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

Topics and Questions Under Review
Food Pattern Modeling Questions

- [For those over 2 years of age] Are changes to the USDA Food Patterns needed based on relationships identified [in systematic reviews]? **How well do USDA Food Pattern variations meet nutrient recommendations for each stage of life?*** If nutrient needs are not met, is there evidence to support supplementation and/or consumption of fortified foods to meet nutrient adequacy?

- [For those under 2 years of age] Can USDA Food Patterns be established based on the relationships identified [in the systematic reviews]? If so, how well do USDA Food Pattern variations meet nutrient recommendations for infants and toddlers? If nutrient needs are not met, is there evidence to support supplementation and/or consumption of fortified foods to meet nutrient adequacy?

- How much added sugars can be accommodated in a healthy diet while still meeting food group and nutrient needs?

Results for this question will be presented. Otherwise all results will be presented at Meeting 6.
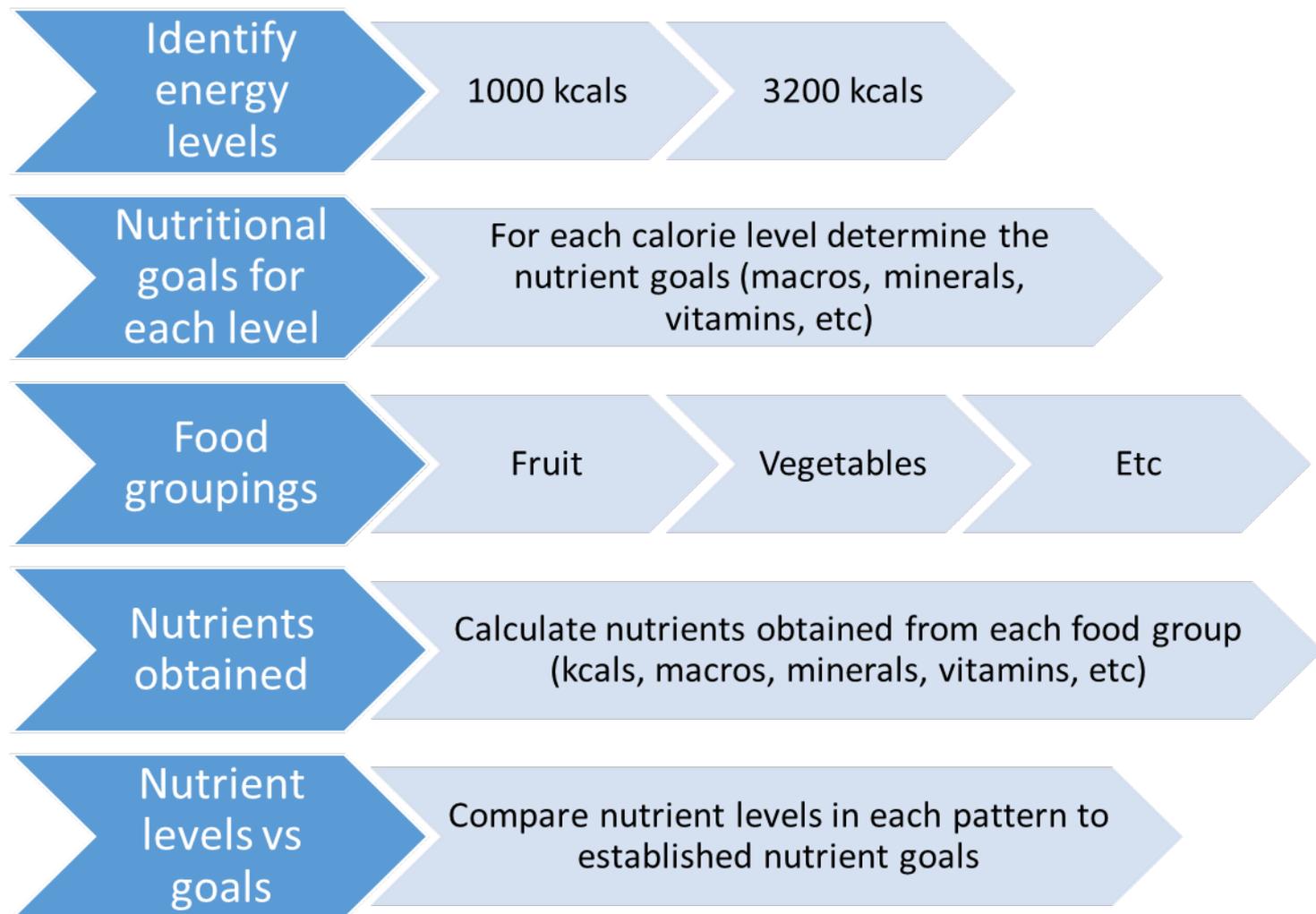
Question

