomic status may include income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or

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level of education.

**Beverage pattern** – The quantities, proportions, variety or combinations of different beverages in diets.

**Discrete beverage groups** –

- Milk: Plain and flavored milk, other dairy drinks and milk substitutes (Excludes milk or milk substitutes added to alcoholic beverages, coffee, tea, and/or foods such as cereal)
- 100% Juice: 100% fruit and/or vegetable juice.
- Coffee/tea: Regular and decaffeinated coffee or tea with additions such as milk, cream and/or sweeteners, and coffee and tea drinks, including ready-to-drink.
- Diet beverages: Diet soft drinks, diet sport/energy drinks and other diet drinks that are low- and no-calorie-sweetened, containing 40 kcal or less per reference amount customarily consumed.
- Sweetened beverages: Energy containing soft drinks, fruit drinks, and sports/energy drinks with added sugars that contain more than 40 kcal per reference amount customarily consumed.
  - Soft drinks: Energy-containing drinks made with carbonated water.
  - Fruit drinks: Energy-containing fruit and/or vegetable drinks that are not 100% juice.
  - Sports/energy drinks: Energy-containing sport/energy drinks, nutritional beverages and protein/nutritional powders consumed with a beverage, smoothies and grain drinks.
- Water: Tap, bottled, flavored, carbonated and enhanced/fortified water containing < 5kcal.
- Alcoholic beverages: Beer, wine, liqueur and cocktails.

**Reference amount customarily consumed (RACC)** – The serving size listed on a Nutrition Facts Label is based on a reference amount of food that is customarily eaten at a single eating occasion as determined by the Food and Drug Administration.

**Human milk** – Mother’s own milk provided at the breast (i.e., nursing) or expressed and fed fresh or after refrigeration/freezing; donor milk is not examined in this review

**Human milk feeding** – Feeding human milk alone or in combination with infant formula and/or complementary foods and beverages (CFB), such as cow’s milk

**Exclusive human milk feeding** – Feeding human milk alone and not in combination with infant formula and/or CFB such as cow’s milk; inclusive of WHO definitions of “exclusive” and “predominant” breastfeeding, which permit limited quantities of drops or syrups containing vitamins, minerals, or medicines; water and water-based drinks such as sweetened water and teas; fruit juice; oral rehydration salts solution; and ritual fluids

**Infant formula** – Commercially prepared infant formula meeting FDA and/or Codex Alimentarius international food standards

**Mixed feeding** – Feeding human milk and infant formula but not CFB such as cow’s milk

**Complementary foods and beverages (CFB)** – Foods and beverages other than human milk or infant formula (liquids, semisolids, and solids) provided to an infant or young child to provide nutrients and energy

# ANALYTIC PLAN

## Dietary Patterns

To describe and evaluate current dietary patterns in the U.S. population for each life-stage, analysis quantified intake patterns of food and beverage using WWEIA, NHANES dietary recall data and corresponding nutrient values from the USDA Food and Nutrient Database for Dietary Studies through the following analyses:

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### Birth to less than 24 months

Food group amounts per 100 calories of total complementary food intake among U.S. children ages 6<12 months and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula), using WWEIA, NHANES 2007-2016

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### Children (2-19 years)

Population average HEI-2015 total and component scores among U.S. children ages 2-19 years, by sex, race-ethnicity and family income using WWEIA, NHANES 2015-2016

Population usual intake distributions of total HEI-2015 scores among U.S. children ages 2-19 years using WWEIA, NHANES 2013-2016

Changes in population average HEI-2015 scores among U.S. children ages 2-19 years between WWEIA, NHANES 2005-2006 and 2015-2016

Food category sources contribution to total energy intake among U.S. children ages 2-19 years, WWEIA, NHANES 2013-2016

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### Adults (20 years and older)

Population average HEI-2015 total and component scores among U.S. adults ages 20 years and older, by sex, race-ethnicity and family income WWEIA, NHANES 2015-2016

Population usual intake distributions of total HEI-2015 scores among U.S. adults ages 20 years and older WWEIA, NHANES 2015-2016

Changes in population average HEI-2015 scores among U.S. adults 20 years and older between WWEIA, NHANES 2005-2006 and 2015-2016

Food category sources contribution to total energy intake among U.S. adults ages 20 years and older, WWEIA, NHANES 2013-2016

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## **Pregnant Women**

Population average HEI-2015 total and component scores among pregnant women in the U.S. using WWEIA, NHANES 2015-2016

Changes in population average HEI-2015 scores among pregnant women in the U.S. between WWEIA, NHANES 2005-2006 and 2015-2016

Food category sources contribution to total energy intake among pregnant women in the U.S. using WWEIA, NHANES 2013-2016

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## **Lactating Women**

Population average HEI-2015 total and component scores among lactating women in the U.S. using WWEIA, NHANES 2013-2016

Changes in population average HEI-2015 scores among lactating women in the U.S. between WWEIA, NHANES 2005-2006 and 2015-2016

Food category sources contribution to total energy intake among lactating women in the U.S. using WWEIA, NHANES 2013-2016

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## **Beverage Consumption**

To describe and evaluate current beverage consumption in the U.S. population for each life-stage, analysis quantified intakes of beverage using WWEIA, NHANES dietary recall data and corresponding nutrient and food component values from the USDA Food and Nutrient Database for Dietary Studies through the following analyses:

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### **Birth to less than 24 months**

Percent of infants ages 6<12 and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula), who consumed beverage types on a given day using WWEIA, NHANES 2007-2016

Mean daily beverage intake (fluid ounces) by beverage type among infants ages 6<12 and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula), using WWEIA, NHANES 2007-2016

Percent of mean daily energy and selected nutrient and food component intakes contributed by beverages among U.S. children ages 6<12 months and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula), using WWEIA, NHANES 2007-2016

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## **Children (2-19 years)**

Percent of children (2-19 years) who consumed beverage types on a given day WWEIA, NHANES 2015-2016

Sweetened beverage consumption by race and age among U.S. children ages 2-19 years, WWEIA, NHANES 2015-2016

Mean daily beverage intake (fluid ounces) by beverage type among U.S. children ages 2-19 years using WWEIA, NHANES 2015-2016

Percent of mean daily energy and selected nutrient and food component intakes contributed by beverages among U.S. children ages 2-19 years using WWEIA, NHANES 2015-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by discrete beverage type among the U.S. population of children ages 2-19 years, WWEIA, NHANES 2015-2016

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## **Adults (20 years and older)**

Percent of adults (20 years and older) who consumed beverage types on a given day, by age and race-ethnicity WWEIA, NHANES 2015-2016

Sweetened beverage consumption by race and age among U.S. adults ages 20 years and older, WWEIA, NHANES 2015-2016

Mean daily beverage intake (fluid ounces) by beverage type among U.S. adults ages 20 years and older using WWEIA, NHANES 2015-2016

Percent of mean daily energy and selected nutrient and food component intakes contributed by beverages among U.S. adults ages 20 years and older, by age and sex using WWEIA, NHANES 2015-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by discrete beverage type among the U.S. population of adults ages 20 years and older, by age and sex, WWEIA, NHANES 2015-2016

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## **Pregnant Women**

Percent of pregnant women who consumed beverage types on a given day WWEIA, NHANES 2013-2016

Sweetened beverage consumption by race among U.S. pregnant women, WWEIA, NHANES 2013-2016

Mean daily beverage intake (fluid ounces) by beverage type among U.S. pregnant women using WWEIA, NHANES 2013-2016

Percent of mean daily energy and selected nutrient and food component intakes contributed by beverages among U.S. pregnant women using WWEIA, NHANES 2013-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by discrete beverage type among the U.S. population of pregnant women, WWEIA, NHANES 2013-2016

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## **Lactating Women**

Percent of lactating women who consumed beverage types on a given day WWEIA, NHANES 2013-2016

Sweetened beverage consumption by race among U.S. lactating women, WWEIA, NHANES 2013-2016

Mean daily beverage intake (fluid ounces) by beverage type among U.S. lactating women using WWEIA, NHANES 2013-2016

Percent of mean daily energy and selected nutrient and food component intakes contributed by beverages among U.S. lactating women using WWEIA, NHANES 2013-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by discrete beverage type among the U.S. population of lactating women, WWEIA, NHANES 2013-2016

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# DESCRIBE AND EVALUATE CURRENT INTAKES OF FOOD GROUPS AND NUTRIENTS: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: Describe and evaluate current intakes of food groups and nutrients.

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency data analysis team.

This document includes details about the methodology as it was applied to the data analysis as follows:

- The [analytic framework](#) describes the overall scope of the question and approach used to describe food group and nutrient intakes
- The [analytic plan](#) details the data and subsequent included analyses
- The Advisory Committee's [analytic results](#) are summarized within Part D, Chapter 1 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report>
  - In addition, online-only supplements were prepared by the data analysis team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis>

## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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**Question:** Describe and evaluate current intakes of food groups and nutrients.

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Food group intakes will be described and evaluated in the following ways:

- Mean intakes of food groups and subgroups
  - Prevalence of reported food groups and subgroups for infants and toddlers (ages birth <24 months)
  - Usual intake distributions of food groups and subgroups
  - Food category sources of food group intakes
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- Current food group intakes compared to existing food group recommendations<sup>i</sup>
  - Changes in food group intakes over time

Nutrient intakes will be described and evaluated in the following ways:

- Mean intakes of nutrients from foods and beverages
  - Mean intakes of nutrients from foods, beverages and dietary supplements
  - Usual intake distribution of nutrients from foods and beverage
  - Usual intake distribution of nutrients from foods, beverages and dietary supplements
  - Current nutrient intakes from foods and beverage compared to Dietary Reference Intakes<sup>ii</sup>
  - Food category sources of nutrient intakes, limited to nutrients of public health concern
  - Changes in nutrient intakes over time, limited to nutrients of public health concern
- 

**Population:** Nationally representative sample of the U.S. population.

Life stages:

- Infants and toddlers (birth to <24 months)
- Children and adolescents (ages 2-19 years)
- Adults (ages 20-64 years)
- Pregnant Women
- Lactating Women
- Older Adults (ages 65 years and older)

NOTE: Exceptions to age groupings will be specified.

