



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

Regan Bailey

Jamy Ard

Teresa Davis

Timothy Naimi

Jamie Stang

Barbara Schneeman

[Dietaryguidelines.gov](https://www.dietaryguidelines.gov)

Subcommittee Status

- Working group reviewing analysis results and drafting conclusions
 - Current intakes of food groups and nutrients*
 - Current dietary patterns and beverages*
 - Dietary patterns across life stages*
 - Prevalence of nutrition-related chronic health conditions*
 - Nutrients of public health concern*
- *Relationship between added sugars intakes and meeting food group and nutrient recs (still to come)*
- *Frequency of eating and meeting food group and nutrient recs (still to come)*
- *Beverages and meeting food group and nutrient recs (still to come)*
- *Alcohol and meeting food group and nutrient recs (still to come)*

Subcommittee Status (continued)

Refining remaining work

- Birth to less than 24 months and Pregnancy/Lactation data analysis elements, for example
 - Food group and nutrient intakes
 - Nutrients and other dietary components of public health concern

Food pattern modeling questions across the life span

- 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

Analytic Framework: Population

Nationally representative sample of the U.S. population

Life stages:

- **Infants and toddlers (B-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 these age groupings will be noted as protocols drafts are presented*

Demographic subgroups:

- Sex
- Race-ethnicity
- Socioeconomic 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

Analytic Framework: Chronic Health Conditions 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

Question (current intakes)

Describe/evaluate current intakes of
food groups and nutrients

Approach to Answer Question: Data Analysis

Summary Statement: food groups

Fruit: whole fruit, 100% fruit juice, sweetened beverages, and desserts & sweet snacks **0.9 cup-eq/day**

Summary Statement: food groups (continued)

Fruit: whole fruit, 100% fruit juice, sugar-sweetened & diet beverages, and desserts & sweet snacks **0.9 cup-eq/day**

Vegetables: part of burgers & sandwiches as well as other mixed dishes **1.5 cup-eq/day**

Analytic Results:

Summary Statement: 3 food groups

Fruit: whole fruit, 100% fruit juice, sugar-sweetened & diet beverages, and desserts & sweet snacks **0.9 cup-eq/day**

Vegetables: part of burgers & sandwiches as well as other mixed dishes **1.5 cup-eq/day**

Dairy: fluid milk decreases and cheese intakes increase with age. **1.6 cup-eq/day**. Total dairy intake decreased over time.

Analytic Results:

Summary Statement: 4 food groups

Fruit: whole fruit, 100% fruit juice, sugar-sweetened & diet beverages, and desserts & sweet snacks **0.9 cup-eq/day**

Vegetables: part of burgers & sandwiches as well as other mixed dishes **1.5 cup-eq/day**

Dairy: fluid milk decreases and cheese intakes increase with age. **1.6 cup-eq/day**. Total dairy intake decreased over time.

Whole grains: Breakfast cereals and bars. Intakes have improved over time, but only 2% meeting recommendations **0.9 oz-eq/day**

Analytic Results:

Summary Statement: food groups (continued)

Fruit: whole fruit, 100% fruit juice, sugar-sweetened & diet beverages, and desserts & sweet snacks **0.9 cup-eq/day**

Vegetables: part of burgers & sandwiches as well as other mixed dishes **1.5 cup-eq/day**

Dairy: fluid milk decreases and cheese intakes increase with age. Total dairy intake decreased over time. **1.6 cup-eq/day**

Whole grains: Breakfast cereals and bars. Intakes have improved over time, but only 2% meeting recommendations **0.9 oz-eq/day**

Protein foods: Animal-based sources (86%) primary sources. Adequate for most, except females 12 to 19 and 70+ y. **5.8 oz-eq/day**

Analytic Results:

Summary Statement: Solid fats & added sugars

- The majority of the population of all age and sex groups exceeds recommended energy intakes from solid fats (**34.9 g/day**) and added sugars (**16.2 tsp Eq/day**).
- The main sources of solid fats include burgers & sandwiches and desserts & sweet snacks.
 - Higher fat dairy foods are also significant sources for children ≤ 11 y
- The main sources of added sugars include sweetened beverages, desserts & sweet snacks, and coffee & tea.

DRAFT Conclusion Statement: food groups

For ages 2+ years, intakes of fruit, vegetables, dairy, and whole grains are generally below recommended amounts, and have not changed over time. Intakes of total grains and total protein foods generally meet recommended amounts.

Analytic Results:

Summary Statement: nutrients (carbohydrates)

For ages 1+ y, over 90% of children (1-18y), 58% of adult males and 67% of adult females (19+y) have carbohydrate intakes within the AMDR.

Analytic Results:

Summary Statement: nutrients (carbohydrates and proteins)

For ages 1+ y, over 90% of children (1-18y), 58% of adult males and 67% of adult females (19+y) have carbohydrate intakes within the AMDR.

Across all age groups, protein intake is within the AMDR.

- Over 10% of adults $\geq 70y$ and 20% of females ages 14-18 have protein $< EAR$.

Analytic Results:

Summary Statement: nutrients (carbohydrates, proteins, and fats)

For ages 1+ y, over 90% of children (1-18y), 58% of adult males and 67% of adult females (19+y) have carbohydrate intakes within the AMDR.

Across all age groups, protein intake is within the AMDR.

- Over 10% of adults $\geq 70y$ and 20% of females ages 14-18 have protein $< EAR$.

The proportion of the population with total fat intakes within the AMDR is $\sim 60\%$ for children and $\sim 50\%$ for adults.

Analytic Results:

AMDR Summary Statement: nutrients

(carbohydrates, proteins, fats, sodium, saturated fats and added sugars)

For ages 1+ y, over 90% of children (1-18y), 58% of adult males and 67% of adult females (19+y) have carbohydrate intakes within the AMDR.

Across all age groups, protein intake is within the AMDR.

- Over 10% of adults $\geq 70y$ and 20% of females ages 14-18 have protein $< EAR$.

The proportion of the population with total fat intakes within the AMDR is $\sim 60\%$ for children and $\sim 50\%$ for adults.

For all ages 1+, sodium, saturated fat, and added sugars are over-consumed.

DRAFT Conclusion Statement: nutrients

For ages 1+, underconsumed nutrients and other food components include

- vitamins A, C, D, E, K
- calcium, magnesium, fiber, choline, and potassium

In addition to those, other population groups had underconsumed food components

- Vitamin B12 among teen and adult females
- Phosphorus among children adolescence
- Iron among reproductive aged females 14-50

Retinol, zinc, copper and selenium are overconsumed among some young children

Dietary Patterns and Beverage Consumption

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+ across life stages and demographic subgroups**
 - 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 Data

- Children (2-19 years) and adults (19+ years)
 - Beverage consumption by sex, age, race/ethnicity
 - Mean daily beverage intake (fluid ounces) by beverage type
 - Sweetened beverage consumption by race/ethnicity and age
 - Percent of mean daily energy and selected nutrient and food component intakes contributed by beverages
 - Percent of daily beverage calories by beverage type

Beverage Category Definitions

Milk: Plain and flavored milk, other milk drinks and milk substitutes

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 that contain more than 40 kcal per reference amount customarily consumed.

Soft drinks: Energy-containing drinks made with carbonated water.

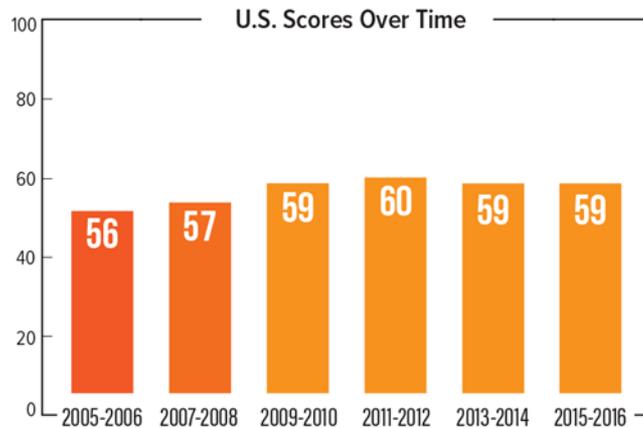
Fruit Drinks: Energy-containing fruit and/or vegetable drinks that are not 100% juice.

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

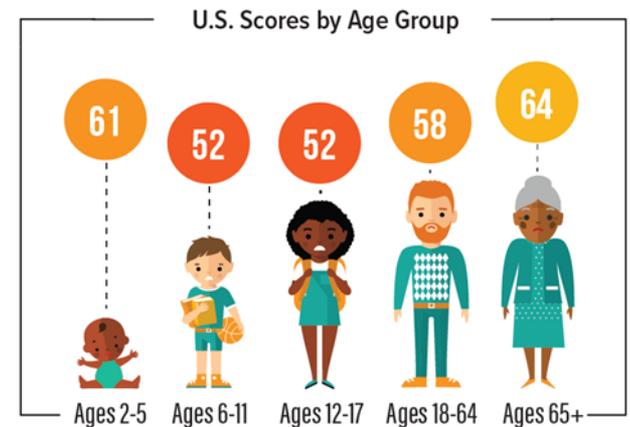
Analytic Results: Dietary Patterns Over Time and By Age

How Healthy Is the American Diet?



The Healthy Eating Index Score

shows that Americans do not align their eating choices with the Dietary Guidelines.
(on a scale from 0-100)

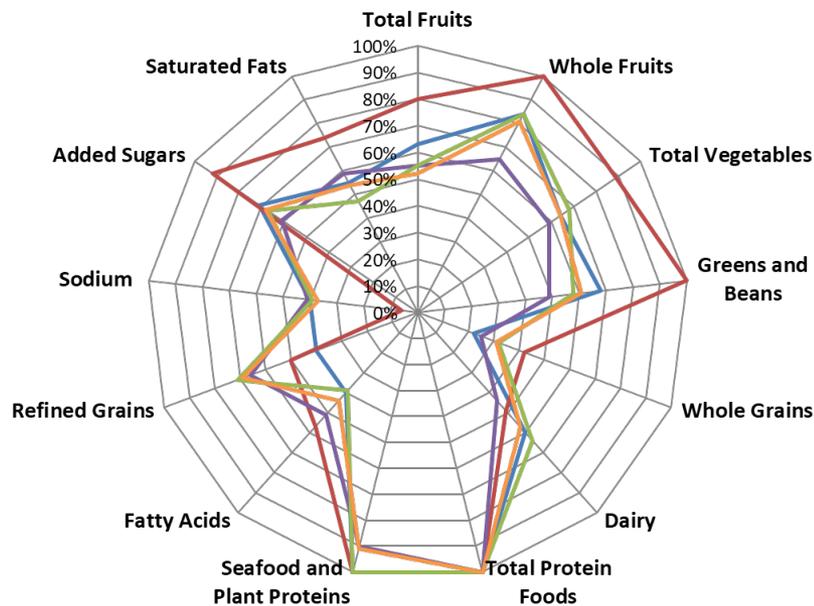


Data source for Healthy Eating Index scores: What We Eat in American, National Health and Nutrition Examination Survey. (Undated data are from 2015-2016).

Analytic Results: HEI-2015 Scores by race ethnicity, ages 2+ yrs

When dietary quality is examined using the Healthy Eating Index (HEI) by race/ethnic subgroups, it is clear that all groups fall short of meeting dietary guidance from the 2015-2020 DGA.