Are changes to the USDA Food Patterns needed based on relationships identified [in systematic reviews]? How well do USDA Food Pattern variations meet nutrient recommendations for each stage of life? If nutrient needs are not met, is there evidence to support supplementation and/or consumption of fortified foods to meet nutrient adequacy?

Approach to Answer Question: Food Pattern Modeling

Analytic Framework

Steps for updating and developing patterns established by USDA for FPM

Identify energy levels	1000 kcals	3200 kcals
Nutritional goals for each level	For each calorie level determine the nutrient goals (macros, minerals, vitamins, etc)	
Food groupings	Fruit	Vegetables	Etc
Nutrients obtained	Calculate nutrients obtained from each food group (kcals, macros, minerals, vitamins, etc)	
Nutrient levels vs goals	Compare nutrient levels in each pattern to established nutrient goals	

For more information see FPM methods presentation from Meeting 1 on dietaryguidelines.gov

Analytic Framework Population and Data Sources

Population: U.S. population ages 2 years and older including women who are pregnant or lactating

Data Sources

- FNDDS 2015-2016: U.S. Department of Agriculture, Agricultural Research Service. 2018. USDA Food and Nutrient Database for Dietary Studies 2015-2016.

- FPED 2015-2016: Bowman SA, Clemens JC, Shimizu M, Friday JE, and Moshfegh AJ. 2018. Food Patterns Equivalents Database 2015-2016: Methodology and User Guide [Online]. Food Surveys Research Group, Beltsville Human Nutrition Research Center, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland. September 2018.

- SR 28: US Department of Agriculture, Agricultural Research Service. 2016. Nutrient Data Laboratory. USDA National Nutrient Database for Standard Reference, Release 28 (Slightly revised). Version Current: May 2016.

Analytic Framework: Key Definitions

- **Food Groups and Subgroups:** USDA Food Patterns provide amounts of five major food groups and subgroups including:
  - Fruits
  - Vegetables: Dark-green, red/orange, beans and peas*, starchy, and other
  - Dairy, including calcium fortified soy beverage
  - Grains: Whole grains and refined grains
  - Protein Foods: Meats, poultry, and eggs; seafood; nuts, seeds, and soy products

*For the purpose of this protocol, beans and peas will be modeled as part of vegetables.

- **Nutrient Profiles:** the anticipated nutrient content for each food group and subgroup that could be obtained by eating a variety of foods in each food group in nutrient dense forms.

$$\text{nutrient profile} = \text{sum} \left(\text{\% contribution of item cluster} \times \text{nutrients in representative food} \right)$$

The nutrient profiles are based on a weighted average of nutrient dense forms of foods.

The weighted average calculation considers a range of American food choices, but in <u>nutrient dense forms</u>, and results in a food pattern that can be adapted to fit an individual's preferences.

Analytic Framework: Key Definitions continued

- **Nutrient Dense Representative Foods** - foods within each item cluster in forms with the least amounts of added sugars, sodium, and solid fats.

- **Typical Choice Representative Food** - foods most frequently consumed within an item cluster of foods and inclusive of any added sugars, solid fats, and/or sodium.

- **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 vegetables 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). [examples provided in full protocol]

Analytic Methods
1. Establish Energy Levels

- Dietary Reference Intakes (DRI) formulas are used to calculate Estimated Energy Requirements (EER) for each age-sex group, including women who are pregnant or lactating.

