2020 Dietary Guidelines Advisory Committee: Data Analysis and Food Pattern Modeling

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Topic Areas (in order of protocol development)

- Current intakes of food groups and nutrients*
- Prevalence of nutrition-related chronic health conditions*
- Nutrients of public health concern*
- Current dietary patterns and beverages*
- Tracking of dietary intake, particularly dietary patterns, across life stages*

* Protocols to be discussed today; available at DietaryGuidelines.gov

Topic Areas (in order of protocol development)

- Beverages and achieving nutrient/food group recommendations (all ages, pregnancy, and lactation)
- Added sugars and achieving nutrient intake/food group recommendations
- Frequency of eating and achieving nutrient/food group recommendations

Topic Areas (in order of protocol development)

Food pattern modeling:

- Are change to the USDA Food Patterns needed based on relationships identified [in systematic reviews]?
- Can USDA Food Patterns for those under 2 years of age be established based on relationships identified?
- Food pattern modeling questions related to nutrient adequacy, supplements/fortified foods, and added sugars

Key Definitions

- **Stage of life** – The age groups defined by NHANES or the age-sex groups defined for the Dietary Reference Intakes.
- **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.
- **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.

Analytic Framework: Population

Nationally representative sample of the U.S. population

Life stages:

- Infants and toddlers (B-24 months): *analytic framework under discussion*
- 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 these age groupings will be noted as protocols drafts are presented*

Demographic subgroups:

- Sex
- Race-ethnicity
- Socioeconomic status
- Food security status

Analytic Framework: Dietary Data Sources

What We Eat in America, National Health and Nutrition Examination Survey (WWEIA, NHANES)

- Cross-sectional, nationally representative dietary intake data

USDA Food and Nutrient Database for Dietary Studies

- Nutrient data on foods and beverages

USDA Food Patterns Equivalents Database

- Food group and subgroup data on foods and beverages

WWEIA Food Categories

- Categorization of foods and beverages as-consumed in the population

NHANES Dietary Supplement Database

- Nutrient data on dietary supplements and non-prescription antacids containing calcium and/or magnesium

Question

Describe/evaluate current intakes of food groups and nutrients

Approach to Answer Question: Data Analysis

Analytic Framework: Food Group Intakes

- Mean intakes of food groups and subgroups
- Usual intake distributions of food groups and subgroups
- Food category sources of food group intakes
- Current food group intakes compared to existing food group recommendations
- Changes in food group intakes over time

Describe/evaluate current intakes of food groups and nutrients

Analytic Framework: Nutrient Intakes

- **Mean intakes of nutrients**
  - foods and beverages
  - foods, beverages, and dietary supplements
- **Usual intake distribution of nutrients**
  - foods and beverage
  - foods, beverages, and dietary supplements
- **Nutrient intakes compared to Dietary Reference Intakes**
- **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

Describe/evaluate current intakes of food groups and nutrients

Analytic Plan – Food Group Intakes

Population average intakes of food groups and subgroups among U.S. population: WWEIA, NHANES, 2015-2016

Population usual intake distributions of food groups and subgroups among U.S. population: WWEIA, NHANES 2013-2016

Percent of the U.S. population that meets food group recommendations in the currently available USDA Food Patterns using WWEIA, NHANES 2013-2016

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

WWEIA Food Category sources of food group intakes among U.S. population, WWEIA, NHANES 2013-2016

Analytic Plan – Nutrient Intakes

Population average nutrient intakes from food and beverage in the U.S.: WWEIA, NHANES 2015-2016

Population average nutrient intakes from food and beverage and dietary supplements in the U.S.: WWEIA, NHANES 2015-2016

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

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

Comparison of nutrient intakes in the U.S. population (NHANES 2013-2016) to Dietary Reference Intakes

Changes in population average intakes of nutrients from foods and beverages between NHANES 2009-2010 and 2015-2016

- limited to nutrients of public health concern

WWEIA Food Category sources of nutrients: NHANES 2013-2016

- limited to nutrients of public health concern

Question

Describe/evaluate prevalence of nutrition-related chronic health conditions

Approach to Answer Question: Data Analysis

Analytic Framework

Categories of nutrition-related chronic health conditions:

- Growth, Size, and Body Composition Outcomes
- Food Allergy Disease Outcomes
- Cardiovascular Intermediate and Endpoint Outcomes
- Cancer Outcomes
- Type 2 Diabetes
- Metabolic Syndrome
- Chronic Liver Disease
- Gestational Diabetes
- Pregnancy-related Hypertensive Disorders
- Osteoporosis
- Sarcopenia

Describe/evaluate prevalence of nutrition-related chronic health conditions

Analytic Framework: Data Sources

National Health and Nutrition Examination Survey (NHANES), 2013-2016
- includes both laboratory, physical exam, and self-report data

National Health Interview Survey (NHIS), 2017
- household interview survey, self-report

National Vital Statistics System (NVSS), 2017
- registration of vital events – e.g., births, deaths

Pregnancy Risk Assessment Monitoring System (PRAMS), 2017
- maternal self-report of behaviors, attitudes, and experiences

Surveillance Epidemiology End Results (SEER), 2016
- cancer registry statistics in the U.S. population

Describe/evaluate prevalence of nutrition-related chronic health conditions

Analytic Framework: birth to < 24 months

Growth, Size, and Body Composition Outcomes

- Prevalence of low weight-for-recumbent length, recumbent-length-for-age, and weight-for-age, NHANES 2015-2016
- Prevalence of high weight-for-recumbent length, recumbent-length-for-age, and weight-for-age, NHANES 2015-2016
- Prevalence of low birthweight among U.S. infants by race-ethnicity and age of mother, NVSS 2017

Food Allergy Disease Outcomes

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

Describe/evaluate prevalence of nutrition-related chronic health conditions

Analytic Plan – Children (2-19 years)

Growth, Size, and Body Composition Outcomes

- Prevalence of overweight, obesity, and severe obesity, NHANES 2015–2016
- Prevalence of underweight, NHANES 2015-2016
- Differences in obesity prevalence by demographics and urbanization, NHANES 2013-2016
- Changes in obesity and severe obesity prevalence, NHANES 2007-2008 to 2015-2016

Cardiovascular Intermediate Outcomes

- Prevalence of hypertension, by demographics and BMI status, NHANES 2013-2016
- Prevalence of high LDL cholesterol by demographics and BMI status, NHANES 2013-2016
- Prevalence of low HDL cholesterol by demographics and BMI status, NHANES 2013-2016

Analytic Plan – Children (2-19 years)

Cancer Outcomes

- Age-adjusted leukemia incidence and death rates, SEER 2011-2015

Type 2 Diabetes and Prediabetes

- Prevalence of type 2 diabetes, NHANES 2013-2016
- Prevalence of prediabetes, NHANES 2013-2016

Analytic Plan – Adults (20 years and older)

Growth, Size, and Body Composition Outcomes

- Prevalence of overweight, obesity, and severe obesity, NHANES 2015–2016
- Prevalence of underweight, NHANES 2015-2016
- Mean body weight, height, waist circumference, and body mass index, NHANES 2015-2016
- Obesity prevalence by demographic characteristics and urbanization level among adults ages 20 years and older in the U.S., NHANES 2013-2016

Describe/evaluate prevalence of nutrition-related chronic health conditions

Analytic Plan – Adults (20 years and older)

Cardiovascular Intermediate and Endpoint Outcomes

- Prevalence of high triglycerides by, NHANES 2015-2016
- Prevalence of high total cholesterol, NHANES 2015-2016
- Prevalence of high low-density lipoprotein, NHANES 2015-2016
- Prevalence of low high-density lipoprotein, NHANES 2015-2016
- Prevalence of hypertension, NHANES 2015-2016
- Age-adjusted prevalence of hypertension (*18 + years*, NHIS 2017)
- Age-adjusted prevalence of coronary heart disease (*18 + years*, NHIS 2017
- Age-adjusted prevalence of stroke, NHIS 2017

Describe/evaluate prevalence of nutrition-related chronic health conditions

Analytic Plan – Adults (20 years and older)

Type 2 Diabetes and Prediabetes

- Prevalence of diagnosed, undiagnosed, and total type 2 diabetes, NHANES 2013-2016
- Prevalence of prediabetes NHANES 2013-2016

Metabolic Syndrome

- Prevalence of metabolic syndrome, NHANES 2013-2016

Chronic Liver Disease Outcomes

- Prevalence of liver disease, NHIS 2017
- Age adjusted chronic liver disease and cirrhosis mortality, NVSS 2017
- Prevalence of high alanine aminotransferase (ALT) and aspartate aminotransferase (AST), NHANES 2013-2016