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Demographic subgroups:

- Sex
  - Race-ethnicity
  - Indicators of socioeconomic status
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<sup>i</sup> [USDA Food Patterns Summary Table, 2015-2020 Dietary Guidelines for Americans: https://fns-prod.azureedge.net/sites/default/files/usda\\_food\\_patterns/USDAFoodPatternsSummaryTable.pdf](https://fns-prod.azureedge.net/sites/default/files/usda_food_patterns/USDAFoodPatternsSummaryTable.pdf)

<sup>ii</sup> National Academies of Science Engineering and Medicine, Health and Medicine Division Dietary Reference Intakes: <https://www.ncbi.nlm.nih.gov/books/NBK222890/>

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Data Source:

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES); cross-sectional, nationally representative dietary intake data.

Data years:

The most recent cycle of WWEIA, NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. For some analyses, multiple cycles of data will be combined to describe “current” intakes (e.g. 2013-2016).

For analyses looking at change in dietary intake over time: the WWEIA 2003-2004 cycle will serve as the years for comparison. Exceptions to these data years will be noted.

Data Source:

National Immunization Survey; cross sectional, nationally representative survey that includes data on breastfeeding initiation and duration.

Data Years:

Data collected in 2017-2018 will be used to determine national estimates of breastfeeding initiation and duration.

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Key definitions:

**Stage of life:** The age groups defined by the NHANES sampling weights or by the DRI age-sex groups

**Socioeconomic status:** Indicators of socioeconomic status may include income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or level of education

**Human milk** – Mother’s own milk provided at the breast (i.e., nursing) or expressed and fed fresh or after refrigeration/ freezing; donor milk is not examined in this review

**Human milk feeding** – Feeding human milk alone or in combination with infant formula and/or complementary foods and beverages (CFB), such as cow’s milk

**Exclusive human milk feeding** – Feeding human milk alone and not in combination with infant formula and/or CFB such as cow’s milk; inclusive of WHO definitions of “exclusive” and “predominant” breastfeeding, which permit limited quantities of drops or syrups containing vitamins, minerals, or medicines; water and water-based drinks such as sweetened water and teas; fruit juice; oral rehydration salts solution; and ritual fluids

**Infant formula** – Commercially prepared infant formula meeting FDA and/or Codex Alimentarius international food standards

**Mixed feeding** – Feeding human milk and infant formula but not CFB such as cow’s milk

**Complementary foods and beverages (CFB)** – Foods and beverages other than human milk or

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infant formula (liquids, semisolids, and solids) provided to an infant or young child to provide nutrients and energy

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## **ANALYTIC PLAN**

### **Food Group Intakes**

The following analyses were used to describe and evaluate current food group intakes in the U.S. population for each life-stage:

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#### **Birth to less than 24 months**

Population average intakes of food groups and subgroups from complementary foods and beverages among U.S. Children ages 6<12 and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula) using WWEIA, NHANES 2007-2016

Prevalence of reported food group and subgroup intakes among U.S. Children ages 6<12 and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula) using WWEIA, NHANES 2007-2016

Food category sources of food groups and subgroups from complementary foods and beverages among U.S. Children ages 6<12 and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula) using WWEIA, NHANES 2007-2016

Breast feeding initiation and duration among infants in the U.S. National Immunization Survey 2017-2018

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## Children (2-19 years)

Population average intakes of food groups and subgroups among U.S. Children ages 2-19 years using WWEIA, NHANES, 2015-2016

- by Sex and Age
- by Race/Ethnicity and Age
- by Family Income in Dollars and Age
- by Family Income as % of Poverty Level and Age

Population usual intake distributions of food groups and subgroups among U.S. Children ages 2-19 years using WWEIA, NHANES 2013-2016

- by Sex and Age

Percent of the U.S. population of children (ages 2-19 years) that meets food group recommendations in the currently available USDA Food Patterns using WWEIA, NHANES 2013-2016

- by Sex and Age

Changes in average food group intakes among U.S. Children ages 2-19 years between WWEIA, NHANES 2003-2004 and 2015-2016

WWEIA Food Category Sources of food group intakes among U.S. Children ages 2-19 years, WWEIA, NHANES 2013-2016

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## Adults (20-64 years)

Population average intakes of food groups and subgroups among U.S. Adults ages 20-69 years using WWEIA, NHANES, 2015-2016

- by Sex and Age
- by Race/Ethnicity and Age
- by Family Income in Dollars and Age
- by Family Income as % of Poverty Level and Age

Population usual intake distributions of food groups and subgroups among U.S. Adults ages 20-70 years using WWEIA, NHANES 2013-2016

- by Sex and Age

Percent of the U.S. population of adults (ages 20-70 years) that meets food group recommendations in the currently available USDA Food Patterns using WWEIA, NHANES 2013-2016

- by Sex and Age
-

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Changes in average food group intakes among U.S. Adults ages 20-64 years between WWEIA, NHANES 2003-2004 and 2015-2016

WWEIA Food Category Sources of food group intakes among U.S. Adults ages 20-71 years, WWEIA, NHANES 2013-2015

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### **Older Adults (65 years and older)**

Population average intakes of food groups and subgroups among U.S. Older Adults ages 70 years and older using WWEIA, NHANES, 2015-2016

- by Sex and Age
- by Race/Ethnicity and Age
- by Family Income in Dollars and Age
- by Family Income as % of Poverty Level and Age

Population usual intake distributions of food groups and subgroups among U.S. Older Adults ages 71 years and older using WWEIA, NHANES 2013-2016

- by Sex and Age

Percent of the U.S. population of Older Adults ages 71 years and older that meets food group recommendations in the currently available USDA Food Patterns using WWEIA, NHANES 2013-2016

- by Sex and Age

Changes in average food group intakes among U.S. older adults ages 65 years and older between WWEIA, NHANES 2003-2004 and 2015-2016

WWEIA Food Category Sources of food group intakes among U.S. Older Adults ages 71 years and older, WWEIA, NHANES 2013-2016

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### **Pregnant Women**

Population average intakes of food groups and subgroups among pregnant women in the U.S. using WWEIA, NHANES, 2015-2016

Population usual intake distributions of food groups and subgroups among pregnant women in the U.S. using WWEIA, NHANES 2013-2016

Changes in average food group intakes among pregnant women in the U.S. between WWEIA, NHANES 2003-2004 and 2015-2016

WWEIA Food Category Sources of food group intakes among pregnant women in the U.S. using WWEIA, NHANES 2013-2016

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## Lactating Women

Population average intakes of food groups and subgroups among lactating women in the U.S. using WWEIA, NHANES, 2013-2016

Population usual intake distributions of food groups and subgroups among lactating women in the U.S. using WWEIA, NHANES 2013-2016

Changes in average food group intakes among lactating women in the U.S. between WWEIA, NHANES 2003-2004 and 2015-2016

WWEIA Food Category Sources of food group intakes among lactating women in the U.S. using WWEIA, NHANES 2013-2016

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## Nutrient Intakes

To describe and evaluate current nutrient intakes in the U.S. population for each life-stage, analysis will quantify intakes of nutrients from food and beverage using WWEIA, NHANES dietary recall data and corresponding nutrient values from the USDA Food and Nutrient Database for Dietary Studies through the following analyses:

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### Infants 6 to less than 24 months

Population average nutrient intakes from complementary food and beverages among U.S. children ages 6<12 months and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula), using WWEIA, NHANES 2007-2016

Population total usual nutrient intake distributions from infant milk source, food and beverages among U.S. children ages 6<12 months, total and stratified by infant milk source (i.e. human milk and/or infant formula), using WWEIA, NHANES 2007-2016

Comparison of total estimated nutrient intakes to DRIs among U.S. children ages 6<12 months by infant milk source using WWEIA, NHANES 2007-2016

Food category sources of nutrients/food components, among U.S. Children ages 6<12 months and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula) using WWEIA, NHANES 2007-2016

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## Children ages 1-18 years

Population average nutrient intakes from food and beverage among U.S. Children ages 1-18 years using WWEIA, NHANES 2015-2016

- by Sex and Age
- by Race/Ethnicity and Age
- by Family Income in Dollars and Age
- by Family Income as % of Poverty Level and Age

Population average nutrient intakes from food and beverage and dietary supplements among U.S. Children ages 1-18 years using WWEIA, NHANES 2015-2016

- by Sex and Age

Population usual nutrient intake distributions from food and beverage among U.S. Children ages 1-18 years using WWEIA, NHANES 2013-2016

- by Race/Ethnicity and Age
- by Family Income as % of Poverty Level and Age

Population usual nutrient intake distributions from food and beverage and dietary supplements among U.S. Children ages 1-18 years using WWEIA, NHANES 2013-2016

- by Sex and Age

Comparison of nutrient intakes in the U.S. population of children ages 1-18 years to Dietary Reference Intakes

- by Sex and Age

Changes in population average intakes of nutrients from foods and beverages between 2009-2010 and 2015-2016 among U.S. Children ages 1-18 years, limited to nutrients of public health concern

- by Sex and Age

WWEIA Food Category Sources of nutrients among U.S. Children ages 1-18 years, WWEIA, NHANES 2013-2016, limited to nutrients of public health concern

- by Sex and Age
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## Adults and Older Adults ages 19 years and older<sup>iii</sup>

Population average nutrient intakes from food and beverage among U.S. Adults ages 20 years and older using WWEIA, NHANES 2015-2016

- by Sex and Age
- by Race/Ethnicity and Age
- by Family Income in Dollars and Age
- by Family Income as % of Poverty Level and Age

Population average nutrient intakes from food and beverage and dietary supplements among U.S. Adults ages 20 years and older using WWEIA, NHANES 2015-2016

- by Sex and Age

Population usual nutrient intake distributions from food and beverage among U.S. Adults ages 19 years and older using WWEIA, NHANES 2013-2016

- by Sex and Age

Population usual nutrient intake distributions from food and beverage and dietary supplements among U.S. Adults ages 19 years and older using WWEIA, NHANES 2013-2016

- by Sex and Age

Comparison of nutrient intakes in the U.S. population of adults ages 19 years and older to Dietary Reference Intakes

- by Sex and Age

Changes in population average nutrient intake from foods and beverages between 2009-2010 and 2015-2016 among U.S. Adults ages 20 years and older, limited to nutrients of public health concern

- by Sex and Age

WWEIA Food Category Sources of nutrients among U.S. Adults ages 19 years and older, WWEIA, NHANES 2013-2016, limited to nutrients of public health concern

- by Sex and Age
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<sup>iii</sup> Due to age grouping differences by NHANES sampling driven age groups and the age-sex groups used in the Dietary Reference intakes, adults and older adults are presented together. The ages grouping for each analysis are noted.