- The food patterns include 12 energy levels from 1000 to 3200 calories at 200 calorie "step" intervals intended to cover energy needs for the majority of the population ages 2 years and older.

Analytic Methods
2. Establish nutritional goals

- Specific nutritional goals for each food intake pattern (i.e., by calorie level) are selected based on the age/sex group(s) for which the pattern is appropriate.
  - The lowest energy level (for sedentary individuals, determined in step 1), rounded to the nearest calorie pattern is determined for each age/sex group and used in evaluating the patterns against nutritional goals.

- Goals for energy, 3 macronutrients, 3 fatty acids, cholesterol, 12 vitamins, 9 minerals, and fiber are based on DRI reports released between 1997 and 2018 and on quantitative recommendations in the current 2015-2020 Dietary Guidelines.
  - Because the Food Patterns are designed as plans for individuals to follow, the goals are the RDA amounts for nutrients having an RDA. The AI is used when an RDA is not published.
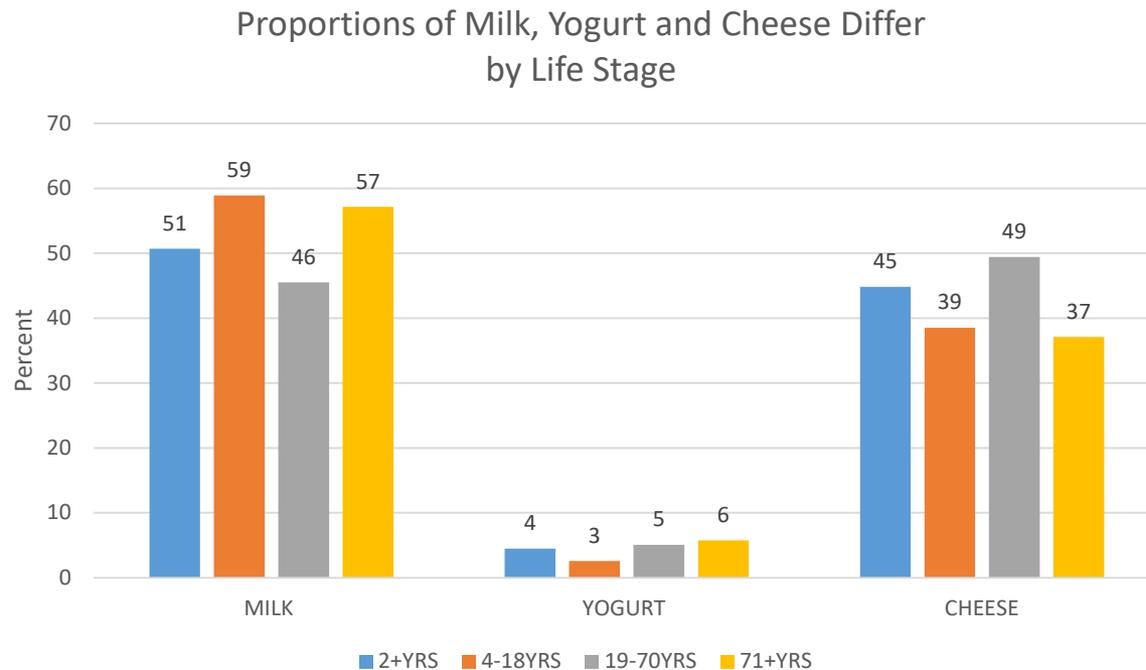
Analytic Methods
3. Establish Food Groupings and Amounts

- For initial updates to test food patterns, existing food groups and subgroups in the USDA Food Patterns published in the 2015-2020 *Dietary Guidelines for Americans* were used in this exercise.

- Further work will test variations in food patterns.