Total HEI-2015 Score				
Race/Ethnicity Groups, ages 2+ yrs				
All Hispanics (57)	NH Asians (65)	NH Blacks (56)	NH Whites (59)	Other Races (58)



Data Source for HEI-2015 Scores: WWEIA, NHANES 2015-2016

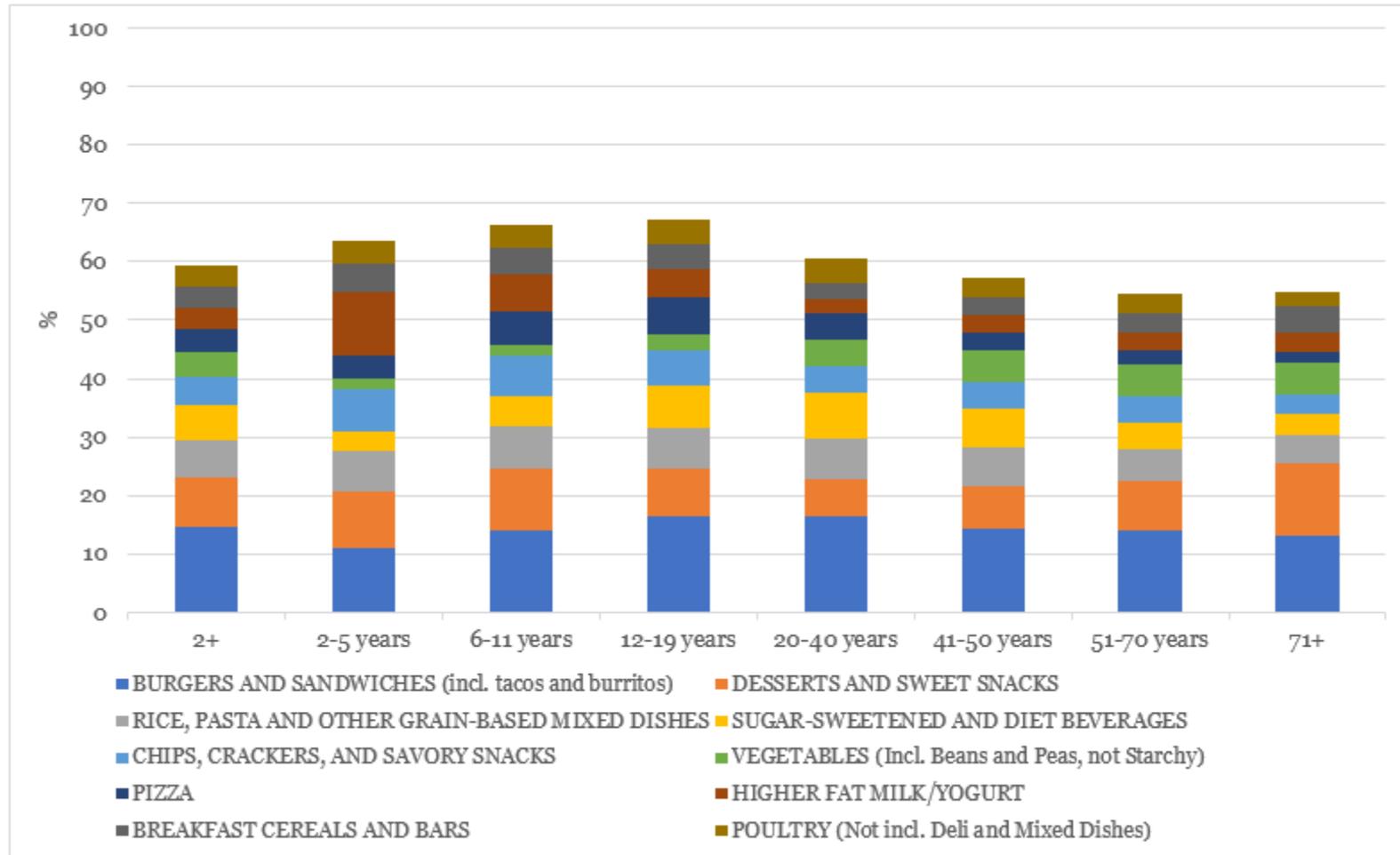
- Among all race-ethnic groups, $\geq 70\%$ of the max score is achieved for the two protein foods components
- No race-ethnic group achieves $\geq 70\%$ of the max score for whole grains, dairy, and fatty acids
- Addition components with $\geq 70\%$ of the max score vary by race-ethnic group
- Non-hispanic (NH) blacks do not achieve $\geq 70\%$ of the max score for any other components and have the lowest total HEI score
- NH Asians have the highest HEI score reflected by higher scores for total fruits, whole fruits, total vegetables, greens and beans, added sugars and saturated fats

Draft Conclusion Statement: DP and Bev - 1

Average diet quality has slightly improved in the last 10 years. However, scores indicate that diet quality is not consistent with recommendations in the 2015-2020 Dietary Guidelines for Americans. Differences are seen across age-groups, sex, race ethnicity, and income; though differences are generally small.

Analytic Results: Food Category Sources of Energy

Figure 2: Males and Females - Distribution of energy intake (percentages) across top 10 sub-categories



Describe/evaluate current dietary patterns and beverage consumption
2020 Dietary Guidelines Advisory Committee: Meeting 4

Draft Conclusion Statement: DP and Bev - 2

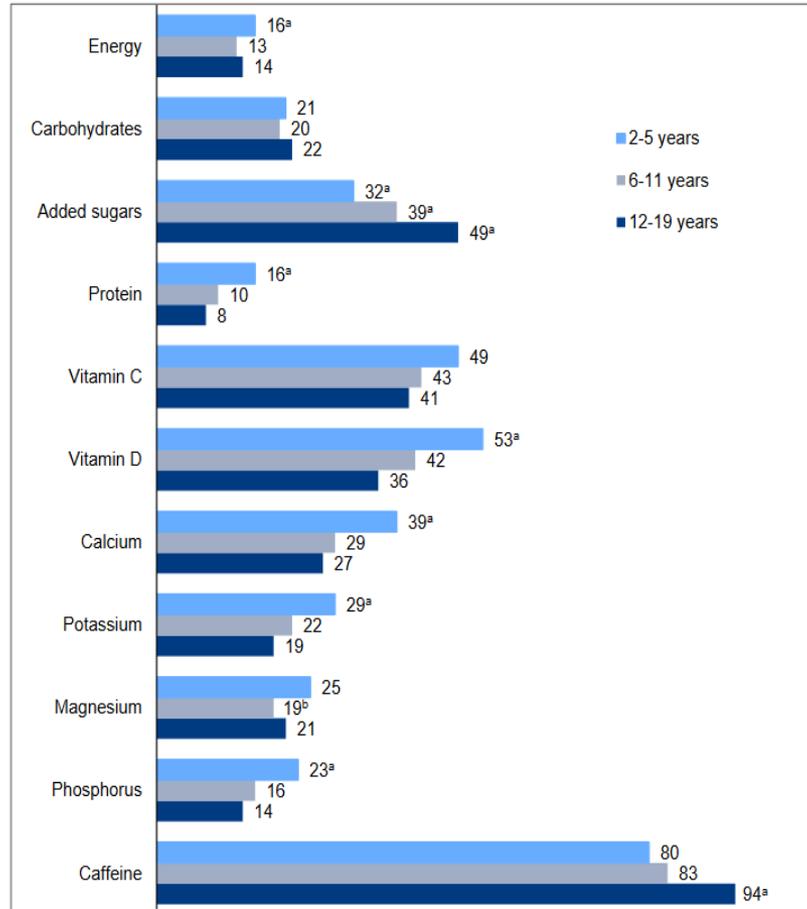
Foods and beverages consumed via mixed dishes (e.g. sandwiches, casseroles, pizza, etc), snacks and sweets, and beverages (other than milk and 100% juice) contribute 50-60% of total energy intake.

Food sub-category source contributions to energy vary by age, sex, race-ethnicity, and income; however for the total population the top five contributors include burgers and sandwiches, desserts and sweet snacks, rice, pasta and other grain-based mixed dishes, sweetened beverages, and chips, crackers and savory snacks.

Analytic Results:

Beverage contribution to intakes of dietary components

Figure 4. Percentage of mean daily energy and selected nutrient intakes contributed by beverages among children, WWEIA, NHANES 2015-2016



^a Significantly different than the other two age groups ($P < 0.01$)

^b Significantly different than age 2 to 5 years ($P < 0.01$)

SOURCE: What We Eat in America, NHANES 2015-2016, day 1, individuals 2-19 years

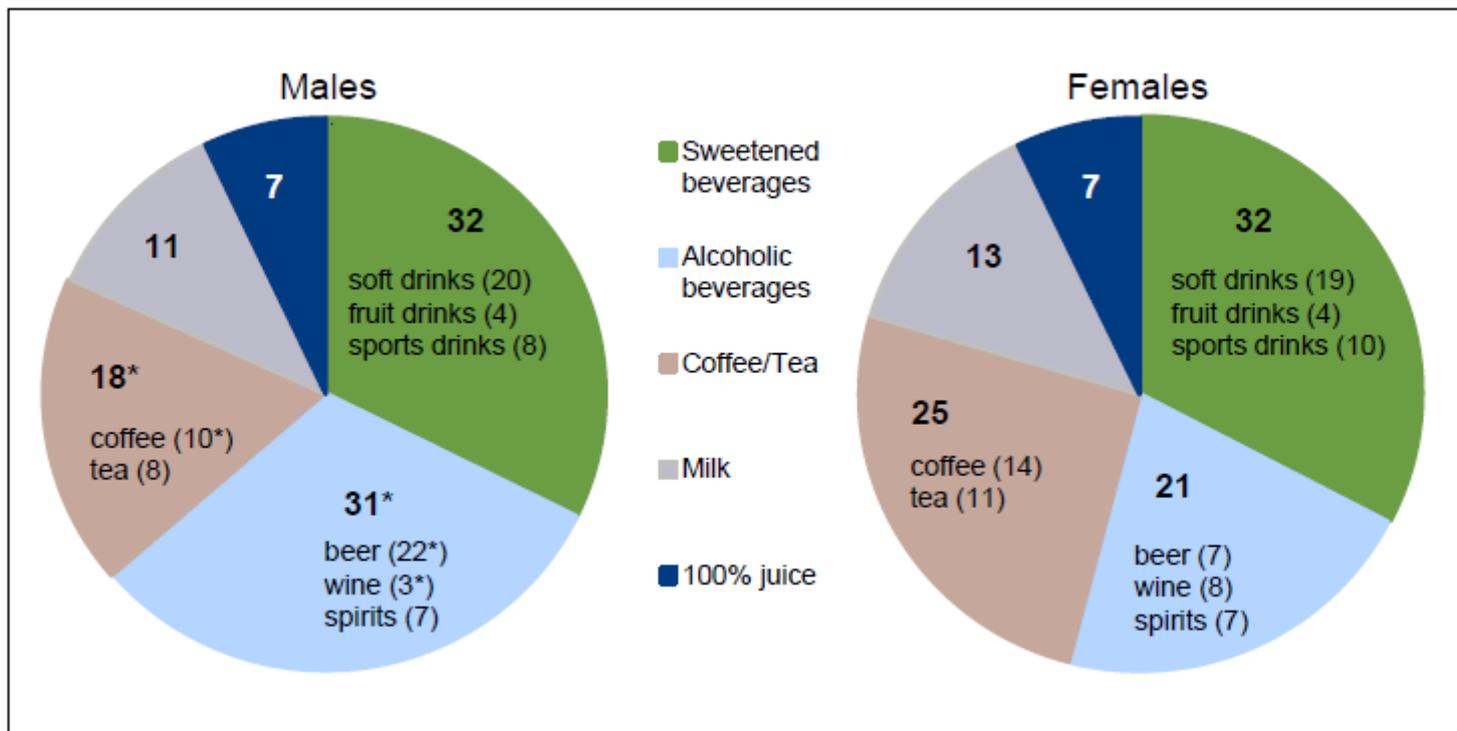
- ~15% of energy comes from beverages
- Beverages contributed >40% of daily intake of added sugars
 - The % of added sugars from beverages significantly increases with age
- Over 40% of vitamins C and D and more than 20% of carbohydrates, calcium, potassium and magnesium
 - Mainly from milk and 100% juice
- >80% of caffeine comes from beverages

Data source: Moshfegh, AJ, Garceau AO, Parker EA, and Clemens JC. Beverage Choices among Children: *What We Eat in America*, NHANES 2015-2016. Food Surveys Research Group Data Brief No. 22.

Analytic Results:

Percent of daily beverage calories by type

Figure 5. Percent of daily beverage calories by beverage type among adults, WWEIA, NHANES 2015-2016



*Significantly different from females, (p<0.01)

SOURCE: What We Eat in America, NHANES 2015-2016, day 1, individuals 20+ years

Data source:

Moshfegh, AJ, Garceau AO, Parker EA, and Clemens JC. Beverage Choices among Children: *What We Eat in America*, NHANES 2015-2016. Food Surveys Research Group Data Brief No. 22. May 2019.

Describe/evaluate current dietary patterns and beverage consumption
2020 Dietary Guidelines Advisory Committee: Meeting 4

Draft Conclusion Statement: DP and Bev - 3

Calories from total beverage intake account for approximately 15 - 18% of total energy intake for Americans ages 2+.