Describe/evaluate prevalence of nutrition-related chronic health conditions

Analytic Plan – Adults (20 years and older)

Cancer Outcomes

Age adjusted, sex specific-incidence and mortality, SEER 2016

- breast
- colon and rectal
- esophageal
- oral cavity and pharynx
- larynx
- lung
- pancreatic
- prostate
- endometrial
- liver

Analytic Plan – Pregnant Women

Prevalence of gestational diabetes, NVSS 2012-2016

Prevalence of pregnancy-induced hypertension (including preeclampsia or toxemia), PRAMS 2017

Describe/evaluate prevalence of nutrition-related chronic health conditions

Analytic Plan – Older Adults (ages 65+)

Prevalence of osteoporosis or low bone mass at the femoral neck or lumbar spine, NHANES 2009-2014

Prevalence of reduced muscle strength, NHANES 2013-2014

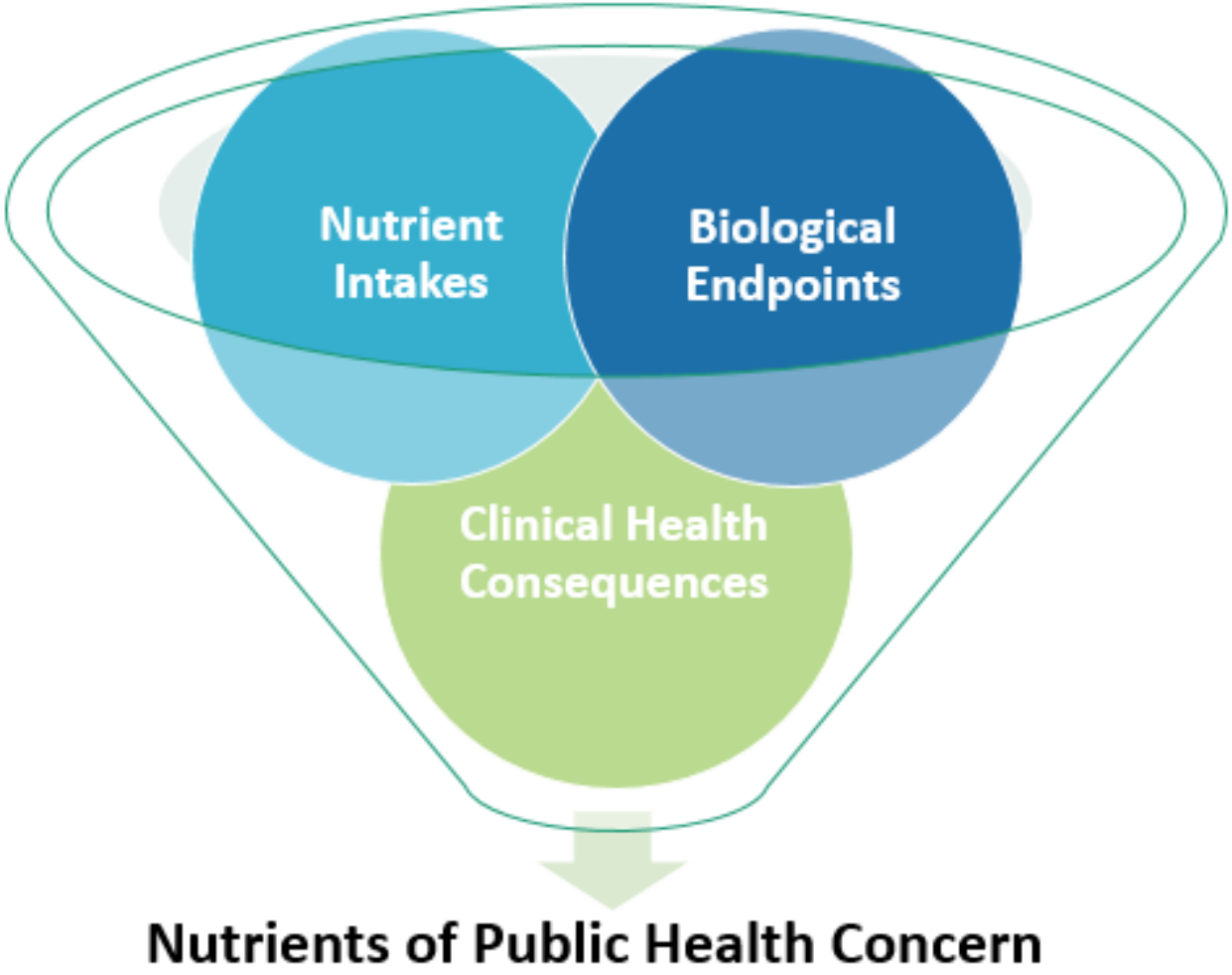
Describe/evaluate prevalence of nutrition-related chronic health conditions