Analytic Methods
4. Determine nutrient profiles

- Nutrient profiles are calculated for all nutrients in each food group and subgroup and for each life stage

  - % contribution of item clusters varies by life stage for children, adults and older adults

  - Nutrient dense representative food does not change

Proportions of Milk, Yogurt and Cheese Differ
by Life Stage

Analytic Methods
Dairy Nutrient Profile Specific to Life Stage

Differences in proportions of intake of each item cluster result in different anticipated nutrient amounts in the Dairy Foods group

Select Nutrient Amounts in Nutrient Profiles for Dairy, ages 2+ and specific to age groups

	Energy (kcal)	Potassium (mg)	Vitamin A (RE)	Vitamin D (IU)	Saturated Fatty acids (g)
2+yrs	84.84	256.54	102.80	58.80	0.58
4-18yrs	82.07	273.80	112.34	67.22	0.44
19-70yrs	84.30	240.55	95.73	53.33	0.66
71+yrs	99.10	305.53	122.31	64.18	0.48

- Using the updated nutrient profiles that apply to ages 2 years and older and for each life stage, the nutrients provided by amounts recommended in the 2015-2020 Dietary Guidelines from each food group (and oils) are compared to the age, gender, and life stage-specific goals (usually at least 90% of the RDA or AI).

- Any nutrient goals that are not feasible to meet within the structure of the food patterns are identified and potential health impacts are considered by the Dietary Guidelines Advisory Committee.

- Food group amounts may be modified to achieve all or most of the established goals.

Analytic Results

Changes across the population in proportions of intake of foods and introduction of new foods to the food supply resulted in some small changes to nutrient profiles for food groups and subgroups.

Nutrient Profiles: Energy Estimates (kcal), 2015 and 2020

	2015	2020 draft	Difference
Fruits	97.93	98.32	0.40
Vegetables			
Dark Green	33.10	32.50	-0.61
Red and Orange	43.41	45.15	1.75
Legumes	242.56	242.69	0.13
Starchy Veg	178.58	180.74	2.17
Other Veg	47.98	52.24	4.26
Whole Grains	91.79	91.47	-0.32
Refined Grains	84.70	86.40	1.70
Protein Foods			
Meats	49.05	43.57	-5.48
Poultry	50.98	50.98	0.00
Seafood high n3	52.88	55.73	2.85
Seafood lo n3	31.30	32.49	1.18
Eggs	77.50	77.50	0.00
Soy Products	47.12	47.65	0.53
Nuts & Seeds	86.71	88.37	1.66
Dairy	76.88	84.84	7.96

Changes in proportions of intake of foods by life stage also result in some small changes to nutrient profiles for food groups and subgroups.

Nutrient Profiles: Energy Estimates, ages 2+ and by life stage

	2+yrs	4-18yrs	19-70yrs	71+yrs
FRUITS	98	96	99	100
VEGETABLES				
Dark-Green	32	39	32	32
Red & Orange	45	44	45	47
Legumes	243	242	243	240
Starchy Veg .	181	187	182	164
Other Veg.	52	50	53	51
GRAINS				
Whole Grains	91	90	92	90
Refined Grains	86	86	86	91
PROTEIN FOODS				
Meats	44	42	44	44
Poultry	51	51	51	52
Seafood - High omega-3	56	55	56	56
Seafood - Low omega-3	32	33	32	33
Eggs	78	78	78	78
Soy Products	48	48	48	48
Nuts & Seeds	88	91	88	88
DAIRY	85	82	84	99

- When using a general nutrient profile, or a life-stage specific nutrient profile; the Healthy U.S. Style pattern meets the RDA or AI and stays within limits for the UL and CDRR for a majority of nutritional goals.