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## **Pregnant Women**

Population average nutrient intakes from food and beverage among pregnant women in the U.S. using WWEIA, NHANES 2013-2016

Population average nutrient intakes from food and beverage and dietary supplements among pregnant women in the U.S. using WWEIA, NHANES 2013-2016

Population usual nutrient intake distributions from food and beverage among pregnant women in the U.S. using WWEIA, NHANES 2013-2016

Population usual nutrient intake distributions from food and beverage and dietary supplements among pregnant women in the U.S. using WWEIA, NHANES 2013-2016

Comparison of nutrient intakes in the U.S. population of pregnant women to Dietary Reference Intakes

WWEIA Food Category Sources of nutrients among pregnant women in the U.S., WWEIA, NHANES 2013-2016, limited to nutrients of public health concern

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## **Lactating Women**

Population average nutrient intakes from food and beverage among lactating women in the U.S. using WWEIA, NHANES 2013-2016

Population average nutrient intakes from food and beverage and dietary supplements among lactating women in the U.S. using WWEIA, NHANES 2013-2016

Population usual nutrient intake distributions from food and beverage among lactating women in the U.S. using WWEIA, NHANES 2013-2016

Population usual nutrient intake distributions from food and beverage and dietary supplements among lactating women in the U.S. using WWEIA, NHANES 2013-2016

Comparison of nutrient intakes in the U.S. population of lactating women to Dietary Reference Intakes

WWEIA Food Category Sources of nutrients among lactating women in the U.S., WWEIA, NHANES 2013-2016, limited to nutrients of public health concern

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# DESCRIBE AND EVALUATE NUTRIENTS OF PUBLIC HEALTH CONCERN: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: Describe and evaluate nutrients of public health concern.

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency data analysis team.

This document includes details about the methodology as it was applied to the data analysis as follows:

- The [analytic framework](#) describes the overall scope of the question and approach used to describe food group and nutrient intakes
- The [analytic plan](#) details the data and subsequent included analyses
- The Advisory Committee's [analytic results](#) are summarized within Part D, Chapter 1 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report>
  - In addition, online-only supplements were prepared by the data analysis team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis>

## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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**Question:** Describe and evaluate nutrients of public health concern.

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A three pronged approach will be used to determine nutrients of public health concern:

1. Estimate prevalence of inadequate and excessive nutrient intakes by comparing current distribution of nutrient intakes in the U.S. population to [Dietary Reference Intakes published by the National Academies of Sciences](#).

Nutrient intakes from food and beverages alone as well as the additional contribution of nutrient from intakes of dietary supplements.

- For nutrients with an Estimated Average Requirement (EAR), the estimated prevalence of inadequate intakes will be determined using the EAR cut-point method for nutrients with an EAR. Iron in menstruating women will be evaluated with the probability approach.
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- For nutrients with an Adequate Intake (AI), mean nutrient intakes will be compared to the AI to determine the estimated prevalence above the AI.
  - For nutrients with a Tolerable Upper Intake Level (UL) or Chronic Disease Risk Reduction (CDRR) intake, the estimated prevalence of potentially excessive intakes will be determined by examining the percent of the population with intakes above the UL or CDRR.
  - For nutrients with an Acceptable Macronutrient Distribution Range (AMDR), the estimated prevalence of the population with intakes outside of the range will be evaluated.
  - Percent energy contributed from added sugars and saturated fat will be compared to the 2015-2020 *Dietary Guidelines for Americans* recommendations of <10% of total energy from each nutrient.
2. When available, consider biological endpoints or validated surrogate endpoints such as biochemical indices of nutrient status with valid cut-points in addition to dietary intakes of nutrients.
  3. Consider scientific evidence on the relationship between nutrient inadequacy or excess and clinical health consequences (e.g. cardiovascular disease, cancer).
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**Population:** Nationally representative sample of the U.S. population.

Life stages:

- Infants and toddlers (birth to <24 months)
- Children and adolescents (ages 2-18 years)
- Adults (ages 19-64 years)
- Pregnant women (ages 20-44 years) self-reported pregnancy status and/or positive urinary pregnancy test
- Lactating women (ages 20-44 years)
- Older adults (ages 65 years and older)

\*NOTE: Age ranges may vary and will be specified in analytic plan

Demographic subgroups:

- Sex
  - Race-ethnicity
  - Socioeconomic status i.e. income, education
  - Household food security
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Data Source:

*Biochemical Indicators*

National Health and Nutrition Examination Survey (NHANES); cross-sectional, nationally representative biomarkers of nutrient status.

Data years: 2013-2016, exceptions to these data years will be noted.

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## Nutrient Intakes

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES); cross-sectional, nationally representative dietary intake data.

*Data years:* 2013-2016, exceptions to these data years will be noted.

The most recent cycle of NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. Two cycles will be combined (WWEIA, NHANES 2013-2016) to calculate distributions of nutrient intakes and other analyses when noted.

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### Key definitions:

**Dietary Reference Intakes (DRI)** – nutrient reference values developed by the National Academies of Sciences, Engineering and Medicine that are specified on the basis of age, sex and life stage and cover more than 40 nutrient substances.

**Acceptable Macronutrient Distribution Range (AMDR)** – is the range of intake for a particular energy source that is associated with reduced risk of chronic disease while providing intakes of essential nutrients. If an individual consumes in excess of the AMDR, there is a potential of increasing the risk of chronic diseases and/or insufficient intakes of essential nutrients.

**Estimated Average Requirement (EAR)** – the average daily nutrient intake level estimated to meet the requirements of half of the healthy individuals in a group.

**Recommended Dietary Allowance (RDA)** – average daily dietary intake level sufficient to meet the nutrient requirements of nearly all (97-98%) healthy individuals in a group.

**Adequate Intake (AI)** – established when evidence is insufficient to develop an RDA and is set at a level assumed to ensure nutritional adequacy.

**Tolerable Upper Intake Level (UL)** – maximum daily intake unlikely to cause adverse health effects to almost all individuals in the general population.

**Chronic Disease Risk Reduction (CDRR)** – lowest level of intake for which there is sufficient strength of evidence to characterize a chronic disease risk reduction.

**Nutrients of public health concern** – Nutrients that are overconsumed (compared to the DRI UL or CDRR or AMDR or percent of energy recommendations and to biological measures of the nutrient when available) or under consumed (compared to the DRI EAR/AI/AMDR and to biological measures of the nutrient when available), and linked in the scientific literature to adverse health outcomes in the general population or in a subpopulation.

**Human milk** – Mother’s own milk provided at the breast (i.e., nursing) or expressed and fed fresh or after refrigeration/ freezing; donor milk is not examined in this review

**Human milk feeding** – Feeding human milk alone or in combination with infant formula and/or complementary foods and beverages (CFB) such as cow’s milk

**Exclusive human milk feeding** – Feeding human milk alone and not in combination with infant formula and/or CFB such as cow’s milk; inclusive of WHO definitions of “exclusive” and

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“predominant” breastfeeding, which permit limited quantities of drops or syrups containing vitamins, minerals, or medicines; water and water-based drinks such as sweetened water and teas; fruit juice; oral rehydration salts solution; and ritual fluids

**Infant formula** – Commercially prepared infant formula meeting FDA and/or Codex Alimentarius international food standards

**Mixed feeding** – Feeding human milk and infant formula but not CFB such as cow’s milk

**Complementary foods and beverages (CFB)** – Foods and beverages other than human milk or infant formula (liquids, semisolids, and solids) provided to an infant or young child to provide nutrients and energy

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## ANALYTIC PLAN

To describe and evaluate nutrients of public health concern in the U.S. population for each life-stage, analysis quantified intake of nutrients using WWEIA, NHANES dietary recall data and corresponding nutrient values from the USDA Food and Nutrient Database for Dietary Studies and the Dietary Supplement Database. Biochemical indicators of nutrition status were assessed using laboratory data from NHANES<sup>iv</sup>.

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### Infants 6 to less than 12 months of age

Population total usual nutrient intake distributions from infant milk source, food and beverages among U.S. children ages 6<12 months, total and stratified by infant milk source (i.e. human milk and/or infant formula), using WWEIA, NHANES 2007-2016

Population total usual nutrient intake distributions from infant milk source, food and beverages as well as dietary supplements among U.S. children ages 6<12 months, total and stratified by infant milk source (i.e. human milk and/or infant formula), using WWEIA, NHANES 2007-2016

Comparison of total estimated nutrient intakes, with and without dietary supplements to DRIs among U.S. children ages 6<12 months by infant milk source using WWEIA, NHANES 2007-2016

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<sup>iv</sup> [https://wwwn.cdc.gov/nchs/data/nhanes/survey\\_contents.pdf](https://wwwn.cdc.gov/nchs/data/nhanes/survey_contents.pdf)

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## **Children (1-18 years, exceptions noted)**

Usual intake distributions of nutrient intakes from foods and beverage among children ages 1-18 years, by sex using WWEIA, NHANES 2013-2016

Usual intake distributions of nutrient intakes from foods and beverage and dietary supplements among children ages 1-18 years, by sex using WWEIA, NHANES 2013-2016

Prevalence (in percent) of low serum ferritin concentration for children in the U.S. population aged 1–19 years, NHANES, 2013–2016

Prevalence (in percent) of high serum ferritin concentration for children in the U.S. population aged 1–19 years, NHANES, 2013–2016

Prevalence (in percent) of high serum soluble transferrin receptor concentration in the U.S. population of children 1-5 years, females 12–19 years, NHANES 2013-2016

Prevalence (in percent) of low folate (RBC) concentration in the U.S. population of children ages 1 – 18 years, by sex, NHANES 2013-2016

Prevalence (in percent) of low serum folate concentration in the U.S. population of children ages 1 – 18 years, by sex, NHANES 2013-2016

Prevalence (in percent) of low serum copper concentration in the U.S. population of children ages 6 -18 years, NHANES 2013-2016

Prevalence (in percent) of low serum zinc concentration in the U.S. population of children ages 6-18 years, by sex NHANES 2013-2016

Prevalence (in percent) of low vitamin D (serum 25-hydroxyvitamin D) in the U.S. population of children ages 1-18 years, by sex NHANES 2013-2016

Prevalence (in percent) of low serum vitamin A and/or carotenoids in the U.S. population of children ages 6-19 years, NHANES 2005-2006