Fluid milk as a beverage decreases starting in early childhood and conversely the intake of sweetened beverages increases.

Beverages account for 40 - 50% of total added sugars intakes. Alcoholic beverages contribute 21% (adult females) and 31% (adult males) of total beverage calories.

Question (life stages)

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

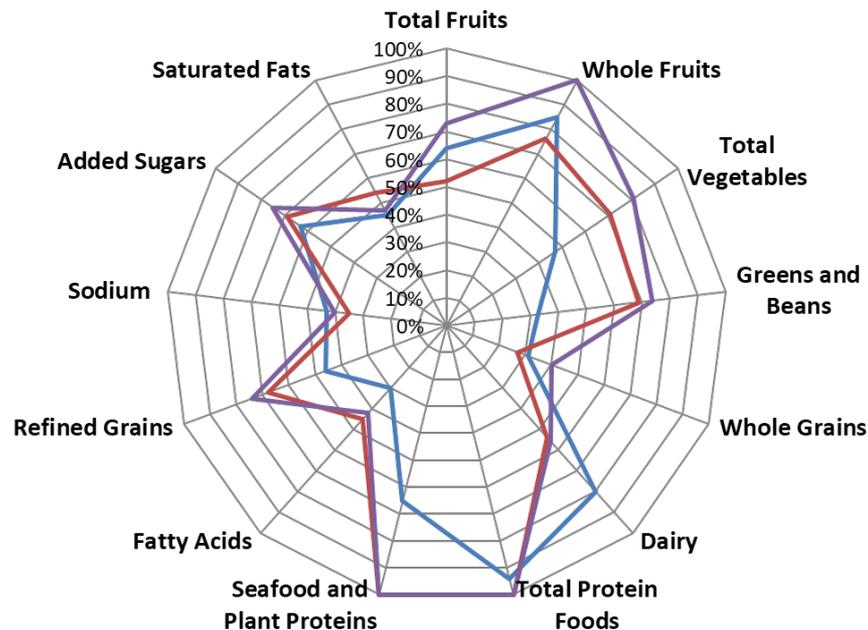
Analytic Framework: Patterns across life stages

-
- **Differences in food category sources of nutrients across life stages, particularly nutrients of concern**
 - **Differences in mean food group intakes across life stages**
 - **Differences in beverage contributions to energy and nutrient intakes across life stages**
-
- **Differences in food category contributions to energy intake across life stages**
 - **Differences in HEI-2015 total and component scores across life stages ages 2 years and older**
-

HEI-2015 Scores by Age Groups

Average dietary quality, measured by the HEI-2015, for Americans is not consistent with the recommendations from the 2015-2020 Dietary Guidelines for Americans. Scores increase with age.

Total HEI-2015 Score By Age Groups		
2-19Y (53)	20-64Y (59)	65+Y (64)

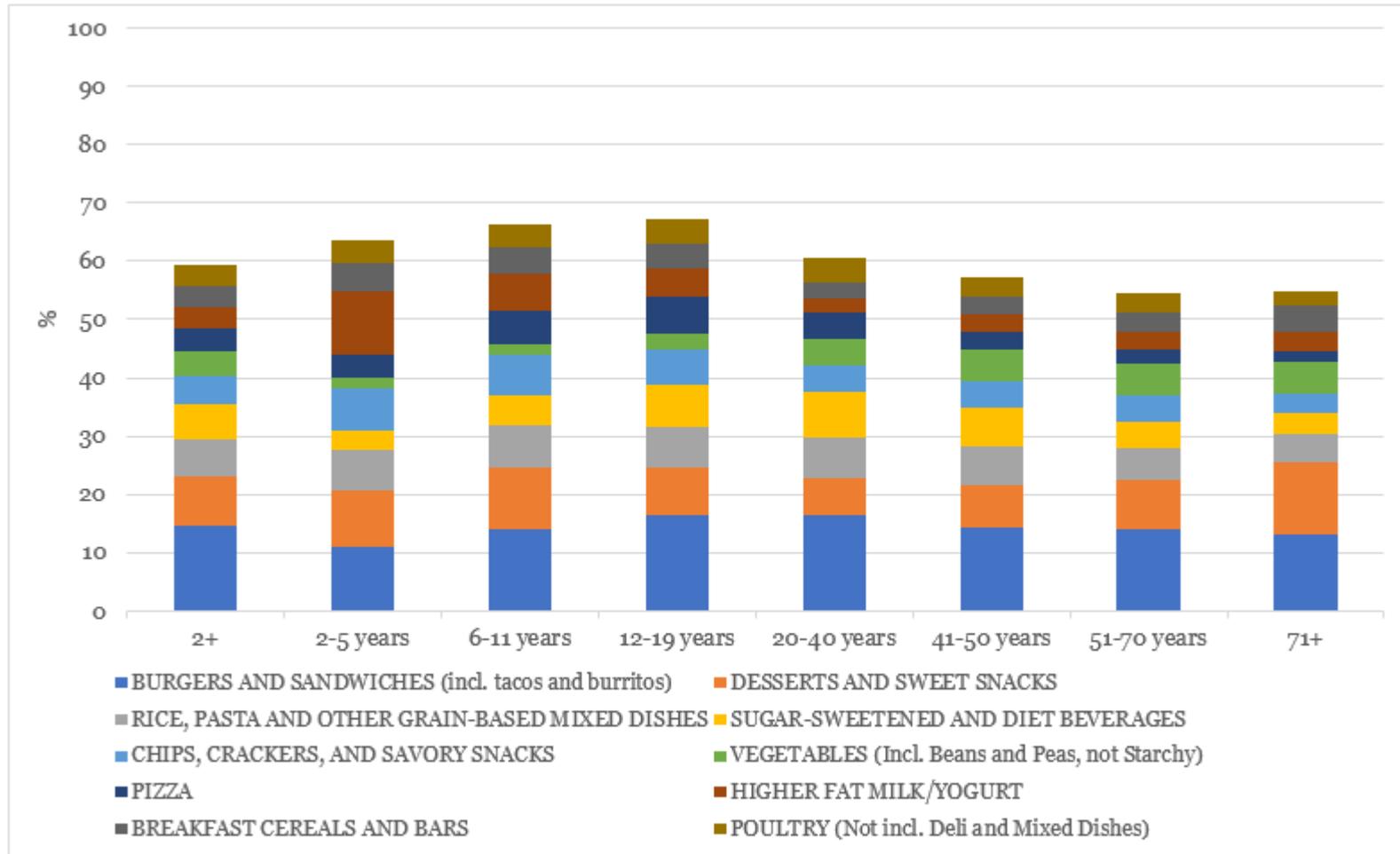


- Children achieve at $\geq 70\%$ of the max score in three categories: whole fruits, total protein foods, and dairy.
- Compared to children, young to middle age adults have higher scores in the additional components of total vegetables, greens and beans, and seafood and plant protein.
- Older adults further improve with the addition of higher scores in total fruit, refined grains and added sugars.
- Notably, those older than 19 have a lower score in the Dairy component compared to the 2-19 year old group.

How does dietary intake track across life stages
2020 Dietary Guidelines Advisory Committee: *Meeting 4*

Analytic Results: Food Category Sources of Energy (continued)

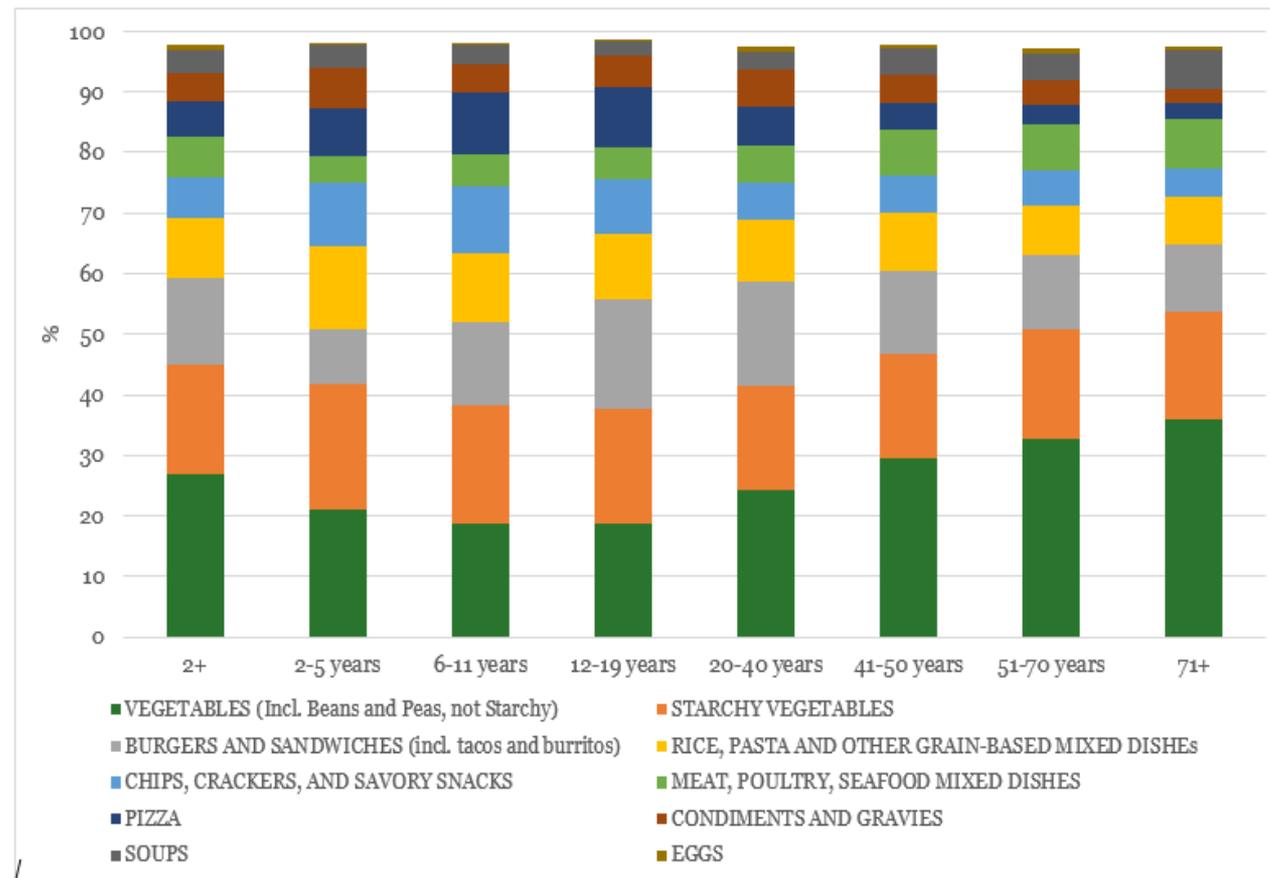
Figure 2: Males and Females - Distribution of energy intake (percentages) across top 10 sub-categories



Analytic Results Summary:

Food Group Intakes Across Life Stages - vegetables

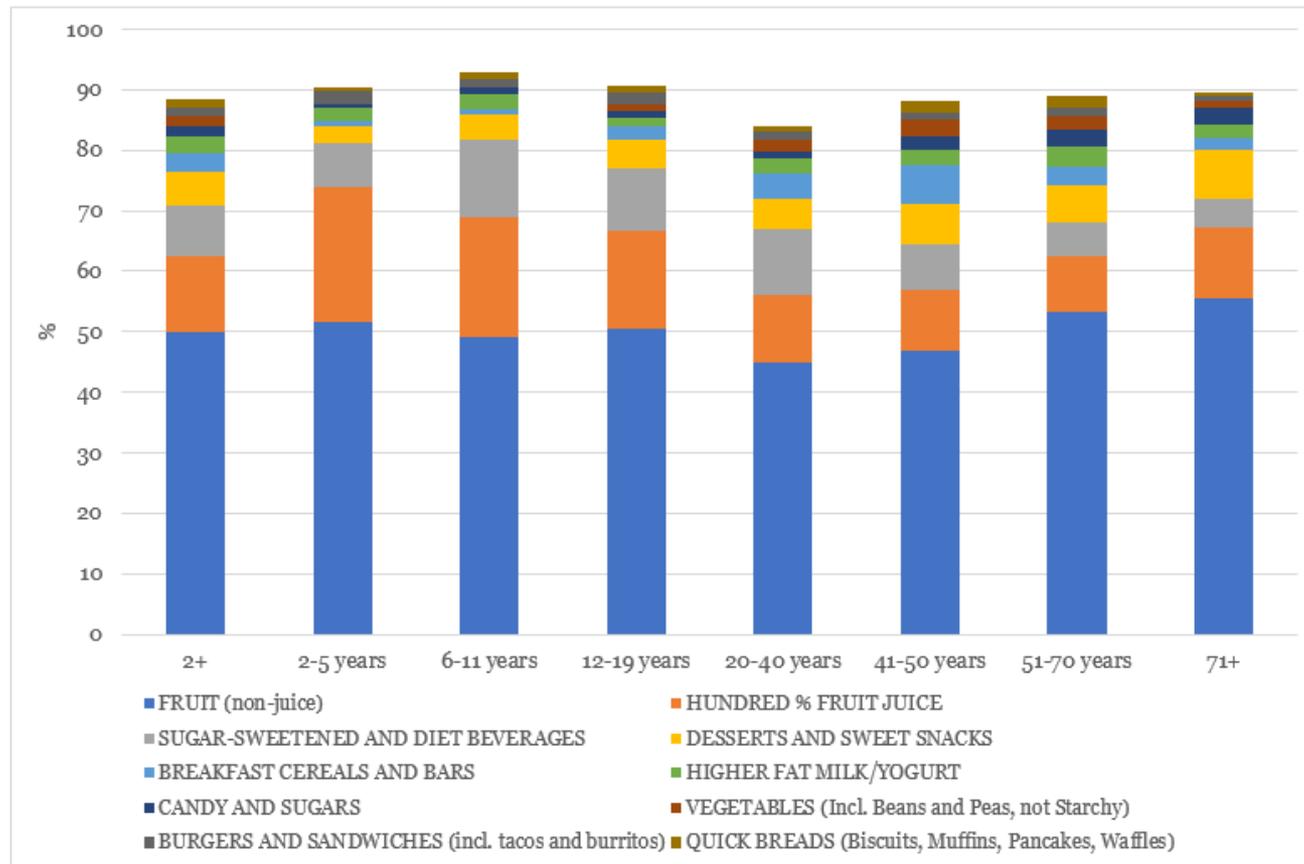
Figure 2. 2: Males and Females – Distribution of total vegetables intake (percentages) across top 10 sub-categories



- Mean vegetable intakes increase with age.
- Less than 50% of vegetables are consumed as vegetables alone.
- Chips, crackers and savory snacks as well as pizza are a larger source of vegetables for children than for adults or older adults.

Analytic Results Summary: Food Group Intakes Across Life Stages - fruits

Figure 1. 2: Males and Females - Distribution of total fruits intake (percentages) across top 10 sub-categories

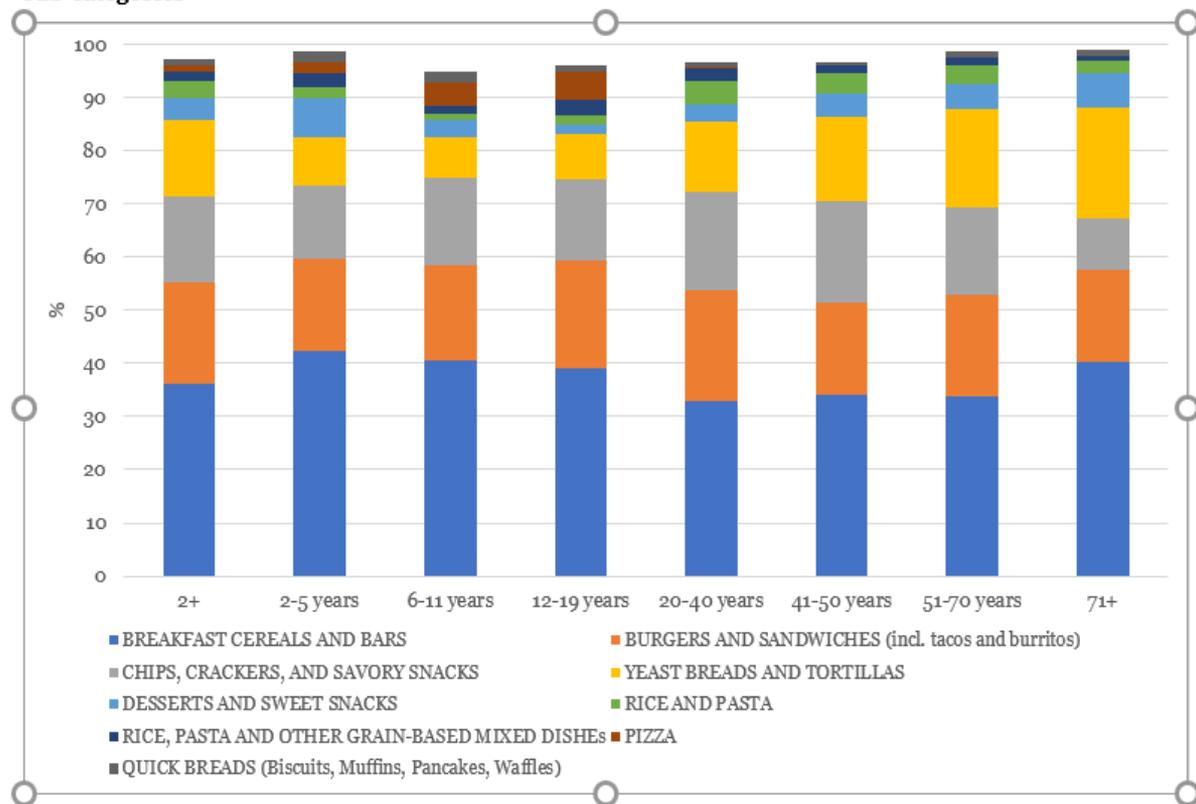


- Mean fruit intake decreased after age 5 and stays similar across age groups.
- 100% fruit juice intakes decrease after adolescents.

Analytic Results Summary:

Food Group Intakes Across Life Stages – whole grains

Figure 4. 2: Males and Females - Distribution of total whole grains intake (percentages) across top 10 sub-categories

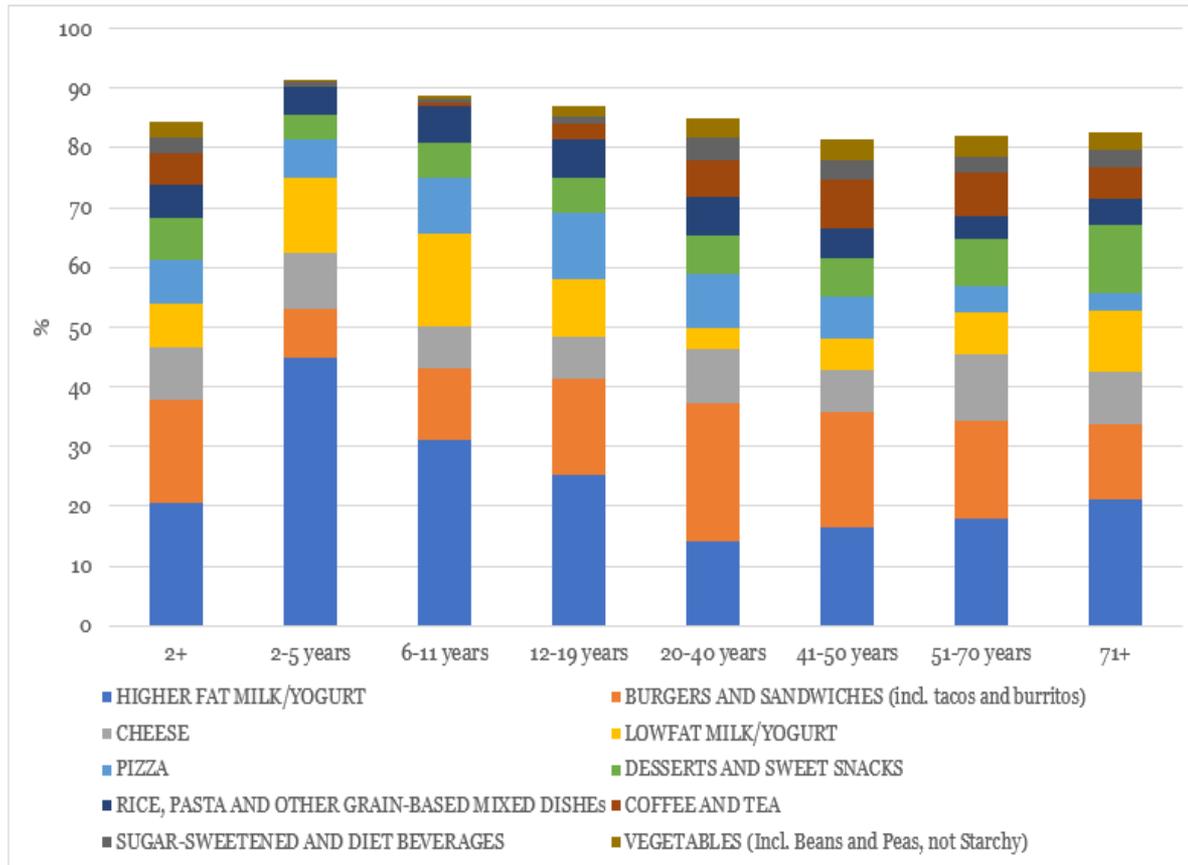


- Intakes of whole grains is ~1oz eq across life stages, and fall well below recommended intakes.
- Chips, crackers, and savory snacks as a source of whole grains decreases and yeast breads and tortillas increase as sources of whole grains among individuals in older age groups.

Analytic Results Summary:

Food Group Intakes Across Life Stages – dairy

Figure 9. 2: Males and Females - Distribution of total dairy intake (percentages) across top 10 sub-categories

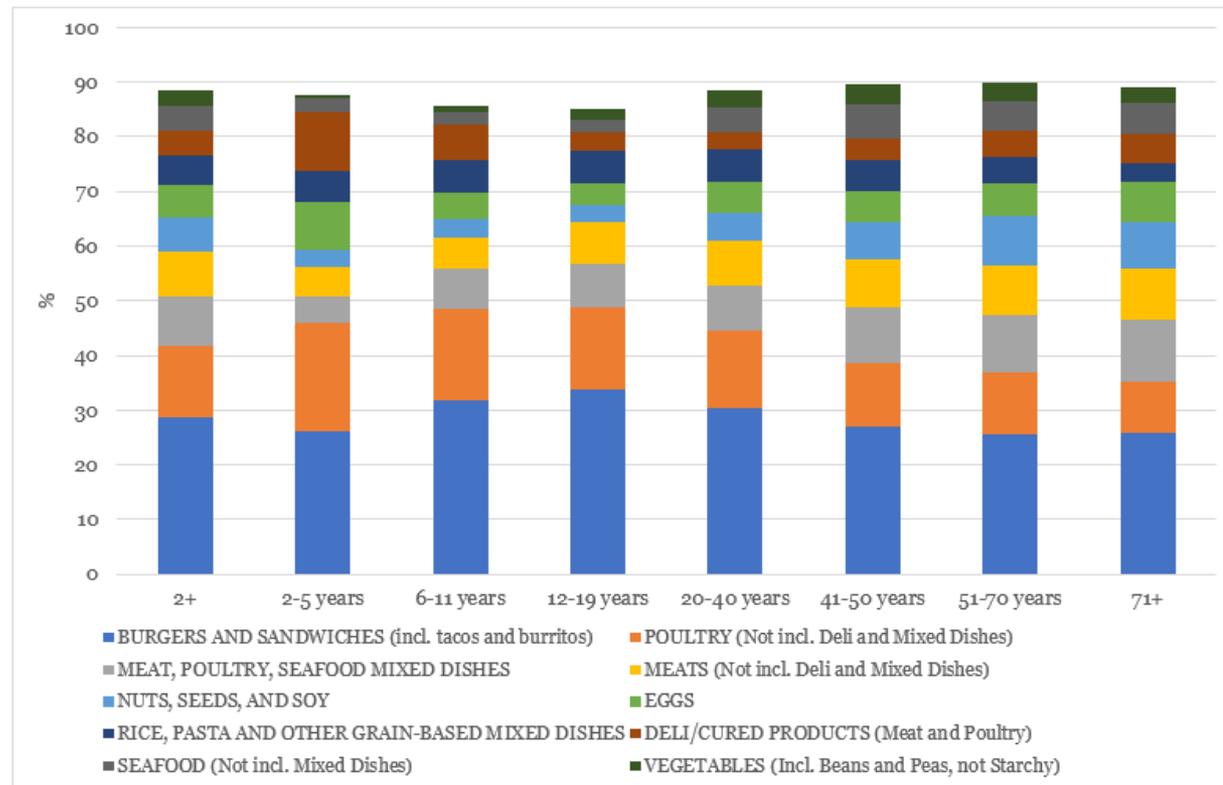


- Dairy intakes decrease across life stages.
- Food category sources shift from higher fat milk/yogurt among young children to burgers and sandwiches among young to middle aged adults.
- Among older adults desserts and sweet snacks becomes a larger contributing source.