- Exceptions:
  - **Iron**: patterns have less than 90% of the RDA for female ages 4-8, 19-30, 31-50, and women who are pregnant
  - **Vitamin D**: patterns do not achieve the RDA for Vitamin D.
    - The 2015 DGAC published a FPM exercise demonstrating how specific choices could help meet Vitamin D from dietary sources
  - **Vitamin E**: not a dietary component of public health concern
  - **Choline**: may be of interest to explore further for some age-sex groups

DRAFT Conclusion Statement
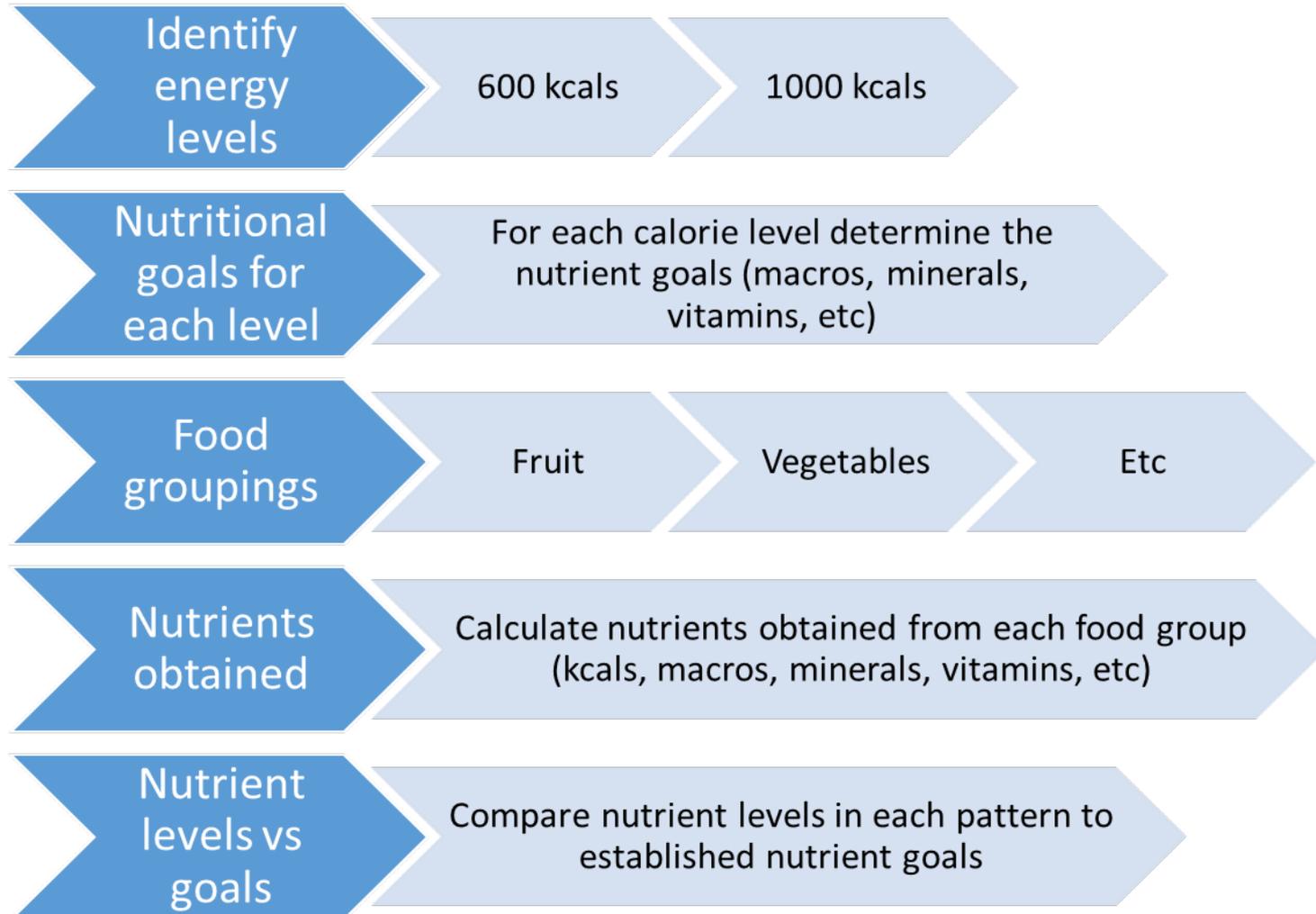
Conclusion statements will be presented in May.