Question

Describe/evaluate nutrients of public health concern

Approach to Answer Question: Data Analysis

Analytic Framework: Three Pronged Approach



Describe/evaluate nutrient of public health concern

2020 Dietary Guidelines Advisory Committee: *Meeting 2*

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, gender, and life stage and cover more than 40 nutrient substances.
  - **Acceptable Macronutrient Distribution Range (AMDR)** – 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.

Key Definitions

DRIs continued

- **Estimated Average Requirement (EAR)** – is the average daily nutrient intake level estimated to meet the requirements of half of the healthy individuals in a group.
- **Adequate Intake (AI)** – is established when evidence is insufficient to develop an RDA and is set at a level assumed to ensure nutritional adequacy.
- **Tolerable Upper Level (UL)** – is the maximum daily intake unlikely to cause adverse health effects to almost all individuals in the general population.

Key Definitions

DRIs continued

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

- **Nutrients of public health concern** – are nutrients that are overconsumed or under consumed (compared to the DRI recommendation 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.

Analytic Framework: Nutrient Intake Adequacy

Nutrient intakes from

- food and beverages alone
- additional contribution from intakes of dietary supplements

Nutrients with an EAR

- EAR cut-point method
- probability approach for iron in menstruating women

Nutrients with an AI

- compare mean intake to AI

Nutrients with a UL or CDRR

- examine percent of population with intakes above UL or CDRR

Nutrients with an AMDR

- examine percent of the population with intakes outside AMDR

Added Sugars and Saturated Fat

- percent energy compared to *2015-2020 Dietary Guidelines for Americans* recommendations of <10% of total energy

Analytic Framework: Data Sources

Biochemical Indicators

- NHANES, laboratory data

Nutrient Intakes

- WWEIA, NHANES, dietary intake data

Data years: 2013-2016, exceptions will be noted

Clinical Health Consequences

- ***Evidence from systematic reviews***
- ***Results on Nutrition-related Chronic Health Conditions***

Analytic Plan – Dietary Intake (ages 1+)[1]

Nutrient Intake Distributions

- Usual intake distributions of nutrient intakes from foods and beverage, NHANES 2013-2016
- Usual intake distributions of nutrient intakes from foods and beverage and dietary supplements, NHANES 2013-2016

[1]Excluding infants receiving human milk

Describe/evaluate nutrient of public health concern

Analytic Plan – Biomarkers of Nutrient Status

Children ages 1-18 years, NHANES 2013-2016 (exceptions noted)

- low and high serum ferritin concentration (ages 1-19 y)
- high serum soluble transferrin receptor concentration (ages 1-5 y, females 12-19 y)
- low folate (RBC) concentration
- low serum folate concentration
- low serum copper concentration (ages 6-18 y)
- low serum zinc concentration (ages 6-18 y)
- low vitamin D (serum 25-hydroxyvitamin D), NHANES 2013-2014

Reference data: 6-19 years, NHANES 2003-2004 and 2005-2006

- *low serum vitamin A and/or carotenoids (2005-2006 only)*
- *low serum vitamin C*
- *low serum vitamin E (2005-2006 only)*
- *low serum vitamin B12*
- *low serum vitamin B6 (serum pyridoxal-5'-phosphate) (2005-2006 only)*

Analytic Plan – Biomarkers of Nutrient Status

Adults ages 19 years and older and for pregnant and lactating women, NHANES 2013-2016 (exceptions noted)

- low and high serum ferritin concentration (females 20–49 y)
- high serum soluble transferrin receptor concentration (females 20–49 y)
- low folate (RBC) concentration
- low serum folate concentration
- high unmetabolized folic acid concentrations (adults, pregnancy)
- low serum copper concentration
- low serum zinc concentration
- low vitamin D (serum 25-hydroxyvitamin D), NHANES 2013-2014 (20-70 y)
- low serum vitamin B12, NHANES 2013-2014
- high serum methylmalonic acid, NHANES 2013-2014
- median urinary iodine status in pregnant women (ages 20-49)