Analytic Results Summary:

Food Group Intakes Across Life Stages – protein foods

Figure 6. 2: Males and Females - Distribution of total protein intake (percentages) across top 10 sub-categories

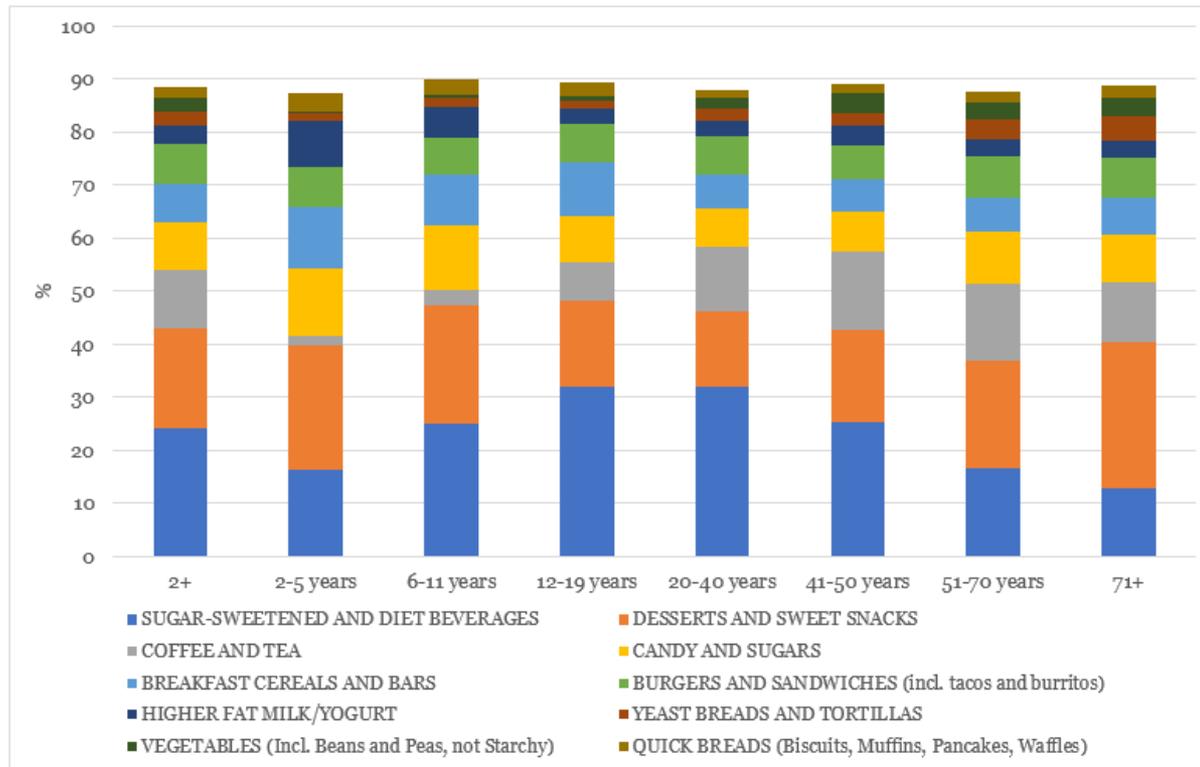


- Mean total protein foods intakes is generally within recommended ranges, though among older adults intakes fall below recommended amounts.
- For older children and younger adults, burgers and sandwiches is a main food category source.
- Mixed dishes contribute a smaller proportion of protein to the intakes of older adults.

Analytic Results Summary:

Food Group Intakes Across Life Stages – added sugars

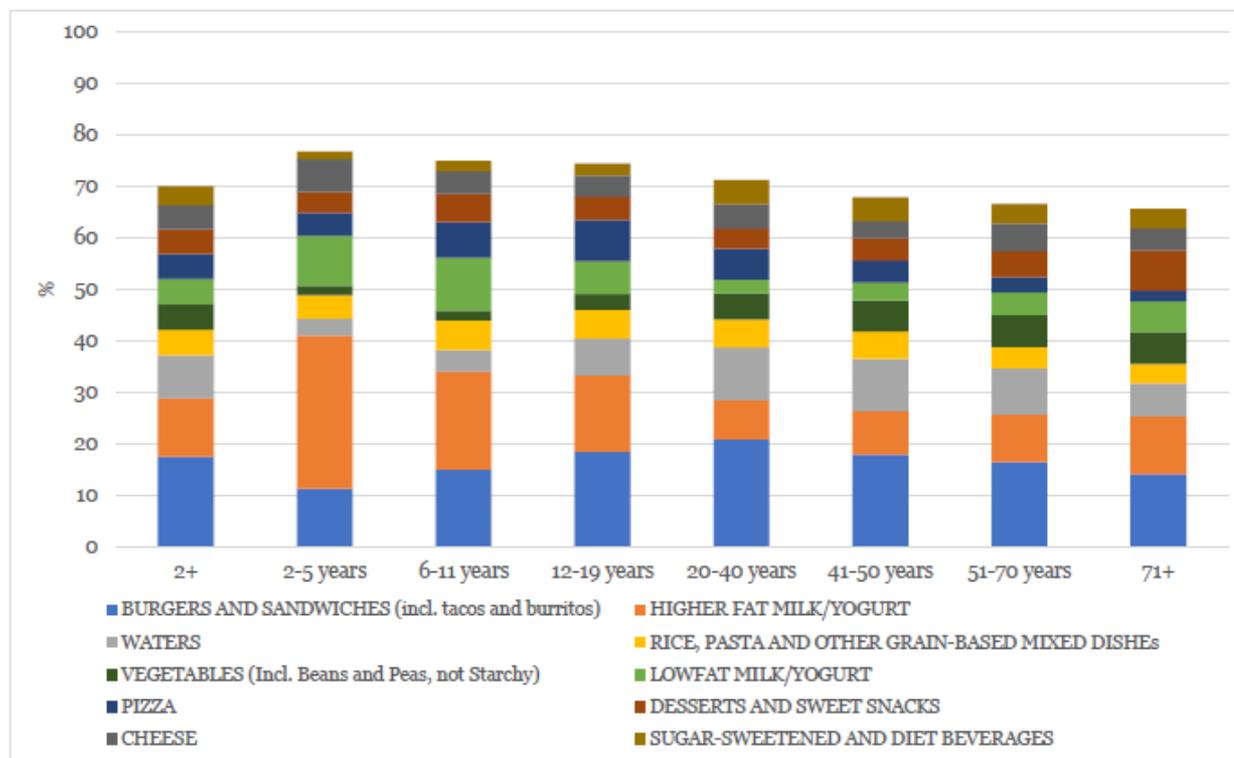
Figure 14. 2: Males and Females - Distribution of added sugars intake (percentages) across top 10 sub-categories



- Mean intakes of added sugars are highest in adolescents and early adulthood.
- Food category sources change across life stages.
- Desserts and sweet snacks are a larger contributor for young children and older adults.
- Sweetened beverages is highest among those ages 6-50 yrs.
- For adults, coffee and tea are also sources of added sugars.

Analytic Results Summary: Nutrient Intakes Across Life Stages – calcium

Figure 2. 2: Males and Females – Distribution of total calcium intake (percentages) across top 10 sub-categories

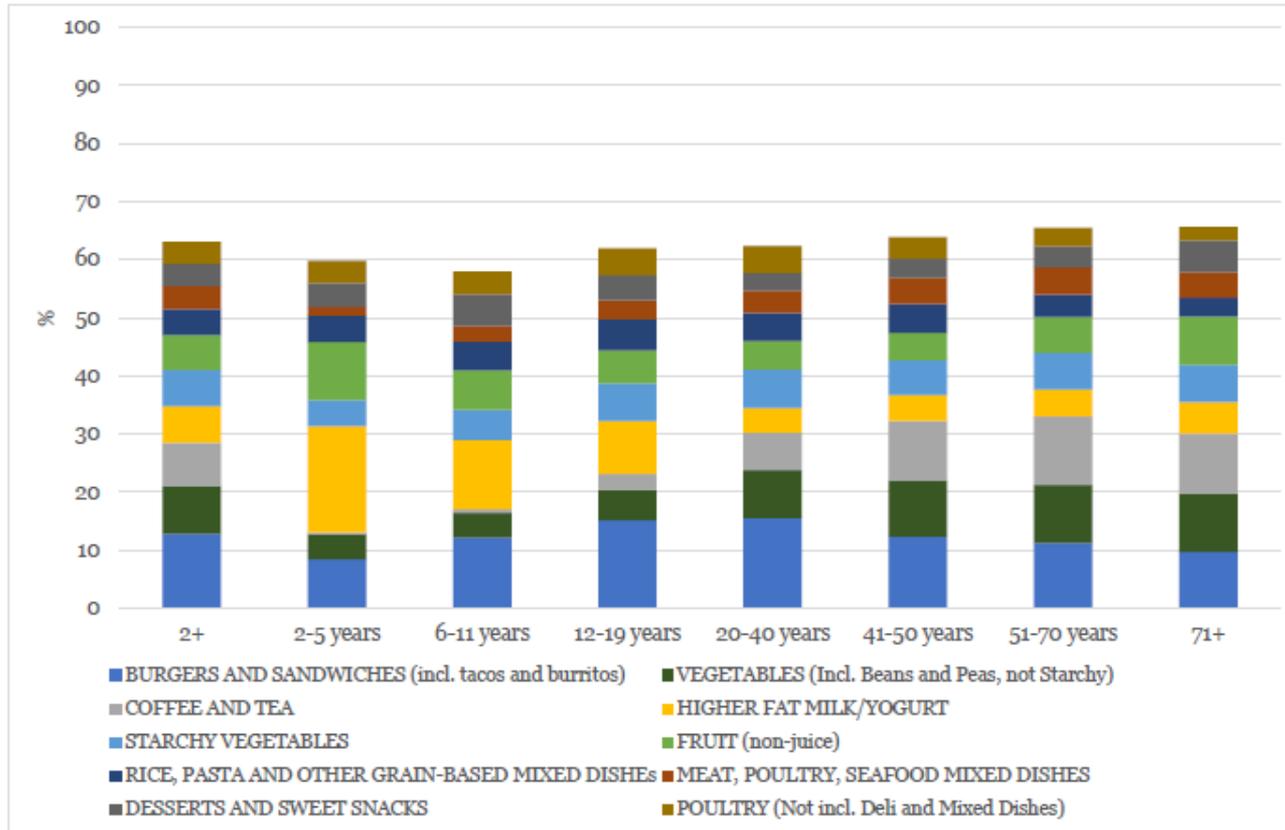


- Higher fat milk/yogurt is the largest contributor of calcium for young children and shifts to burgers and sandwiches for adolescents and young adults.
- Waters make up a larger contributor among adults.