Question #2

Question

[For those under 2 years of age] Can USDA Food Patterns be established based on the relationships identified [in the systematic reviews]? If so, how well do USDA Food Pattern variations meet nutrient recommendations for infants and toddlers? If nutrient needs are not met, is there evidence to support supplementation and/or consumption of fortified foods to meet nutrient adequacy?

Approach to Answer Question: Food Pattern Modeling

Analytic Framework (B24)

Identify energy levels → 600 kcals → 1000 kcals

Nutritional goals for each level → For each calorie level determine the nutrient goals (macros, minerals, vitamins, etc)

Food groupings → Fruit → Vegetables → Etc

Nutrients obtained → Calculate nutrients obtained from each food group (kcals, macros, minerals, vitamins, etc)

Nutrient levels vs goals → Compare nutrient levels in each pattern to established nutrient goals

Analytic Framework (B24) Population and Data Sources

Population: U.S. population ages 6<12 months and 12<24 months

Data Sources

- FNDDS 2015-2016: U.S. Department of Agriculture, Agricultural Research Service. 2018. USDA Food and Nutrient Database for Dietary Studies 2015-2016.

- FPED 2015-2016: Bowman SA, Clemens JC, Shimizu M, Friday JE, and Moshfegh AJ. 2018. Food Patterns Equivalents Database 2015-2016: Methodology and User Guide [Online]. Food Surveys Research Group, Beltsville Human Nutrition Research Center, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland. September 2018.

- SR 28: US Department of Agriculture, Agricultural Research Service. 2016. Nutrient Data Laboratory. USDA National Nutrient Database for Standard Reference, Release 28 (Slightly revised). Version Current: May 2016.

- Dietary Reference Intakes (DRI) formulas are used to calculate Estimated Energy Requirements (EER) for each age-sex group, including women who are pregnant or lactating.

- The food patterns will include 5 energy levels from 600 to 1000 calories at 100 calorie "step" intervals intended to cover energy needs for the majority of the population ages 6 months to less than 24 months.

Analytic Methods (B24)
2. Establish nutritional goals

- Note that only 3 RDAs exist for 7-11 mo olds
  - Protein, iron and zinc
- All other nutrients have an AI

- Existing food groups and subgroups in the USDA Food Patterns published in the 2015-2020 Dietary Guidelines for Americans informed this exercise.

- Patterns will be tested with the percent of energy for complementary foods and beverages (CFB) calculated as the calorie level minus the energy from human milk.

% Energy from CFB:HM

	15% below	Mean	15% above
18 mo.	100:0	80:20	50:50
12 mo.	100:0	80:20	50:50
9 mo.	60:40	45:55	30:70
6 mo.	35:65	20:80	NA*

* For 6 months, an intake of human milk that is 15% above average would be 95%, very close to 100% of energy from human milk, at which point there is no pattern for CFB to model.

- Initially, food group amounts for the 1000 calorie pattern established in the 2015-2020 USDA Food Patterns will be used.

- To develop patterns less than 1000 calories, amounts of each food group will be modified to smaller amounts.
  - Decrease amounts and keep the food group density (i.e. food group or subgroup amounts per 100 calories) in the pattern similar to the food group density of the 1000 calorie pattern.
  - Food group amounts in the draft patterns will be compared to mean food group intakes in each age group.

Analytic Methods (B24)
4. Determine nutrient profiles

- Determined using nutrient profiles to estimate the amounts of nutrients that would be obtained by consuming various foods within each group

- Includes proportions of foods consumed in children less than 2 years of age

- Includes baby foods

- Excludes infant formula and follow-on formula

nutrient profile = sum (**% contribution of item cluster** X **nutrients in representative food**)

- Using the updated nutrient profiles that apply to children less than 2 years of age, the nutrients provided by amounts recommended in the 2015-2020 Dietary Guidelines from each food group (and oils) are compared to the age, gender, and life stage-specific goals (usually at least 90% of the RDA or AI).

- Any nutrient goals that are not feasible to meet within the structure of the food patterns are identified and potential health impacts are considered by the Dietary Guidelines Advisory Committee.