Prevalence (in percent) of low serum vitamin C in the U.S. population of children ages 6-19 years, NHANES 2003-2006

Prevalence (in percent) of low serum vitamin E in the U.S. population of children ages 6-19 years, NHANES 2005-2006

Prevalence (in percent) of low serum vitamin B12 in the U.S. population of children ages 1-19 years, NHANES 2003-2006

Prevalence (in percent) of low serum vitamin B6 (serum pyridoxal-5'-phosphate) in the U.S. population of children ages 1-19 years, by sex NHANES 2005-2006

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## **Adults (20 years and older, exceptions noted)**

Usual intake distributions of nutrient intakes from foods and beverage among adults ages 19

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years and older, by sex using WWEIA, NHANES 2013-2016

Usual intake distributions of nutrient intakes from foods and beverage and dietary supplements among adults ages 19 years and older, by sex using WWEIA, NHANES 2013-2016

Prevalence (in percent) of low serum ferritin concentration for women in the U.S. population aged 20–49 years, NHANES 2013-2016

Prevalence (in percent) of high serum ferritin concentration for women in the U.S. population aged 20–49 years, NHANES 2013-2016

Prevalence (in percent) of high serum soluble transferrin receptor concentration for women in the U.S. population aged 20–49 years, NHANES 2013-2016

Prevalence (in percent) of low folate (RBC) concentration in the U.S. population of adults ages 19 years and older, by sex, NHANES 2013-2016

Prevalence (in percent) of low serum folate concentration in the U.S. population of adults ages 19 years and older, by sex, NHANES 2013-2016

Prevalence (in percent) of high unmetabolized folic acid concentrations in the U.S. population of adults ages 19 and older, by sex, NHANES 2011-2012

Prevalence (in percent) of low serum copper concentration in the U.S. population of adults ages 19 years and older, by sex, NHANES 2013-2016

Prevalence (in percent) of low serum zinc concentration in the U.S. population of adults ages 19 years and older, by sex, NHANES 2013-2016

Prevalence (in percent) of low vitamin B12 status in the U.S. population of adults ages 19 years and older, by age and sex, NHANES 2013-2014

Prevalence (in percent) of high methylmalonic acid in the U.S. population of adults ages 19 years and older, by age and sex, NHANES 2013-2014

Prevalence (in percent) of low vitamin D (serum 25-hydroxyvitamin D) status in the U.S. population of adults ages 20-70 years, by sex, NHANES 2013-2014

Prevalence (in percent) of low serum vitamin A and/or carotenoids in the U.S. population of women ages 20-59 years, NHANES 2005-2006

Prevalence (in percent) of low serum vitamin C in the U.S. population of adults ages 20-59 years, by sex, NHANES 2003-2006

Prevalence (in percent) of low serum vitamin E in the U.S. population of adults ages 40-59 years, by sex, NHANES 2005-2006

Prevalence (in percent) of low serum vitamin B6 (serum pyridoxal-5'-phosphate) in the U.S. population of adults ages 20-59 years, by sex, NHANES 2005-2006

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## Pregnant Women

Usual intake distributions of nutrient intakes from foods and beverage among pregnant women using WWEIA, NHANES 2013-2016

Usual intake distributions of nutrient intakes from foods and beverage and dietary supplements among pregnant women using WWEIA, NHANES 2013-2016

Prevalence (in percent) of low serum ferritin concentration for pregnant women in the U.S. population, NHANES 2013-2016

Prevalence (in percent) of high serum ferritin concentration for pregnant women in the U.S. population aged 20–49 years, NHANES 2013-2016

Prevalence (in percent) of high serum soluble transferrin receptor concentration for pregnant women in the U.S. population, NHANES 2013-2016

Prevalence (in percent) of low folate (RBC) concentration in the U.S. population of pregnant women, NHANES 2013-2016

Prevalence (in percent) of low serum folate concentration in the U.S. population of pregnant women, NHANES 2013-2016

Prevalence (in percent) of high unmetabolized folic acid concentrations in the U.S. population of pregnant women, NHANES 2011-2012

Prevalence (in percent) of low serum copper concentration in the U.S. population of pregnant women, NHANES 2013-2016

Prevalence (in percent) of low serum zinc concentration in the U.S. population of pregnant women, NHANES 2013-2016

Prevalence (in percent) of low vitamin B12 status in the U.S. population of pregnant women, NHANES 2013-2014

Prevalence (in percent) of high methylmalonic acid in the U.S. population of pregnant women, NHANES 2013-2014

Prevalence (in percent) of low vitamin D (serum 25-hydroxyvitamin D) status in the U.S. population of pregnant women, NHANES 2013-2014

Median urinary iodine status among pregnant women in the U.S., NHANES 2013-2016

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## Lactating Women

Usual intake distributions of nutrient intakes from foods and beverage among lactating women using WWEIA, NHANES 2013-2016

Usual intake distributions of nutrient intakes from foods and beverage and dietary supplements among lactating women using WWEIA, NHANES 2013-2016

Prevalence (in percent) of low serum ferritin concentration for lactating women in the U.S. population, NHANES 2013-2016

Prevalence (in percent) of high serum ferritin concentration for lactating women in the U.S. population aged 20–49 years, NHANES 2013-2016

Prevalence (in percent) of high serum soluble transferrin receptor concentration for lactating women in the U.S. population, NHANES 2013-2016

Prevalence (in percent) of low folate (RBC) concentration in the U.S. population of lactating women, NHANES 2013-2016

Prevalence (in percent) of low serum folate concentration in the U.S. population of lactating women, NHANES 2013-2016

Prevalence (in percent) of low serum copper concentration in the U.S. population of lactating women, NHANES 2013-2016

Prevalence (in percent) of low serum zinc concentration in the U.S. population of lactating women, NHANES 2013-2016

Prevalence (in percent) of low vitamin B12 status in the U.S. population of lactating women, NHANES 2013-2014

Prevalence (in percent) of high methylmalonic acid in the U.S. population of lactating women, NHANES 2013-2014

Prevalence (in percent) of low vitamin D (serum 25-hydroxyvitamin D) status in the U.S. population of lactating women, NHANES 2013-2014

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# DESCRIBE AND EVALUATE PREVALENCE OF NUTRITION-RELATED CHRONIC HEALTH CONDITIONS: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: Describe and evaluate prevalence of nutrition-related chronic health conditions.

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency data analysis team.

This document includes details about the methodology as it was applied to the data analysis as follows:

- The [analytic framework](#) describes the overall scope of the question and approach used to describe prevalence of nutrition-related chronic health conditions
- The [analytic plan](#) details the data and subsequent included analyses
- The Advisory Committee's [analytic results](#) are summarized within Part D, Chapter 1 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report>
  - In addition, online-only supplements were prepared by the data analysis team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis>

## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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**Question:** Describe and evaluate prevalence of nutrition-related chronic health conditions.

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The prevalence of nutrition-related chronic health conditions are outcomes being examined as part of the data analysis approach. These will be described using nationally representative data descriptive of the U.S. population. The following categories of nutrition-related chronic health conditions will be considered:

- Growth, Size and Body Composition Outcomes
  - Food Allergy Disease Outcomes
  - Cardiovascular Intermediate and Endpoint Outcomes
  - Cancer Outcomes
  - Type 2 Diabetes
  - Metabolic Syndrome
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- Chronic Liver Disease
  - Dentition
  - Osteoporosis
  - Sarcopenia
  - Gestational Diabetes
  - Pregnancy-related Hypertensive Disorders
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**Population:** Nationally representative sample of the U.S. population.

Life stages:

- Infants and toddlers (birth to <24 months)
- Children and adolescents (ages 2-19 years)
- Adults (ages 20-64 years)
- Pregnant women (ages 20-44 years)
- Older adults (ages 65 years and older)

Demographic subgroups:

- Sex
- Race/ethnicity
- Socioeconomic status

NOTE: Exceptions to age groupings will be specified.

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Data Sources:

The prevalence of nutrition-related chronic health conditions will be described using the following data sources. The data source will be specified in the Analytic Plan.

**National Health and Nutrition Examination Survey (NHANES);** cross-sectional, nationally representative survey that includes both laboratory and questionnaire data.

Data years: 2013-2014, 2015-2016.

The most recent cycle of NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. Exceptions will be noted.

**National Health Interview Survey (NHIS);** cross-sectional, nationally representative household interview survey.

NHIS survey data collected in 2017 will be the most current data available for consideration by the Committee. Exceptions will be noted.

**National Vital Statistics System (NVSS);** cross-sectional data provided by the CDC National Center for Health Statistics through contracts with systems legally responsible for the registration of vital events – births, deaths, marriages, divorces, and fetal deaths.

NVSS data from 2017 will be the most current data available for consideration by the Committee.

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Exceptions will be noted.

**Pregnancy Risk Assessment Monitoring System (PRAMS);** cross-sectional data on maternal behaviors, attitudes, and experiences before, during and shortly after pregnancy. The CDC Division of Reproductive Health in collaboration with state health departments conduct this surveillance survey which covers 83% of live births.

PRAMS 2017 is the most recently released data available for consideration by the Committee. Exceptions will be noted.

**Surveillance Epidemiology End Results (SEER);** cancer statistics in the U.S. population. SEER is supported by the Surveillance Research Program (SRP) in the National Cancer Institute Division of Cancer Control and Population Sciences (DCCPS).

SEER data from 2016 will be the most current data available for consideration by the Committee. Exceptions will be noted.

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Key definitions:

**Stage of life** – The age groups defined by the NHANES sampling weights or by the DRI age-sex groups.

**Socioeconomic status** – Indicators of socioeconomic status may include income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or level of education.

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## ANALYTIC PLAN

The following analyses were used to describe and evaluate prevalence, and in some cases the incidence, of nutrition-related chronic health conditions in the U.S. population for each life-stage. The data source and data years are noted for each analysis.