Analytic Results Summary:

Nutrient Intakes Across Life Stages – potassium

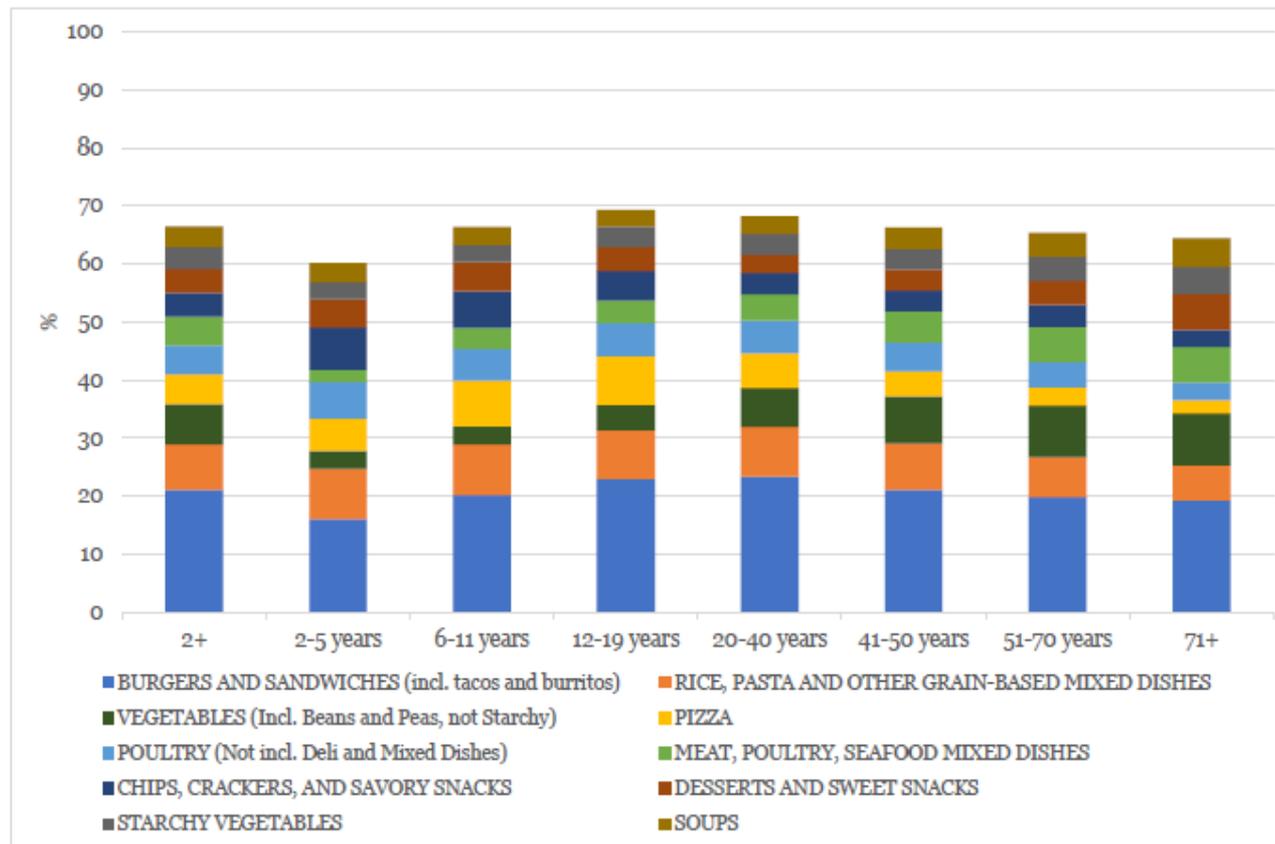
Figure 3. 2: Males and Females – Distribution of total potassium intake (percentages) top 10 across sub-categories



- Higher fat milk/yogurt is the largest contributor of potassium for young children and shifts to burgers and sandwiches for adolescents and young adults.
- Coffee/tea and vegetables, is a larger contributing source for adults.

Analytic Results Summary: Nutrient Intakes Across Life Stages – sodium

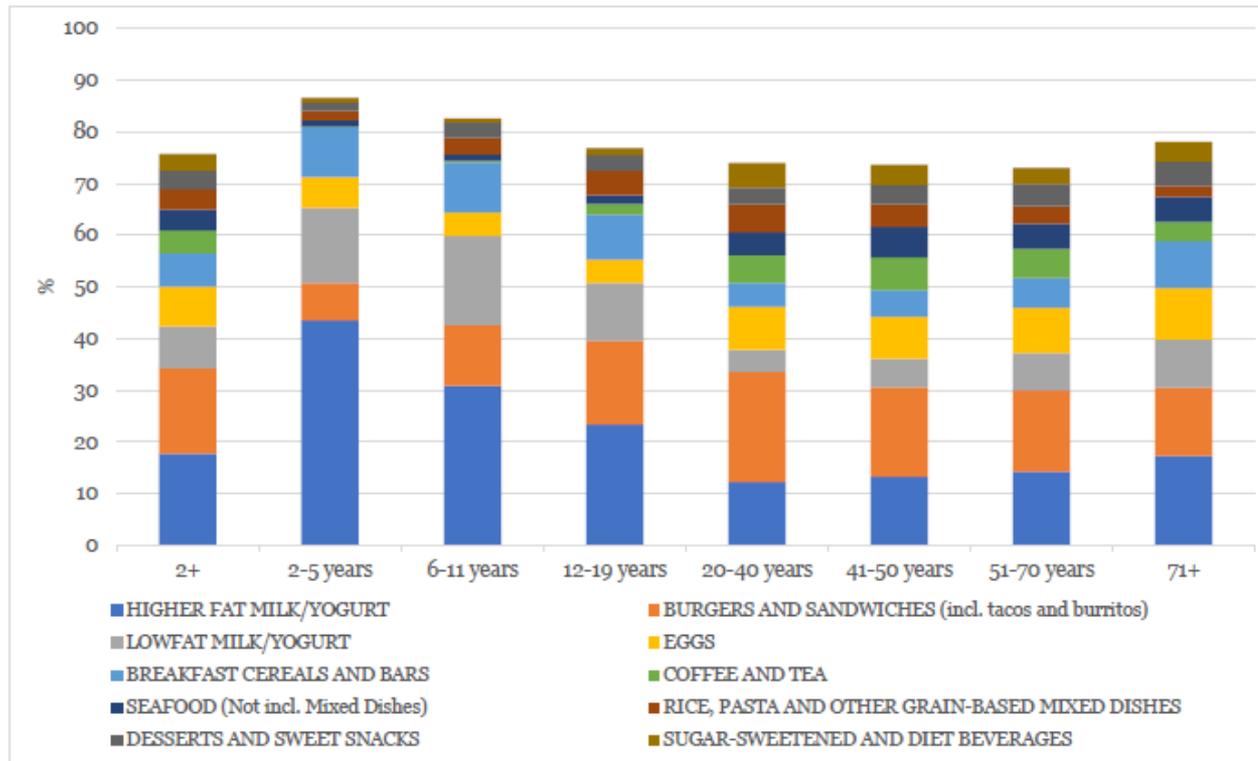
Figure 4. 2: Males and Females - Distribution of total sodium intake (percentages) across top 10 sub-categories



- Sodium is overconsumed across all life stages.
- Across life stages, burgers and sandwiches is the largest contributor to sodium intakes.

Analytic Results Summary: Nutrient Intakes Across Life Stages – vitamin D

Figure 6. 2: Males and Females - Distribution of total vitamin D intake (percentages) across top 10 sub-categories



- Vitamin D is underconsumed across all life stages.
- For children, higher fat and low fat milk/yogurt are a key source.
- Burgers and sandwiches are a larger source for adults than children.

DRAFT Conclusion Statement:

Dietary patterns and nutrients across life stages

Generally, there are consistencies in diet quality seen across all life stages.

Diet quality is better among young children and older adults, but does not align with existing dietary guidance.

Food category sources of food groups and nutrients differ across life-stage groups. In particular, intakes of milk and yogurt after early childhood decrease and intakes of added sugars from beverages increase.

Fruit and vegetable intakes declines through adolescence and adulthood and increases among older adults. Intakes of burgers and sandwiches contribute to most food groups, nutrients and food components which fall outside of recommended ranges.

Question (chronic health conditions)

Describe/evaluate prevalence of nutrition-related chronic health conditions

Approach to Answer Question: Data Analysis

Draft Conclusion Statement

Nutrition related chronic health conditions are common across every life stage of the U.S. population.

There are disparities in the severity of the prevalence, incidence, or mortality rate of chronic health conditions between groups classified by sex, age, race-ethnicity, income level, and weight status

In general, chronic health conditions have become more prevalent over time, particularly among older populations, certain race-ethnicity groups, and those with a lower income are disproportionately affected.

Analysis Results for Life Stages

Birth to less than 24m

- Growth, size and body composition outcomes
- Food allergy disease outcomes

Children (2-19 years)

- Growth, size and body composition outcomes
- Cardiovascular intermediate outcomes
- Cancer outcomes
- Diabetes
- Dental caries

Pregnant Women

- Gestational diabetes
- Pregnancy-induced hypertension

Adults (20 years and older)

- Growth, size and body composition outcomes
- Cardiovascular intermediate and endpoint outcomes
- Diabetes and metabolic syndrome
- Chronic liver disease outcomes
- Cancer outcomes
- Dental caries

Older Adults (60 + years)

- Reduced muscle strength
- Osteoporosis or low bone mass

Analytic Results:

Birth to less than 24m

More U.S. children from birth to less than 24 months are overweight (8.9%) than underweight (1.4%) based on weight-for-recumbent length.

The prevalence of low birthweight (<2500 grams) and very low birthweight (<1500 grams) are 8.3% and 1.4%, respectively. Non-Hispanic black mothers have the highest prevalence of low birthweight babies (13.9%), and has increased over time.

Birth to 4 years

The prevalence of food allergy based on proxy-report is 6.6%.

Analysis Results

Birth to less than 24m

- Growth, size and body composition outcomes
- Food allergy disease outcomes

Children (2-19 years)

- Growth, size and body composition outcomes
- Cardiovascular intermediate outcomes
- Cancer outcomes
- Diabetes
- Dental caries

Analysis Results:

Growth, Size and Body Composition

- Overall prevalence of:
 - overweight (16.6%)
 - obesity (18.5%)
 - underweight (3.0%)
- The prevalence of underweight is higher in boys than girls and increases with age, however the overall prevalence has decreased from 2007-2008
- The prevalence of obesity is higher in boys than girls, increases with age, and has increased since 2007-2008

Source: [Prevalence of underweight among children age 2–19 years in the U.S. by age, sex and race-ethnicity using NHANES 2015-2016](#)
[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](#)
[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](#)

Analytic Results:

Growth, Size and Body Composition

- Among girls, the race-ethnicity group with the highest prevalence of obesity is non-Hispanic blacks (25.1%)
- Among boys, the race-ethnicity with the highest prevalence is Hispanic and Mexican Americans (29.2%)
- The prevalence of obesity is lowest among children whose household head is a college graduate

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

Draft Conclusions: CVD Intermediate Outcomes

12-19 years olds

The prevalence of hypertension 4.1% and is higher in males, non-Hispanic blacks, 18-19 year olds, and those with obesity relative to peer counterparts.

The prevalence of high LDL cholesterol is 5.4%, and the prevalence of low HDL cholesterol is 15.5%.

The prevalence of high LDL cholesterol is higher in non-Hispanic whites (17%) and Hispanic and Mexican American (16%) when compared with non-Hispanic black (8%) and Asian (7%) youths.

Draft Conclusions: CVD Intermediate Outcomes (continued)

12-19 years olds (continued)

The prevalence of low HDL cholesterol is higher in males, non-Hispanic whites, and youths with obesity.

For each chronic health condition, the highest prevalence is among those with obesity.

Analytic Results: Cancer Outcomes leukemia (ages 0-19)

0-19 years olds

- Incidence rate of leukemia: 4.7 per 100,000
- Mortality rate of leukemia: 0.6 per 100,000
- Incidence and mortality rates of leukemia are higher among boys (5.1, 0.7 per 100,000) than girls (4.4, 0.5 per 100,000)

Source: [Leukemia incidence and death rates among children ages 0-19 years using age-adjusted SEER 2011-2015](#)

Analysis Results: Diabetes and Prediabetes (ages 12-19)

12-19 years olds

- Prevalence of diabetes: 0.5%
- Prevalence of diabetes and prediabetes: 23.1%

Source: [Prevalence of prediabetes among children ages 12-19 years, by age, sex and race-ethnicity using NHANES 2011-2014](#)

Analysis Results: Dental Caries (ages 2-19)

2-19 years olds

- The prevalence of total dental caries was 45.8%, while the prevalence of untreated dental caries was 13.0%
- The prevalence of total caries was lowest in ages 2-5 (21.4%) and higher in age groups 6- 11 years (50.5%) and 12-19 years (53.8%)
- Hispanic youth have the highest prevalence of dental caries (57.1%), but non-Hispanic black youth have the highest prevalence untreated dental caries (17.1%)
- The prevalence of both total caries and untreated caries is lower among those with higher family income.
- There has been a slight downward trend over time for the prevalence of total and untreated dental caries.