Reference data: NHANES (years noted)

- *low serum vitamin A and/or carotenoids (20-59 y) (2005-2006)*
- *low serum vitamin C (20-59 y) (2003-2004, 2005-2006)*
- *low serum vitamin E (40-59 y) (2005-2006)*
- *low serum vitamin B6 (serum pyridoxal-5'-phosphate) (20-59 y) (2009-2010)*

Question

Describe/evaluate current dietary patterns and beverage consumption

Approach to Answer Question: Data Analysis

Analytic Framework: Dietary Patterns

- **The Healthy Eating Index - 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**

Noted limitation: Data on self-selected dietary patterns such as a vegetarian dietary pattern are not available in the most recent cycles of NHANES.

Analytic Framework: Beverage Consumption

- **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**
- **Percent of energy and nutrients from beverage types**
  - Energy
  - Macro/micro nutrients
  - Added sugars

Describe/evaluate current dietary patterns and beverage consumption

Key Definitions

Beverage pattern – the quantities, proportions, variety or combinations of different beverages in diets

Discrete Beverage Types

- **Milk** – plain and flavored milk, other milk 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/without 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 RACC

Key Definitions

- **Sweetened beverages** – energy containing drinks with added sugars that contain more than 40 kcal per RACC.
  - **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 < 5 kcal per RACC
- **Alcoholic beverages** – beer, wine, liqueur, and cocktails

Analytic Plan – Dietary Patterns (ages 2+)

Population average HEI-2015 total and component scores, WWEIA, NHANES 2015-2016
Population usual intake distributions of total HEI-2015 scores, WWEIA, NHANES 2013-2016
Changes in population average– 2015 scores between WWEIA, NHANES 2003-2004 and 2015-2016
Food category sources contribution to total energy intake, WWEIA, NHANES 2013-2016

Describe/evaluate current dietary patterns and beverage consumption

Analytic Plan – Beverage Intakes (ages 2+)

Percent who consumed beverage types on a given day WWEIA, NHANES 2015-2016

Sweetened beverage consumption WWEIA, NHANES 2015-2016

Mean daily beverage intake in volume (fluid ounces) by beverage type, WWEIA, NHANES 2015-2016

Percent of mean daily energy and selected nutrient intakes contributed by beverages, WWEIA, NHANES 2015-2016

- Specifically carbohydrates, added sugars, protein, vitamin C, vitamin D, calcium, potassium, magnesium, phosphorus, and caffeine. Nutrients of public health concern to be included.

Percent of daily beverage calories by beverage type, WWEIA, NHANES 2015-2016

Describe/evaluate current dietary patterns and beverage consumption

Question

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

Approach to Answer Question: Data Analysis

Key Definitions

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

Analytic Framework: Dietary Intake

- **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 group recommendations will be examined
- **Differences in beverage contributions to energy and nutrient intakes across life stages**
  - beverages will not include human milk or infant formula

Analytic Framework: Dietary Patterns

- **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. prepared pureed fruits and vegetables
  - For ages 2 years and older, food category contributions to total energy intake will be assessed
- **Differences in HEI-2015 total and component scores across life stages ages 2 years and older**

Analytic Plan

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 across life stages, NHANES 2015-2016

Percent of the U.S. population across life stages, (ages 2 years and older) that meets current food group recommendations WWEIA, NHANES 2013-2016

Percent of mean daily energy and selected nutrient intakes contributed by beverages across life stages, WWEIA, NHANES 2015-2016

- Specifically carbohydrates, added sugars, protein, vitamin C, vitamin D, calcium, potassium, magnesium, phosphorus, and caffeine, and nutrients of public health concern

Analytic Plan

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, WWEIA, NHANES 2015-2016

Next Steps

- **Build out analyses for birth to 24 months population**
  - cross-cutting discussion with B-24 subcommittee
- **Draft protocols for beverages and added sugars questions**
  - cross-cutting discussion with Beverages and Added Sugars subcommittee
- **Draft protocols for frequency of eating question**
  - cross-cutting discussion with Frequency of Eating subcommittee
- **Integrate nutrient intakes from dietary supplements**
  - data anticipated for release in fall 2019
- **Review data analysis results**
- **Draft conclusion statements**

2020 Dietary Guidelines Advisory Committee: Dietary Patterns Subcommittee

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