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### Birth to less than 24 months of age

#### Growth, Size and Body Composition Outcomes

Prevalence of low weight-for-recumbent length, recumbent length for age, and weight for age measured among infants and toddlers from birth to 24 months of age using NHANES 2015-2016

Prevalence of high weight-for-recumbent length, recumbent length for age, and weight for age measured among infants and toddlers from birth to 24 months of age using NHANES 2015-2016

Prevalence of low birthweight among U.S. infants by race-ethnicity and age of mother using data from the NVSS 2017

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## **Food Allergy Disease Outcomes**

Prevalence of food allergy among U.S. infants and children ages 0-4 years reported by proxy using NHIS 2017

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### **Children (2-19 years)**

#### **Growth, Size and Body Composition Outcomes**

Prevalence of overweight, obesity, and severe obesity among children ages 2–19 years in the U.S. by age, sex and race-ethnicity using NHANES 2015–2016

Prevalence of underweight among children age 2–19 years in the U.S. by age, sex and race-ethnicity using NHANES 2015-2016

Differences in obesity prevalence by demographics (age, race-ethnicity, household education), and urbanization using NHANES 2013-2016

Changes in obesity and severe obesity prevalence among children in the U.S. by age and sex using NHANES 2007-2008 to 2015-2016

#### **Cardiovascular Intermediate Outcomes**

Prevalence of hypertension among children in the U.S. ages 12-19 years, by age, sex, race-ethnicity and BMI status using NHANES 2013-2016

Prevalence of high LDL cholesterol among U.S. children ages 12-19 years by age, race-ethnicity and BMI status using NHANES 2013-2016

Prevalence of low HDL cholesterol among U.S. children ages 12-19 years by age, race-ethnicity and BMI status using NHANES 2013-2016

#### **Cancer Outcomes**

Leukemia incidence and death rates among children ages 0-19 years using age-adjusted SEER 2011-2015

#### **Type 2 Diabetes**

Prevalence of type 2 diabetes among children ages 12-19 years, by age, sex and race-ethnicity using NHANES 2013-2016

Prevalence of prediabetes among children ages 12-19 years, by age, sex and race-ethnicity using NHANES 2013-2016

Prevalence of dental caries among children ages 12-19 years, by age, race-ethnicity and income using NHANES 2015-2016

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### **Adults (19 years and older, age ranges specified)**

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## **Growth, Size and Body Composition Outcomes**

Prevalence of overweight, obesity, and severe obesity among adults ages 20 years and older in the U.S. by age, sex and race-ethnicity using NHANES 2015–2016

Prevalence of underweight among adults ages 20 years and older in the U.S. by age, and sex using NHANES 2015-2016

Mean body weight, height, waist circumference, and body mass index among adults ages 20 years and older in the U.S. using NHANES 2015-2016

Obesity prevalence by demographic characteristics and urbanization level among adults ages 20 years and older in the U.S., using NHANES 2013-2016

## **Dental Caries and Tooth Loss**

Prevalence of dental caries and tooth loss among adults ages 20-64 years and older adults ages 65years and older in the U.S., by age, race-ethnicity, and income NHANES 2015-2016

## **Cardiovascular Intermediate and Endpoint Outcomes**

Prevalence of high triglycerides among adults ages 20 years and older, by age, sex and race-ethnicity using NHANES 2015-2016

Prevalence of high total cholesterol among adults ages 20 years and older, by age, sex and race-ethnicity using NHANES 2015-2016

Prevalence of high low-density lipoprotein among adults ages 20 years and older, by age, sex and race-ethnicity using NHANES 2015-2016

Prevalence of low high-density lipoprotein among adults ages 20 years and older, by age, sex and race-ethnicity using NHANES 2015-2016

Prevalence of hypertension among adults ages 20 years and older, by age, sex and race-ethnicity using NHANES 2015-2016

Age-adjusted prevalence of hypertension among adults ages 18 years and older, by age, sex, race-ethnicity and education in the U.S. using NHIS, 2017

Age-adjusted prevalence of coronary heart disease among adults ages 18 years and older, by age, sex, race-ethnicity and education in the U.S. using NHIS, 2017

Age-adjusted prevalence of stroke among adults ages 18 years and older, by age, sex, race-ethnicity and education in the U.S. using NHIS, 2017

## **Type 2 Diabetes and Prediabetes**

Prevalence of diagnosed, undiagnosed and total type 2 diabetes among adults ages 20 years and older, by age, sex and race-ethnicity using NHANES 2013-2016

Prevalence of prediabetes among adults ages 20 years and older, by age, sex and race-ethnicity using NHANES 2013-2016

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## **Metabolic Syndrome**

Prevalence of metabolic syndrome among adults ages 20 years and older, by sex and race-ethnicity using NHANES 2013-2016

## **Chronic Liver Disease Outcomes**

Prevalence of self-reported liver disease among adults ages 18 years and older, by sex and race-ethnicity using NHIS, 2017

Age adjusted chronic liver disease and cirrhosis mortality in the U.S. using NVSS, 2017

Prevalence of high alanine aminotransferase (ALT) and aspartate aminotransferase (AST) among adults ages 20 years and older, by sex and race-ethnicity using NHANES 2013-2016

## **Cancer Outcomes**

Age adjusted incidence of female breast cancer in the U.S. using SEER 2016

Age adjusted breast cancer mortality in the U.S. using SEER 2016

Age adjusted incidence of colon and rectal cancer in the U.S., by sex using SEER 2016

Age adjusted colon and rectal cancer mortality in the U.S., by sex using SEER 2016

Age adjusted incidence of esophageal cancer in the U.S., by sex using SEER 2016

Age adjusted esophageal cancer mortality in the U.S., by sex using SEER 2016

Age adjusted incidence of prostate cancer in the U.S. using SEER 2016

Age adjusted prostate cancer mortality in the U.S. using SEER 2016

Age adjusted incidence of larynx cancer in the U.S., by sex using SEER 2016

Age adjusted larynx cancer mortality in the U.S., by sex using SEER 2016

Age adjusted incidence of lung cancer in the U.S., by sex using SEER 2016

Age adjusted lung cancer mortality in the U.S., by sex using SEER 2016

Age adjusted incidence of oral cavity and pharynx cancer in the U.S., by sex using SEER 2016

Age adjusted oral cavity and pharynx cancer mortality in the U.S., by sex using SEER 2016

Age adjusted incidence of pancreatic cancer in the U.S., by sex using SEER 2016

Age adjusted pancreatic cancer mortality in the U.S., by sex using SEER 2016

Age adjusted incidence of endometrial cancer in the U.S., by sex using SEER 2016

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Age adjusted endometrial cancer mortality in the U.S., by sex using SEER 2016

Age adjusted incidence of liver cancer in the U.S., by sex using SEER 2016

Age adjusted liver cancer mortality in the U.S., by sex using SEER 2016

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### **Pregnant Women**

Prevalence of gestational diabetes in the U.S. 2012-2016 by age, race-ethnicity, education and pre-pregnancy BMI status using NVSS

Prevalence of pregnancy-induced hypertension among pregnant women in the U.S. using the Pregnancy Risk Assessment Monitoring System, 2017

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### **Older Adults (ages 60 years and older)**

Prevalence of reduced muscle strength in older adults in the U.S., ages 60 years and older by age, sex and race-ethnicity, NHANES 2013-2014

Prevalence of osteoporosis or low bone mass at the femoral neck or lumbar spine among older adults in the U.S., ages 65 years and older by age, sex and race-ethnicity, NHANES 2009-2014

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# HOW DOES DIETARY INTAKE, PARTICULARLY DIETARY PATTERNS, TRACK ACROSS LIFE STAGES FROM THE INTRODUCTION OF FOODS, INTO CHILDHOOD, AND THROUGH OLDER ADULTHOOD?: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: How does dietary intake, particularly dietary patterns, track across life stages from the introduction of foods, into childhood, and through older adulthood?

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency data analysis team.

This document includes details about the methodology as it was applied to the data analysis as follows:

- The analytic framework describes the overall scope of the question and approach used to describe food group and nutrient intakes
- The analytic plan details the data and subsequent included analyses
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## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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

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Dietary intake across life stages will be described in the following ways:

- Differences in food category sources of nutrients across life stages, particularly nutrients of concern
  - Differences in mean food group intakes across life stages
    - For ages 2 years and older, the percent of each age group who meets existing food
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group recommendations<sup>v</sup> will be examined

- Differences in beverage contributions to energy and nutrient intakes across life stages
  - For ages 0 to less than 24 months, beverages will not include human milk or infant formula

Dietary patterns across life stages will be described in the following ways:

- Differences in food category contributions to energy intake across life stages
  - For infants and toddlers receiving human milk or infant formula, energy intake will be limited to complementary foods including baby foods (e.g. commercially prepared pureed fruits and vegetables)
  - For ages 2 years and older, food category contributions to total energy intake will be assessed
- Differences in Healthy Eating Index – 2015 (HEI-2015) total and component scores across life stages ages 2 years and older<sup>vi</sup>

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**Population:** Nationally representative sample of the U.S. population.

Life stages:

- Infants and toddlers (birth to <24 months)
- Children and adolescents (ages 2-19 years)
- Adults (ages 20-64 years)
- Pregnant women (20-44 years)
- Lactating women (20-44 years)
- Older adults (ages 65 years and older)

Note: Exceptions to age groupings will be specified.

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Demographic subgroups:

- Sex
- Race-ethnicity
- Socioeconomic status e.g. income, education
- Food security status

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Data Source:

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES); cross-sectional, nationally representative dietary intake data.

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<sup>v</sup> USDA Food Patterns Summary Table, 2015-2020 Dietary Guidelines for Americans: [https://fns-prod.azureedge.net/sites/default/files/usda\\_food\\_patterns/USDAFoodPatternsSummaryTable.pdf](https://fns-prod.azureedge.net/sites/default/files/usda_food_patterns/USDAFoodPatternsSummaryTable.pdf)

<sup>vi</sup> The Healthy Eating Index-2015 is used to assess how well a set of foods, such as diets in a population, align with the 2015-2020 Dietary Guidelines for Americans.

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### Data years:

The most recent cycle of WWEIA, NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. For some analyses, multiple cycles of data will be combined to describe “current” intakes (e.g. 2013-2016).

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### Key definitions:

**Stage of life** – The age groups defined by the NHANES sampling weights or by the DRI age-sex groups.

**Introduction of foods** – Introduction of complementary foods and beverages, i.e. other than human milk or infant formula.

**Socioeconomic status** – Indicators of socioeconomic status may include income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or level of education.