Source: [Prevalence of dental caries among children ages 2-19 years, by age, race-ethnicity and income using NHANES 2015-2016](#)

Analysis Results for Life Stages (continued)

Birth to less than 24m

- Growth, size and body composition outcomes
- Food allergy disease outcomes

Children (2-19 years)

- Growth, size and body composition outcomes
- Cardiovascular intermediate outcomes
- Cancer outcomes
- Diabetes
- Dental caries

Adults (20 years and older)

- Growth, size and body composition outcomes
- Cardiovascular intermediate and endpoint outcomes
- Diabetes and metabolic syndrome
- Chronic liver disease outcomes
- Cancer outcomes
- Dental caries

Analytic Results:

Body Size and Composition (adults ages 20+ yrs)

Adults, 20+ y

- The overall prevalence of underweight among adults 20 years and older is 1.5%
- The overall prevalence of overweight (31.6%) and obesity (39.6%), including severe obesity (7.7%)
 - The prevalence of overweight has decreased over time while the prevalence of obesity and the prevalence of severe obesity have increased
 - The prevalence of obesity and the prevalence of severe obesity is higher among women than men

Source: [Prevalence of underweight among adults ages 20 years and older in the U.S. by age, and sex using NHANES 2015-2016](#)

[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](#)

[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](#)

Analytic Results:

Body Size and Composition (Adults ages 20+ yrs)

Adults, 20+ y

- Mean body weight, waist circumference, and body mass index have increased over time
- Adults ages 40-59 have the highest prevalence of obesity (42.8%)
- Hispanic and Mexican Americans have the highest prevalence of obesity among adult males (46.2%)
- Non-Hispanic blacks have the highest prevalence of obesity among adult females (54.8%)

Source: [Prevalence of underweight among adults ages 20 years and older in the U.S. by age, and sex using NHANES 2015-2016](#)
[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](#)
[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](#)

Analytic Results:

Dental Outcomes (Adults ages 20+ yrs)

Adults, 20+ y

- The overall prevalence of dental caries among adults ages 20-64 was 89.9% and 96.2% among adults ages 65 and older
- Women have a higher prevalence (91.5%) than men (88.2%) among ages 20-64, but the prevalence converges among adults 65 and older (women: 96.3%, men: 96.1%)
- Non-Hispanic blacks have the highest prevalence of untreated dental caries among all race-ethnicity groups
- The overall prevalence of complete tooth loss is 2.2% among adults ages 20-64 and 17.3% among adults ages 65 and older.

Source: [Prevalence of dental caries and tooth loss among adults ages 20-64 and older adults ages 65+ in the U.S., by age, race-ethnicity, and income NHANES 2011-2016](#)

Analytic Results: CVD Intermediate & Outcomes

Adults

- Overall prevalence of cardiovascular intermediate and endpoint outcomes:
 - High total cholesterol: 12.4%
 - Low high-density lipoprotein (HDL): 18.4%
 - Hypertension: 29%, adults 18 and over
 - Coronary heart disease (CHD): 5.6%, adults 18 and over
 - Stroke: 2.9%, adults 18 and over

Source: [Prevalence of high total cholesterol 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 18 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](#)

Analytic Results: Cardiovascular Intermediate & Outcomes

Adults

- The prevalence of high cholesterol and low HDL has decreased since 2007-8
- Women have a higher prevalence of high total cholesterol; men have a higher prevalence of hypertension, low HDL, CHD, and stroke
- Adults ages 40-59 had the highest prevalence of high total cholesterol and low HDL, however, adults ages 65 and over had the highest prevalence of hypertension, CHD, and stroke

Source: [Prevalence of high total cholesterol 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 18 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](#)

Analytic Results: Cardiovascular Outcomes

Key findings continued, Adults

- Non-Hispanic whites have the highest prevalence of high total cholesterol among women (17.2%), however, Hispanics have the highest prevalence of high total cholesterol among men (14.8%)
- Hispanics have the highest prevalence of low HDL of both men and women (36.2%, 13.8%)
- Non-Hispanic blacks have the highest prevalence of hypertension (40.3%) and stroke (4.2%)
- American Indian/Alaskan Natives have the highest prevalence of coronary heart disease at 9.0%
- The prevalence of hypertension, coronary heart disease, and stroke are lower among those with higher education levels. Those with a college degree have the lowest prevalence

Source: [Prevalence of high total cholesterol 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 18 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](#)

Analytic Results:

Diabetes, Prediabetes, and Metabolic Syndrome

Adults

Prevalence estimates

- Diabetes is 14.0%.
 - Diagnosed: 9.7%,
 - Undiagnosed: 4.3%
- Prediabetes is 33.9%
- Metabolic syndrome is 34.9%
- Men have a higher prevalence of diabetes and prediabetes than women, but have a similar prevalence of metabolic syndrome
- The prevalence of each is higher among older age groups
- More than half of older adults (52%) have metabolic syndrome
- The prevalence of diabetes is higher among those with higher BMI
- Hispanic and Mexican Americans have the highest prevalence of diabetes and metabolic syndrome

Source: NCHS, National Health and Nutrition Examination Survey, 2013-2016

[Prevalence of diagnosed, undiagnosed and total diabetes among adults ages 20+ years, by age, sex and race-ethnicity using NHANES 2013-2016](#)

[Prevalence of prediabetes among adults ages 18 years and older, by age, sex and race-ethnicity using NHANES 2011-2014](#)

Analytic Results: Chronic Liver Disease Outcomes

Adults

- Prevalence of:
 - Self-reported liver disease: 1.7%
 - High ALT: 9.7%
 - High AST: 16.0%
- Hispanics have a higher prevalence of liver disease, high ALT, and high AST than non-Hispanics
- American Indian/Alaska Natives have the highest prevalence of liver disease
- Men and women have a similar prevalence of liver disease
- Chronic liver disease mortality rate: 14.3 for men and 7.5 for women per 100,000
 - Mortality rates have increased over time
 - Males ages 55-64 have the highest mortality rate

Source: [Prevalence of high alanine aminotransferase \(ALT\) and aspartate aminotransferase \(AST\) among adults ages 20 years and older, by sex and race-ethnicity using NHANES 2005-2008](#)

[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, 2016](#)

Analytic Results: Chronic Liver Disease Outcomes (continued)

Key findings: age-adjusted chronic liver disease and cirrhosis mortality per 100,000 population (ages 15+)

- Male mortality rate:
 - 2016: 14.3
 - 2006: 12.1
- Female mortality rate:
 - 2016: 7.5
 - 2006: 5.8
- From 2006 – 2016, mortality rates have increased for every age group except males 45-54
- The age/sex group with the highest mortality rate from chronic liver disease were males 55-64 years old (45.9 per 100,000); the age/sex group with the lowest mortality was females 25-34 years old (1.6)

Source: [Age-adjusted chronic liver disease and cirrhosis mortality in the U.S. using NVSS, 2016](#)

Analytic Results: Cancer Outcomes

- The cancer with the highest incidence rate among all ages is female breast cancer (127.5 per 100,000), followed by male prostate cancer (109.5 per 100,000)
- The age group and cancer type with the highest incidence rate is prostate cancer among males 65 years and older (560.4 per 100,000)
- The cancer with the highest mortality rate among all ages is lung and bronchus cancer (41.9 per 100,000)
 - The age group and cancer type with the highest mortality rate is lung and bronchus cancer among those 65 years and older (251.6 per 100,000)
- Men have a higher incidence and mortality rates than women at all ages across all shared cancer types
- The incidence and mortality rates for every cancer type are highest among the 65 years and older age group

Source: [SEER Cancer Statistics 2016](#)

Analysis Results for Life Stages (cont.)

Birth to less than 24m

- Growth, size and body composition outcomes
- Food allergy disease outcomes

Children (2-19 years)

- Growth, size and body composition outcomes
- Cardiovascular intermediate outcomes
- Cancer outcomes
- Diabetes
- Dental caries

Pregnant Women

- Gestational diabetes
- Pregnancy-induced hypertension (not available for 2017 at this time)

Adults (20 years and older)

- Growth, size and body composition outcomes
- Cardiovascular intermediate and endpoint outcomes
- Diabetes and metabolic syndrome
- Chronic liver disease outcomes
- Cancer outcomes
- Dental caries

Analytic Results: Gestational Diabetes

- Total prevalence: 6.0%
 - Women younger than 20 y: 1.9%
 - Women older than 40 y: 12.8%
- Race-ethnicity groups with the highest prevalence:
 - Non-Hispanic Asians: 11.1%
 - American Indian/Alaska Native: 9.2%
 - Native Hawaiian/Pacific Islander: 8.4%
- Prevalence remains relatively stable across education status
- Prevalence is higher among those with higher BMI– those classified as Obesity Class III had a prevalence of 13.9%

Source: [Prevalence of gestational diabetes in the U.S. 2012-2016 by age, race-ethnicity, education and pre-pregnancy BMI status using NVSS](#)

Analysis Results for Life Stages (including older adults)

Birth to less than 24m

- Growth, size and body composition outcomes
- Food allergy disease outcomes

Children (2-19 years)

- Growth, size and body composition outcomes
- Cardiovascular intermediate outcomes
- Cancer outcomes
- Diabetes
- Dental caries

Pregnant Women

- Gestational diabetes
- Pregnancy-induced hypertension

Adults (20 years and older)

- Growth, size and body composition outcomes
- Cardiovascular intermediate and endpoint outcomes
- Diabetes and metabolic syndrome
- Chronic liver disease outcomes
- Cancer outcomes
- Dental caries

Older Adults (60 + years)

- Reduced muscle strength
- Osteoporosis or low bone mass

Analytic Results: Reduced Muscle Strength

Older Adults

- Overall age-adjusted prevalence: 19.2%
- Higher among those 80 y and over (48.6%) than those ages 60-79 (10.9%)
- The age-adjusted prevalence is 19.4% among women and 19% among men, and for ages 80 years and older the prevalence is 49.7% among women and 47.1% among men
- The race-ethnicity group with the highest age-adjusted prevalence is non-Hispanic Asians at 31.4%, closely followed by Hispanics, 30.4%. Non-Hispanic blacks have a prevalence of 18.8% and non-Hispanic whites have a prevalence of 17.9%

Source: NCHS, National Health and Nutrition Examination Survey, 2013-2014

Analytic Results: Osteoporosis

Key findings: Prevalence of osteoporosis (50+)

- Prevalence of osteoporosis:
 - At the femoral neck: 6%
 - At the lumbar spine: 8%
 - Either: 11%
- Prevalence of low bone mass:
 - At the femoral neck: 43%
 - At the lumbar spine: 28%
 - Either: 45%
- Prevalence of low bone mass is 53% among women and 36% among men