### **Discrete Beverage Groups –**

- Milk: Plain and flavored milk, other dairy drinks and milk substitutes (Excludes milk or milk substitutes added to alcoholic beverages, coffee, tea, and/or foods such as cereal).
- 100% Juice: 100% fruit and/or vegetable juice.
- Coffee/tea: Regular and decaffeinated coffee or tea with additions such as milk, cream and/or sweeteners, and coffee and tea drinks, including ready-to-drink.
- Diet beverages: Diet soft drinks, diet sport/energy drinks and other diet drinks that are low- and no-calorie-sweetened, containing 40 kcal or less per reference amount customarily consumed.
- Sweetened beverages: Energy containing soft drinks, fruit drinks, and sports/energy drinks with added sugars that contain more than 40 kcal per reference amount customarily consumed.
  - Soft drinks: Energy-containing drinks made with carbonated water.
  - Fruit drinks: Energy-containing fruit and/or vegetable drinks that are not 100% juice.
  - Sports/energy drinks: Energy-containing sport/energy drinks, nutritional beverages and protein/nutritional powders consumed with a beverage, smoothies and grain drinks.
- Water: Tap, bottled, flavored, carbonated and enhanced/fortified water containing < 5kcal.
- Alcoholic beverages: Beer, wine, liqueur and cocktails

**Reference amount customarily consumed (RACC)** – the serving size listed on a Nutrition Facts Label is based on a reference amount of food that is customarily eaten at a single eating occasion as determined by the Food and Drug Administration.

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## **ANALYTIC PLAN**

Analysis quantified intake patterns of food and beverage using WWEIA, NHANES dietary recall data and corresponding nutrient values from the USDA Food and Nutrient Database for Dietary Studies. The following analyses were used to describe changes in dietary intakes, particularly dietary patterns

across life stages.

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**All analyses requested across life stages with exceptions noted for infants and toddlers less than 24 months.**

WWEIA Food Category Sources of nutrients, particularly nutrients of concern, across life stages, WWEIA, NHANES 2013-2016

Population average intakes of food groups and subgroups in the U.S. across life stages, NHANES 2015-2016

Percent of the U.S. population across life stages, (ages 2 years and older) that meets food group recommendations in the currently available USDA Food Patterns using WWEIA, NHANES 2013-2016

Percent of mean daily energy and selected nutrient and food component intakes contributed by beverages in the U.S. population across life stages, using WWEIA, NHANES 2015-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Food category sources contribution to energy intake across life stages, WWEIA, NHANES 2013-2016

Population average HEI-2015 total and component scores in the U.S. across life-stages, ages 2 years and older using WWEIA, NHANES, 2015-2016

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# WHAT IS THE RELATIONSHIP BETWEEN BEVERAGE CONSUMPTION<sup>vii</sup> AND ACHIEVING NUTRIENT AND FOOD GROUP RECOMMENDATIONS?: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: What is the relationship between beverage consumption and achieving nutrient and food group recommendations?

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency data analysis team.

This document includes details about the methodology, as it was applied to the data analysis as follows:

- The analytic framework describes the overall scope of the question and approach used to describe the relationship between beverage consumption and achieving nutrient and food group recommendations.
- The analytic plan details the data and subsequent included analyses
- The Advisory Committee's analytic results are summarized within Part D, Chapter 10 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report>
  - In addition, online-only supplements were prepared by the data analysis team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis>

## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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**Question:** What is the relationship between beverage consumption and achieving nutrient and food group recommendations?

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Note: Alcohol is a part of total beverage consumption that will be addressed in a separate protocol "What is the relationship between alcohol consumption and achieving nutrients and food group

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<sup>vii</sup> Alcohol is a part of total beverage consumption addressed in a separate protocol "What is the relationship between alcohol consumption and achieving nutrient and food group recommendations?"

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recommendations?”

### Beverage category contributions to food groups and nutrients

- Average contribution of food group and nutrients per 8 oz of each discrete beverage type

The following are also a part of the analytic framework for the question: *describe and evaluate current dietary patterns and beverages*.

- Beverage contribution as a percent of total daily energy and selected nutrients and food groups
  - Energy (and percent of energy from macronutrients)
  - Macro/Micro nutrients, limited to nutrients of public health concern
  - Other food components: e.g. added sugars, caffeine
- Percent of daily beverage calories by discrete beverage type
- Consumption prevalence of cow’s milk and milk alternative beverages
- Prevalence of nutritionally fortified beverages consumption

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**Population:** Nationally representative sample of the U.S. population.

#### Life stages:

- Infants and toddlers (birth to <24 months)
- Children and adolescents (ages 2-19 years)
- Adults (ages 20-64 years)
- Pregnant women (ages 20-44 years) self-reported pregnancy status and/or positive urinary pregnancy test.
- Lactating women (ages 20-44 years)
- Older adults (ages 65 years and older)

Note: Exceptions to age groupings will be specified.

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#### Demographic subgroups:

- Sex
- Race-ethnicity
- Socioeconomic status (e.g. income, education)
- Food security status

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#### Data Source:

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES); cross-sectional, nationally representative dietary intake data.

#### Data years:

The most recent cycle of WWEIA, NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. For some analyses, multiple cycles of data will

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be combined to describe “current” intakes (e.g. 2013-2016).

For analyses looking at change in dietary intake over time: the WWEIA 2003-2004 cycle will serve as the years for comparison, with exceptions noted to these data years.

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### Key definitions:

**Stage of life** – The age groups defined by the NHANES sampling weights or by the DRI age-sex groups.

**Socioeconomic status** – Indicators of socioeconomic status may include income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or level of education.

**Beverage pattern** – The quantities, proportions, variety or combinations of different beverages in diets.

### **Discrete beverage groups –**

- Milk: Plain and flavored milk, other dairy drinks and milk substitutes (Excludes milk or milk substitutes added to alcoholic beverages, coffee, tea, and/or foods such as cereal)
  - 100% Juice: 100% fruit and/or vegetable juice.
  - Coffee/tea: Regular and decaffeinated coffee or tea with additions such as milk, cream and/or sweeteners, and coffee and tea drinks, including ready-to-drink.
  - Diet beverages: Diet soft drinks, diet sport/energy drinks and other diet drinks that are low- and no-calorie-sweetened, containing 40 kcal or less per reference amount customarily consumed.
  - Sweetened beverages: Energy containing soft drinks, fruit drinks, and sports/energy drinks with added sugars that contain more than 40 kcal per reference amount customarily consumed.
    - Soft drinks: Energy-containing drinks made with carbonated water.
    - Fruit drinks: Energy-containing fruit and/or vegetable drinks that are not 100% juice.
    - Sports/energy drinks: Energy-containing sport/energy drinks, nutritional beverages and protein/nutritional powders consumed with a beverage, smoothies and grain drinks.
  - Water: Tap, bottled, flavored, carbonated and enhanced/fortified water containing < 5kcal.
  - Alcoholic beverages: Beer, wine, liqueur and cocktails.
- 

## **ANALYTIC PLAN**

To describe the relationship between beverage consumption and achieving nutrient and food group recommendations in the U.S. population for each life-stage, analysis quantified beverage intake patterns using WWEIA, NHANES dietary recall data and corresponding nutrient values from the USDA Food and Nutrient Database for Dietary Studies through the following analyses:

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### **Contextual Analysis not specific to life stage**

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## Food group and nutrient amounts per 8oz of beverage type

Nutrients limited to nutrients of public health concern as well as added sugars and caffeine

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### **Birth to less than 24 months**

Prevalence of intakes of cow's milk (plain and sweetened/flavored), calcium fortified soy (plain and sweetened/flavored), almond and other milk substitutes (e.g. almond beverage) among U.S. infants and toddlers ages 6<12 and 12<24 months using WWEIA, NHANES 2007-2016

Percent of mean daily energy and selected nutrient and food component intakes, excluding infant milk source, contributed by discrete beverage categories among U.S. infants and toddlers ages 6<12 and 12<24 months using WWEIA, NHANES 2007-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories, excluding infant milk source, by discrete beverage type among U.S. infants and toddlers ages 6<12 and 12<24 months, WWEIA, NHANES 2015-2016

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### **Children (2-19 years)**

Prevalence of nutritional beverage (e.g. pediatric fortified nutritional beverages) consumption among U.S. children by sex, race-ethnicity and family income WWEIA, NHANES 2015-2016

Prevalence consumed in addition to other foods and beverages during an eating event

Prevalence consumed as a beverage-only event

Prevalence of intakes of cow's milk (plain and sweetened/flavored), calcium fortified soy (plain and sweetened/flavored), almond and other milk substitutes (e.g. almond beverage) among U.S. children by age and sex, race-ethnicity and family income WWEIA, NHANES 2015-2016

*The following analyses are also a part of the protocol: Describe and evaluate current dietary patterns and beverages.*

Percent of mean daily energy and selected nutrient and food component intakes contributed by discrete beverage categories among U.S. children ages 2-19 years using WWEIA, NHANES 2015-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by discrete beverage type among the U.S. children ages 2-19 years, WWEIA, NHANES 2015-2016

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## Adults (20 years and older)

Prevalence of nutritional beverage (e.g. fortified nutritional beverages) consumption among U.S. adults by sex, race-ethnicity and family income WWEIA, NHANES 2015-2016

Prevalence consumed in addition to other foods and beverages during an eating event

Prevalence consumed as a beverage-only event

Prevalence of intakes of cow's milk (plain and sweetened/flavored), calcium fortified soy (plain and sweetened/flavored), almond and other milk substitutes (e.g. almond beverage) among U.S. adults by age and sex, race-ethnicity and family income WWEIA, NHANES 2015-2016

*The following analyses are also a part of the protocol for: Describe and evaluate current dietary patterns and beverages.*

Percent of mean daily energy and selected nutrient and food component intakes contributed by discrete beverage categories among U.S. adults ages 20 years and older using WWEIA, NHANES 2015-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by discrete beverage type among U.S. adults ages 20 years and older, WWEIA, NHANES 2015-2016

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## Pregnant Women

Prevalence of nutritional beverage (e.g. fortified nutritional beverages) consumption among pregnant women in the U.S. WWEIA, NHANES 2013-2016

Prevalence consumed in addition to other foods and beverages during an eating event

Prevalence consumed as a beverage-only event

Prevalence of intakes of cow's milk (plain and sweetened/flavored), calcium fortified soy (plain and sweetened/flavored), almond and other milk substitutes (e.g. almond beverage) among pregnant women in the U.S. WWEIA, NHANES 2013-2016

*The following analyses are also a part of the protocol for: Describe and evaluate current dietary patterns and beverages.*

Percent of mean daily energy and selected nutrient and food component intakes contributed by discrete beverage categories among pregnant women in the U.S. WWEIA, NHANES 2015-2016

Nutrients and food components include: macronutrients, added sugars, nutrients

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identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by discrete beverage type among the pregnant women in the U.S. WWEIA, NHANES 2013-2016

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## **Lactating Women**

Prevalence of nutritional beverage (e.g. fortified nutritional beverages) consumption among lactating women in the U.S. WWEIA, NHANES 2013-2016

Prevalence consumed in addition to other foods and beverages during an eating event

Prevalence consumed as a beverage-only event

Prevalence of intakes of cow's milk (plain and sweetened/flavored), calcium fortified soy (plain and sweetened/flavored), almond and other milk substitutes (e.g. almond beverage) among lactating women in the U.S. WWEIA, NHANES 2013-2016

*The following analyses are also a part of the protocol for: Describe and evaluate current dietary patterns and beverages.*

Percent of mean daily energy and selected nutrient and food component intakes contributed by discrete beverage categories among lactating women in the U.S. WWEIA, NHANES 2013-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by discrete beverage type among lactating women in the U.S. WWEIA, NHANES 2013-2016

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# WHAT IS THE RELATIONSHIP BETWEEN ALCOHOL CONSUMPTION AND ACHIEVING NUTRIENT AND FOOD GROUP RECOMMENDATIONS?: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: What is the relationship between alcohol consumption and achieving nutrient and food group recommendations?

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency data analysis team.

This document includes details about the methodology, as it was applied to the data analysis as follows:

- The [analytic framework](#) describes the overall scope of the question and approach used to describe the relationship between alcohol consumption and achieving nutrient and food group recommendations.
- The [analytic plan](#) details the data and subsequent included analyses
- The Advisory Committee's [analytic results](#) are summarized within Part D, Chapter 11 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report>
  - In addition, online-only supplements were prepared by the data analysis team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis>

## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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**Question:** What is the relationship between alcohol consumption and achieving nutrient and food group recommendations?

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Alcoholic beverage category contributions to food groups and nutrients

- Average contribution of energy, caffeine, and added sugars per alcoholic drink equivalent of beer, wine, and liquor and cocktails.

Prevalence of alcohol use, binge drinking and heavy alcohol use

The following are also a part of the analytic framework for the question: *describe and evaluate*

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*current dietary patterns and beverages.*

- Alcoholic beverage contribution as a percent of total daily energy and selected nutrients and food groups
    - Energy (and percent of energy from macronutrients)
    - Macro/Micro nutrients, limited to nutrients of public health concern
    - Other food components: e.g. added sugars, caffeine
  - Percent of daily beverage calories by alcoholic beverage type
- 

**Population:** Nationally representative sample of the U.S. population.

Life stages:

- Children and adolescents (ages 2-19 years)
- Adults (ages 20-64 years)
- Pregnant women (ages 20-44 years) self-reported pregnancy status and/or positive urinary pregnancy test.
- Lactating women (ages 20-44 years)
- Older adults (ages 65 years and older)

Note: Exceptions to age groupings will be specified.

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Demographic subgroups:

- Sex
  - Race-ethnicity
  - Socioeconomic status (e.g. income, education)
  - Food security status
- 

Data Source:

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES); cross-sectional, nationally representative dietary intake data.

Data years:

The most recent cycle of WWEIA, NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. For some analyses, multiple cycles of data will be combined to describe “current” intakes (e.g. 2013-2016).

Data Source:

Behavioral Risk Factor Surveillance System (BRFSS); cross-sectional, nationally representative survey on behaviors including alcohol use.

Data Years: 2015-2017

Data Source:

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National Survey on Drug Use and Health (NSDUH); cross-sectional; nationally representative survey on drug use and mental health including alcohol use prevalence

Data Years: 2016

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Key definitions:

**Stage of life** – The age groups defined by the NHANES sampling weights or by the DRI age-sex groups.

**Socioeconomic status** – Indicators of socioeconomic status may include income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or level of education.

**Beverage pattern** – The quantities, proportions, variety or combinations of different beverages in diets.

**Discrete beverage groups** –

- Milk: Plain and flavored milk, other dairy drinks and milk substitutes (Excludes milk or milk substitutes added to alcoholic beverages, coffee, tea, and/or foods such as cereal)
- 100% Juice: 100% fruit and/or vegetable juice.
- Coffee/tea: Regular and decaffeinated coffee or tea with additions such as milk, cream and/or sweeteners, and coffee and tea drinks, including ready-to-drink.
- Diet beverages: Diet soft drinks, diet sport/energy drinks and other diet drinks that are low- and no-calorie-sweetened, containing 40 kcal or less per reference amount customarily consumed.
- Sweetened beverages: Energy containing soft drinks, fruit drinks, and sports/energy drinks with added sugars that contain more than 40 kcal per reference amount customarily consumed.
  - Soft drinks: Energy-containing drinks made with carbonated water.
  - Fruit drinks: Energy-containing fruit and/or vegetable drinks that are not 100% juice.
  - Sports/energy drinks: Energy-containing sport/energy drinks, nutritional beverages and protein/nutritional powders consumed with a beverage, smoothies and grain drinks.
- Water: Tap, bottled, flavored, carbonated and enhanced/fortified water containing < 5kcal.
- Alcoholic beverages: Beer, wine, liqueur and cocktails.

**Alcoholic-drink Equivalent** - One alcoholic drink-equivalent contains 14 grams (0.6 fl oz) of pure alcohol. The following are reference beverages that are one alcoholic drink-equivalent: 12 fluid ounces of regular beer (5% alcohol), 5 fluid ounces of wine (12% alcohol), or 1.5 fluid ounces of 80 proof distilled spirits (40% alcohol). Drink-equivalents are not intended to serve as a standard drink definition for regulatory purposes.

**Binge drinking** – males: drinking five or more drinks on the same occasion; females has been defined as drinking four or more drinks on the same occasion

**Frequent binge drinking** - binge drinking on 5 or more days in the past 30 days based on the thresholds defined for binge drinking.

## **ANALYTIC PLAN**

To describe the relationship between alcohol consumption and achieving nutrient and food group recommendations in the U.S. population for each life-stage, analysis quantified intake patterns using WWEIA, NHANES dietary recall data and corresponding nutrient values from the USDA Food and Nutrient Database for Dietary Studies through the following analyses:

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### **Contextual Analysis not specific to life stage**

Average contribution of energy, caffeine, and added sugars per alcoholic drink equivalent of beer, wine, and liquor and cocktails.

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### **Children and Young Adults (12-20 years)**

Prevalence of under-age alcohol use, binge drinking and heavy drinking among youth ages 12-20, 2016 National Survey on Substance Use and Health

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### **Adults (20 years and older)**

Prevalence of alcohol use, binge drinking and heavy drinking among adults ages 18-25 and 26 years and older, 2016 National Survey on Substance Use and Health

Percent of mean daily energy and selected nutrient and food component intakes contributed by alcoholic beverages among U.S. adults ages 20 years and older using WWEIA, NHANES 2015-2016

Nutrients and food components include: macronutrients, added sugars, nutrients identified to be of public health concern once defined, and caffeine

Percent of daily beverage calories by alcoholic beverage type among the U.S. population of adults ages 20 years and older, WWEIA, NHANES 2015-2016

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### **Pregnant Women**

Consumption of Alcohol Beverages and Binge Drinking Among Pregnant Women Aged 18–44 Years in the U.S. BRFSS, 2015–2017

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# WHAT IS THE RELATIONSHIP BETWEEN ADDED SUGARS CONSUMPTION AND ACHIEVING NUTRIENT AND FOOD GROUP RECOMMENDATIONS?: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: What is the relationship between added sugars consumption and achieving nutrient and food group recommendations?

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency data analysis team.

This document includes details about the methodology, as it was applied to the data analysis as follows:

- The [analytic framework](#) describes the overall scope of the question and approach used to describe the relationship between added sugars consumption and achieving nutrient and food group recommendations.
- The [analytic plan](#) details the data and subsequent included analyses
- The Advisory Committee's [analytic results](#) are summarized within Part D, Chapter 12 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report>
  - In addition, online-only supplements were prepared by the data analysis team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis>

## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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**Question:** What is the relationship between added sugars consumption and achieving nutrient and food group recommendations?

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Total intakes of added sugars from all sources will be evaluated in the following ways:

- Usual intake distribution of added sugars intakes in the U.S. population
- Percent of population with added sugars intakes <10% and ≥10% of total energy intake

Understanding the relationship between added sugars consumption and achieving nutrient and food group recommendations will be evaluated in the following ways:

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- 
- Food category sources contribution to total added sugars intakes
  - Nutrient and food group contributions from food category sources of added sugars as a percent of energy, nutrients and other dietary components.
- 

**Population:** Nationally representative sample of the U.S. population.

Life stages:

- Infants and toddlers (birth to < 24 months)
- Children and adolescents (ages 2-19 years)
- Adults (ages 20-64 years)
- Pregnant women (ages 20-44 years) self-reported pregnancy status and/or positive urinary pregnancy test.
- Lactating women (ages 20-44 years)
- Older adults (ages 65 years and older)

Note: Exceptions to age groupings will be specified.

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Demographic subgroups:

- Sex
  - Race-ethnicity
  - Socioeconomic status (e.g. income, education)
  - Food security status
- 

Data Source:

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES); cross-sectional, nationally representative dietary intake data.

Data years:

The most recent cycle of WWEIA, NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. For some analyses, multiple cycles of data will be combined to describe “current” intakes (e.g. 2013-2016).

For analyses looking at change in dietary intake over time: the WWEIA 2003-2004 cycle will serve as the years for comparison, with exceptions noted to these data years.

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Key definitions:

**Stage of life** – The age groups defined by the NHANES sampling weights or by the DRI age-sex groups.

**Socioeconomic status** – Indicators of socioeconomic status may include income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or level of education.

**Added sugars** - Sugars that are either added during the processing of foods, or are packaged as such (e.g., a bag of sugar). Added sugars include sugars (free, mono- and disaccharides), sugars from syrups and honey, and sugars from concentrated fruit or vegetable juices that are in excess of what would be expected from the same volume of 100 percent fruit or vegetable juice of the same type (FDA, 2016).