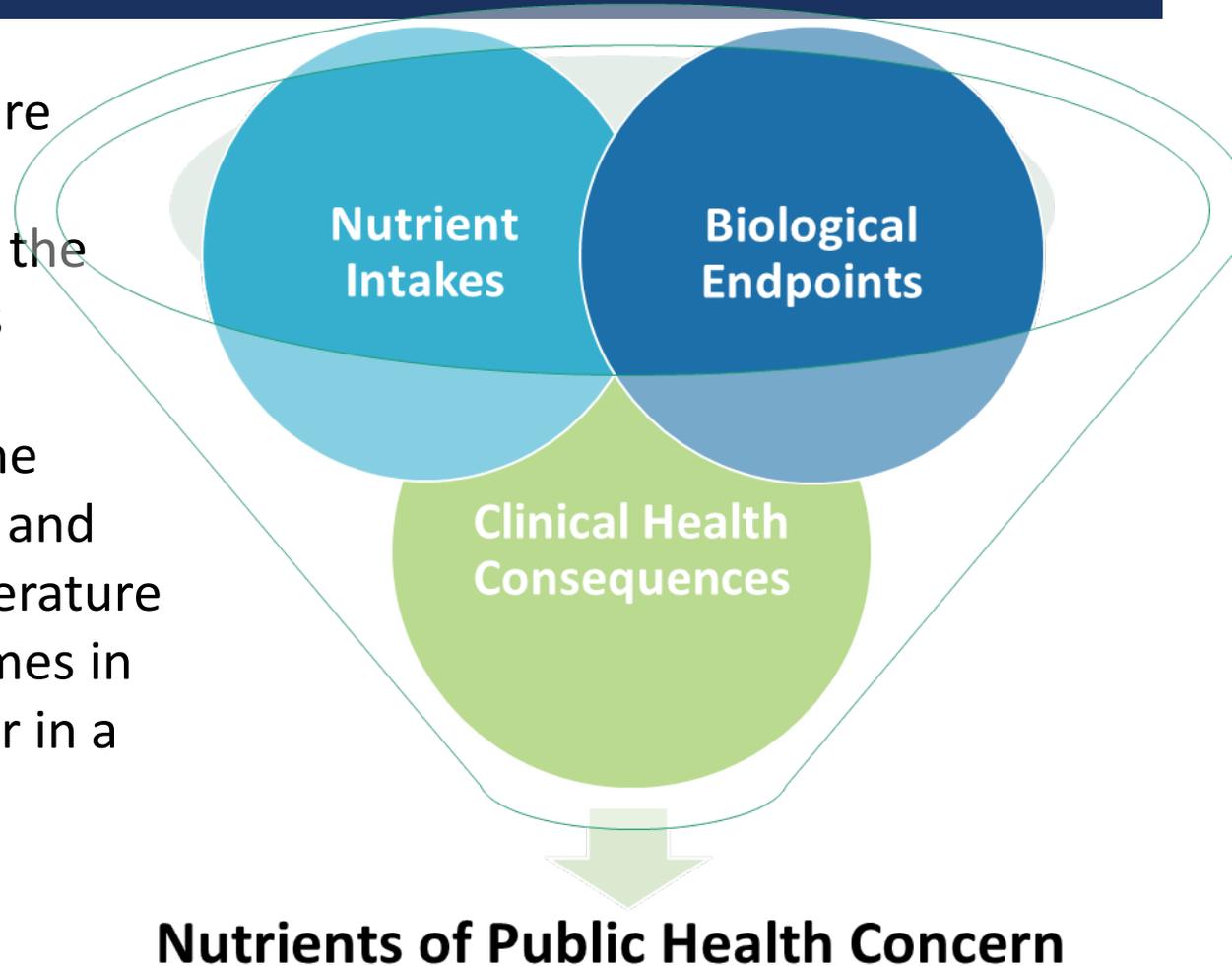
Source: [Prevalence of osteoporosis or low bone mass at the femoral neck or lumbar spine among older adults in the U.S., ages 50 years and older by age, sex and race-ethnicity, NHANES 2013-2014](#)

Describe/evaluate nutrients of
public health concern

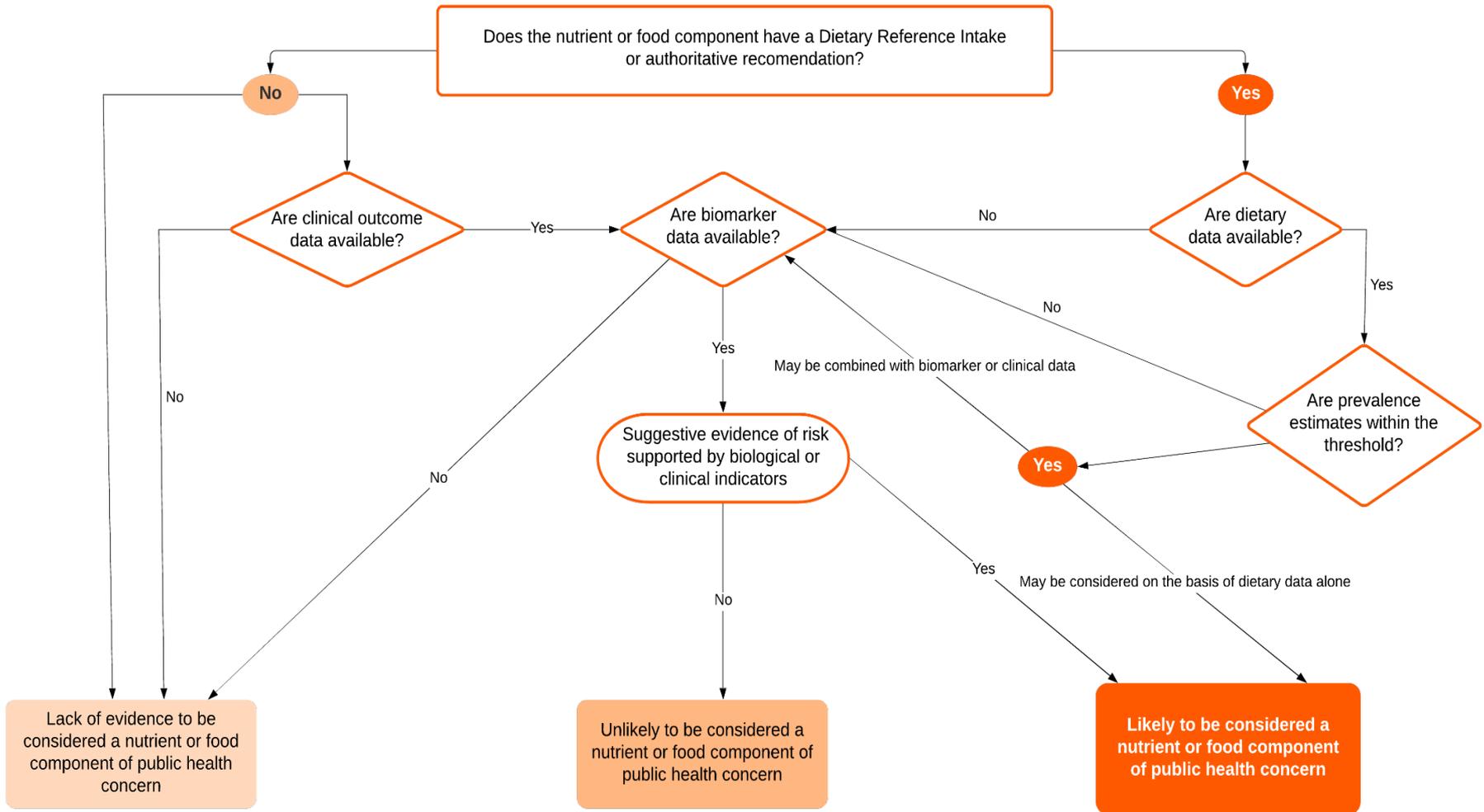
Approach to Answer Question: Data Analysis

THREE-PRONGED ANALYTICAL FRAMEWORK FOR ESTABLISHING NUTRIENTS OF PUBLIC HEALTH CONCERN

Food components that are overconsumed or under consumed (compared to the dietary reference intakes 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.



Nutrients of Public Health Concern



UNDERCONSUMED AND OVERCONSUMED NUTRIENT OR FOOD COMPONENT

Proposed Term

- Underconsumed nutrient or food component
- Overconsumed nutrient or food component

Proposed Definition

- A food component that is underconsumed by 5% or more of the population or in specific groups relative to the EAR, AI, or other quantitative authoritative recommendations from the diet alone
- A food component that is consumed in potential excess of the UL, CDRR, or other quantitative authoritative recommendations by 5% or more of the population or in specific groups from the diet alone

NUTRIENT OF PUBLIC HEALTH CONCERN

- Nutrient or food component of public health concern
 - Underconsumed and overconsumed nutrients or food components with supporting evidence through biochemical indices or functional status indicators, if available, plus evidence that the inadequacy or excess is directly related to a specific health condition, indicating public health significance

Nutrient or Food Component that Pose Special Challenges

- Nutrient or food component that pose special challenges
- Nutrients or food components that pose special challenges in identifying at risk groups or for which dietary guidance to meet recommended intake levels was challenging to develop

Underconsumed Food Components (Ages 1+ years)

Compared to EAR

- Protein*
- Vitamin A*
- Thiamin*
- Riboflavin*
- Niacin*
- Vitamin B6*
- Folate*
- Vitamin B12*
- Vitamin C*
- Vitamin D
- Vitamin E
- Vitamin K
- Calcium
- Copper*
- Iron*
- Phosphorus*
- Magnesium
- Selenium*
- Zinc*

Compared to AI

- Fiber
- Choline
- Potassium

* Indicates only some population sub-groups

UNDERCONSUMED FOOD COMPONENTS (AGES 1+ YEARS CONTINUED)

Compared to EAR

- **Protein***
- ~~Vitamin A*~~
- ~~Thiamin*~~
- ~~Riboflavin*~~
- ~~Niacin*~~
- ~~Vitamin B6*~~
- ~~Folate*~~
- **Vitamin B12***
- ~~Vitamin C*~~
- ~~Vitamin D~~
- ~~Vitamin E~~
- ~~Vitamin K~~
- ~~Calcium~~
- ~~Copper*~~
- ~~Iron*~~
- **Phosphorus***
- **Magnesium**
- ~~Selenium*~~
- ~~Zinc*~~

Compared to AI

- Fiber
- **Choline**
- Potassium

*Indicates only some population sub-groups

Overconsumed Nutrients

- Compared to UL
 - Retinol (1-3 y; ~12% > UL)
 - Zinc (1-3y; ~50% > UL)
 - Selenium (1-3y; ~50% > UL)
 - Copper (1-3y; ~6% > UL)

- Compared to CDRR
 - Sodium (all ages, 1+ y)

Compared to 2015-2020 DGA rec

- Saturated fat (all ages, 1+ y)
- Added sugars (all ages, 1+ y)

* Indicates only some population subgroups

Food component that pose special challenges (Ages 1+ years)

Underconsumed Compared to EAR or AI

- Protein* (adolescence and older females)
- Vitamin B12* (older adults, 60+ y)
- Choline
- Phosphorus* (9-14y)
- Magnesium

Overconsumed Compared to UL

- Retinol (1-3 y; ~12% > UL)
- Zinc (1-3y; ~50% > UL)
- Selenium (1-3y; ~50% > UL)
- Copper (1-3y; ~6% > UL)

* Indicates only some population subgroups

Analytic Summary

Nutrient intakes have not changed considerably since their last evaluation.

Nutrient intake distributions, taken into consideration with biological endpoints and prevalence of clinical outcomes suggest that **vitamin D, calcium, dietary fiber, and potassium** are underconsumed and **sodium, saturated fat, and added sugars** are overconsumed and may be of public health relevance for all Americans, ages 1 year and older.

Distinction as nutrient of public health concern under discussion.

Analytic Summary: Life-stage specific

In addition to those identified for all Americans 1+y, certain life stages have specific food components considerations

- Based on dietary data and serum ferritin, iron is of public health concern among adolescent (20%, ages 12-19y) and premenopausal females (16%, ages 20-49y)
- Older adults may be at risk for low intakes or status for protein and vitamin B12 which may be of public health concern.

Adolescents (ages 9-14y) have a constellation of dietary risk including low dietary intakes from food and beverage of protein (girls), folate (girls), vitamin B6 (girls), phosphorus, magnesium, and choline.

Young children ages 1-3 over consume retinol, zinc, selenium and copper.

Remaining Work – still to come

- Working group reviewing analysis results and drafting conclusions
 - *Relationship between added sugars intakes and meeting food group and nutrient recs (still to come)*
 - *Frequency of eating and meeting food group and nutrient recs (still to come)*
 - *Beverages and meeting food group and nutrient recs (still to come)*
 - *Alcohol and meeting food group and nutrient recs (still to come)*

Refining and Prioritizing Remaining Work

Refining remaining work

- Birth to less than 24 months and Pregnancy/Lactation data analysis elements, for example
 - Food group and nutrient intakes
 - Nutrients and other dietary components of public health concern

Food pattern modeling questions across the life span

- 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

2020 Dietary Guidelines Advisory Committee: Dietary Patterns Subcommittee



Members:

Regan Bailey

Jamy Ard

Teresa Davis

Timothy Naimi

Jamie Stang

Barbara Schneeman

Support Staff:

TusaRebecca Pannucci

Kellie O. Casavale

Emily Callahan

Cheyenne Swanson

Kevin Kuczynski

Kristin Koegel

Eve Stoody (DFO rep)