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## **ANALYTIC PLAN**

To describe the relationship between added sugars consumption and achieving nutrient and food group recommendations in the U.S. population for each life-stage, analysis quantified intake of added sugars using WWEIA, NHANES dietary recall data and corresponding nutrient values from the USDA Food and Nutrient Database for Dietary Studies and the Food Patterns Equivalents Database through the following analyses:

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### **Infants and Toddlers (birth <24 months)**

Average intakes of added sugars among U.S. children ages 6<12 and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula) using WWEIA, NHANES 2007-2016

Food Category Sources of added sugars among U.S. children ages 6<12 and 12<24 months, total and stratified by infant milk source (i.e. human milk and/or infant formula) using WWEIA, NHANES 2007-2016

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## **Children (2-19 years)**

Usual intake distribution of added sugars intakes in the U.S. population of children ages 2-19 by age and sex, race ethnicity and family income using WWEIA, NHANES 2013-2016

Percent of population of children in the U.S. ages 2-19 with added sugars intakes <10% and ≥10% of total energy intake, by age and sex, race-ethnicity and family income using WWEIA, NHANES 2013-2016.

Food category sources contribution to total added sugars intakes in the U.S. population of children ages 2-19 by age and sex, race ethnicity and family income using WWEIA, NHANES 2013-2016.

Nutrient and food group contributions from food category sources of added sugars as a percent of energy, nutrients and other dietary components in the U.S. population of children ages 2-19 by age and sex, race ethnicity and family income using WWEIA, NHANES 2013-2016, limited to nutrients of public health concern

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## **Adults (20 years and older)**

Usual intake distribution of added sugars intakes in the U.S. population of adults ages 20 years and older by age and sex, race ethnicity and family income using WWEIA, NHANES 2013-2016

Percent of population of adults in the U.S. ages 20 years and older with added sugars intakes <10% and ≥10% of total energy intake, by age and sex, race-ethnicity and family income using WWEIA, NHANES 2013-2016.

Food category sources contribution to total added sugars intakes in the U.S. population of adults ages 20 years and older by age and sex, race ethnicity and family income using WWEIA, NHANES 2013-2016.

Nutrient and food group contributions from food category sources of added sugars as a percent of energy, nutrients and other dietary components in the U.S. population of adults ages 20 years and older by age and sex, race ethnicity and family income using WWEIA, NHANES 2013-2016, limited to nutrients of public health concern

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## **Pregnant Women**

Usual intake distribution of added sugars intakes in the U.S. population of pregnant women using WWEIA, NHANES 2013-2016

Percent of population of pregnant women in the U.S. with added sugars intakes <10% and ≥10% of total energy intake using WWEIA, NHANES 2013-2016.

Food category sources contribution to total added sugars intakes in the U.S. population of pregnant women using WWEIA, NHANES 2013-2016.

Nutrient and food group contributions from food category sources of added sugars as a percent of energy, nutrients and other dietary components in the U.S. population of pregnant women using WWEIA, NHANES 2013-2016, limited to nutrients of public health concern

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## **Lactating Women**

Usual intake distribution of added sugars intakes in the U.S. population of lactating women using WWEIA, NHANES 2013-2016

Percent of population of lactating women in the U.S. with added sugars intakes <10% and ≥10% of total energy intake using WWEIA, NHANES 2013-2016.

Food category sources contribution to total added sugars intakes in the U.S. population of lactating women using WWEIA, NHANES 2013-2016.

Nutrient and food group contributions from food category sources of added sugars as a percent of energy, nutrients and other dietary components in the U.S. population of lactating women using WWEIA, NHANES 2013-2016, limited to nutrients of public health concern

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# WHAT IS THE RELATIONSHIP BETWEEN THE FREQUENCY OF EATING AND ACHIEVING NUTRIENT AND FOOD GROUP RECOMMENDATIONS?: DATA ANALYSIS PROTOCOL

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This document describes the protocol for data analysis used to address the following question: What is the relationship between the frequency of eating and achieving nutrient and food group recommendations?

This data analysis was conducted by the 2020 Dietary Guidelines Advisory Committee, Data Analysis and Food Pattern Modeling Cross-Cutting Working Group, with support from a federal interagency DAT.

This document includes details about the methodology as it was applied to the data analysis as follows:

- The [analytic framework](#) describes the overall scope of the question and approach used to describe food group and nutrient intakes
- The [analytic plan](#) details the data and subsequent included analyses
- The Advisory Committee's [analytic results](#) are summarized within Part D, Chapter 13 of the Scientific Report of the 2020 Dietary Guidelines Advisory Committee:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report>
  - In addition, online-only supplements were prepared by the data analysis team for the 2020 Dietary Guidelines Advisory Committee to support its review of the scientific evidence:  
<https://www.dietaryguidelines.gov/2020-advisory-committee-report/data-analysis>

## ANALYTIC FRAMEWORK

The analytic framework describes the overall scope of the analyses, including the population and type of analyses and data sources identified to answer the question. It also includes the definitions of key terms.

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**Question:** What is the relationship between the frequency of eating and achieving nutrient and food group recommendations?

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Frequency of eating, with and without naming conventions, will be described and evaluated in the following ways:

- Distribution of eating event frequency in a 24 hour period (midnight to midnight)
  - Hourly distribution of eating events in a 24 hour period
  - Percent of Americans engaging in self-described meals (e.g. breakfast, lunch, dinner) and snacks including beverage events in a 24 hour period (midnight to midnight)
  - Time (hour of the day) in which self-described meals and snacks including beverage events
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are consumed in a 24 hour period (midnight to midnight)

The relationship between frequency of eating and achieving nutrient and food group recommendations will be evaluated in the following ways:

Examined by eating event type with naming convention

- Proportion of daily food group and subgroup intake by eating event type
- Proportion of daily nutrient intake by eating event type

Proportion of total energy intake and select dietary component intakes from foods and beverages reported between 8:00pm and 11:59pm.

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**Population:** Nationally representative sample of the U.S. population

Life stages:

- Children and adolescents (ages 2-19 years)
- Adults (ages 20-64 years)
- Older Adults (ages 65 years and older)

Note: exceptions to age groupings will be noted.

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Demographic subgroups:

- Sex
  - Race-ethnicity
  - Socioeconomic status (e.g., income, education)
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Data Source:

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES); cross-sectional, nationally representative dietary intake data

Data years:

The most recent cycle of WWEIA, NHANES data collected in 2015-2016 will be the most current data available for consideration by the Committee. For some analyses, multiple cycles of data will be combined to describe “current” intakes (e.g., 2013-2016).

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Key definitions:

**Stage of life** - The age groups defined by the NHANES sampling weights or by the DRI age-sex groups.

**Socioeconomic status** - Indicators of socioeconomic status may include income in dollars, income as a percent of the poverty ratio, food security, eligibility for federal assistance programs, or level of education.

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**Eating event types** - Survey respondents select the name of all eating occasions from a fixed list that was provided during the interview.

**breakfast** includes all eating occasions designated by the respondent as "breakfast", or the Spanish equivalents "desayuno", and "almuerzo"

**lunch** includes all eating occasions designated as "brunch", "lunch", or the Spanish equivalent "comida"

**dinner** includes all eating occasions designated as "dinner", "supper", or the Spanish equivalent "cena".

**snack occasions** include all reports of "snack", "drink", or "extended consumption" (items that were consumed over a long period of time). Spanish language interviewers used the Spanish language snack occasion names: "merienda", "entre comida", "botana", "bocadillo", "tentempie", and "bebida". Snacks consist of one or more food and beverage items, including and excluding occasions in which plain water was the only item reported. In WWEIA, NHANES 2015-2016, water was the only item reported in approximately 27 percent of the snack occasions.

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## ANALYTIC PLAN

The following analyses were used to describe the relationship between eating frequency and intakes of food groups and nutrients:

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### Children (2-19 years)

Distribution of eating event frequency in a 24 hour day (midnight to midnight) among U.S. children by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Hourly distribution of eating events in a 24 hour period (midnight to midnight) among U.S. children by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. children engaging in self-described breakfast (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. children engaging in self-described lunch (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. children engaging in self-described dinner (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. children engaging in self-described snacks, including beverage-only events (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Time (hour of the day) in which self-described meals and snacks including beverage events are consumed in a 24 hour period (midnight to midnight) among U.S. children by age and

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sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Distribution of meal patterns (number of self-described meals and snacks) among U.S. children by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Proportion of daily food group and subgroup intake by eating event type among U.S. children by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Proportion of daily nutrient intake by eating event type among U.S. children by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016, limited to nutrients of public health concern

Proportion of total energy intake and select dietary component intakes from foods and beverages reported between 8:00pm and 11:59pm by children ages 12 to 19 years; WWEIA NHANES, 2013-2016.

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### **Adults (20-64 years)**

Distribution of eating event frequency in a 24 hour day (midnight to midnight) among U.S. adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Hourly distribution of eating events in a 24 hour period (midnight to midnight) among U.S. adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. adults engaging in self-described breakfast (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. adults engaging in self-described lunch (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. adults engaging in self-described dinner (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. adults engaging in self-described snacks, including beverage-only events (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Time (hour of the day) in which self-described meals and snacks including beverage events are consumed in a 24 hour period (midnight to midnight) among U.S. adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Distribution of meal patterns (number of self-described meals and snacks) among U.S. adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Proportion of daily food group and subgroup intake by eating event type among U.S. adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Proportion of daily nutrient intake by eating event type among U.S. adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016, limited to nutrients of public health concern

Proportion of total energy intake and select dietary component intakes from foods and

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### **Older Adults (70 years and older)**

Distribution of eating event frequency in a 24 hour day (midnight to midnight) among U.S. older adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Hourly distribution of eating events in a 24 hour period (midnight to midnight) among U.S. older adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. older adults engaging in self-described breakfast (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. older adults engaging in self-described lunch (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. older adults engaging in self-described dinner (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Percent of U.S. older adults engaging in self-described snacks, including beverage-only events (and Spanish language equivalents) by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Time (hour of the day) in which self-described meals and snacks including beverage events are consumed in a 24 hour period (midnight to midnight) among U.S. older adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Distribution of meal patterns (number of self-described meals and snacks) among U.S. older adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Proportion of daily food group and subgroup intake by eating event type among U.S. older adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016

Proportion of daily nutrient intake by eating event type among U.S. older adults by age and sex, race-ethnicity, and income; WWEIA, NHANES, 2015-2016, limited to nutrients of public health concern

Proportion of total energy intake and select dietary component intakes from foods and beverages reported between 8:00pm and 11:59pm by adults ages 60 years and older; WWEIA, NHANES 2013-2016

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