- Food group amounts may be modified to achieve all or most of the established goals.

DRAFT Conclusion Statement (B24)

Conclusion statements will be presented in May.

Question #3

Question – added sugars

How much added sugars can be accommodated in a healthy diet while still meeting food group and nutrient needs?

Approach to Answer Question: Food Pattern Modeling

Analytic Framework (added sugars)

Exercise 1. Estimating the number of the calories in the USDA Food Patterns that could be used for added sugars.

Exercise 2. Redistributing calories from top reported sources of added sugars to foods and beverages that achieve food group and nutrient goals.

Exercise 3. Estimating excess calories from added sugars when USDA Food Patterns are used with typical vs nutrient dense choices.

Analytic Framework
Population and Data Sources (added sugars)

Population: U.S. population ages 2 years and older including women who are pregnant or lactating

Data Sources

- FNDDS 2015-2016: U.S. Department of Agriculture, Agricultural Research Service. 2018. USDA Food and Nutrient Database for Dietary Studies 2015-2016.

- FPED 2015-2016: Bowman SA, Clemens JC, Shimizu M, Friday JE, and Moshfegh AJ. 2018. Food Patterns Equivalents Database 2015-2016: Methodology and User Guide [Online]. Food Surveys Research Group, Beltsville Human Nutrition Research Center, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland. September 2018.

- SR 28: US Department of Agriculture, Agricultural Research Service. 2016. Nutrient Data Laboratory. USDA National Nutrient Database for Standard Reference, Release 28 (Slightly revised). Version Current: May 2016.

- The base pattern is developed as described in the FPM protocol for testing updated and variations of the patterns for ages 2 and older.

- Calories from all food groups and oils, termed "essential calories," are summed and the remaining calories are considered calories for other uses, including additional nutrient dense foods from a food group, solid fats, added sugars, or alcohol.

- The calories from solid fats and added sugars are assigned based on the proportional intakes of solid fats and added sugars in the population, using the NCI analysis of usual intakes for WWEIA, NHANES 2013-16.

- The assigned calories for added sugars for each of the 12 patterns will be reported using Nutrient Profiles for ages 2+, and for each life stage.

Exercise 1. Estimating the number of the calories in the USDA Food Patterns that could be used for added sugars.

Exercise 2. Redistributing calories from top reported sources of added sugars to foods and beverages that achieve food group and nutrient goals.

Exercise 3. Estimating excess calories from added sugars when USDA Food Patterns are met with typical vs nutrient dense choices.

Exercise 2: redistributing kcal from added sugars (step 1)

Step 1	Example using 14-18 yr old female and the Dairy Foods Group
estimate the calories coming from the top sources of added sugars	Current mean intake of added sugars is 267 kcal in this age/sex group • Top 5 sources of added sugar = 70% of those kcal • 197 kcal come from top 5 sources • Redistribute 197 kcal from added sugar towards meeting food group goals

Step 2	Example using 14-18 yr old female and the Dairy Foods Group
Use current mean intakes of food groups to quantify the amount of each food group that is needed to meet the recommendations	For a 14-18 yr old female assigned the 1800 kcal pattern, the dairy group goal is 3 cup-eq. • Current mean intake of dairy is 1.6 cup-eq. • There is a shortfall of 1.4 cup-eq for dairy

Analytic Methods
Exercise 2: redistributing kcal from added sugars (step 3)

Step 3	Example using 14-18 yr old female and the Dairy Foods Group
Use the nutrient profiles for each food group to estimate how many calories would be needed to reach the food group or subgroup goal	Dairy foods = 85 kcal/cup-eq Therefore, 1.4 cup-eq = 119 kcal to meet the food group goal of 3 cup-eq

Step 4	Example using 14-18 yr old female and the Dairy Foods Group
compare the estimated calories needed to meet food group goals to the estimated kcal from added sugars obtained from the top sources	We shifted 119 calories from the top 5 sources of added sugars to meet the dairy foods recommendation. ~80 calories remain Could be used towards meeting a different food group goals such as fruit, vegetables, or protein foods.

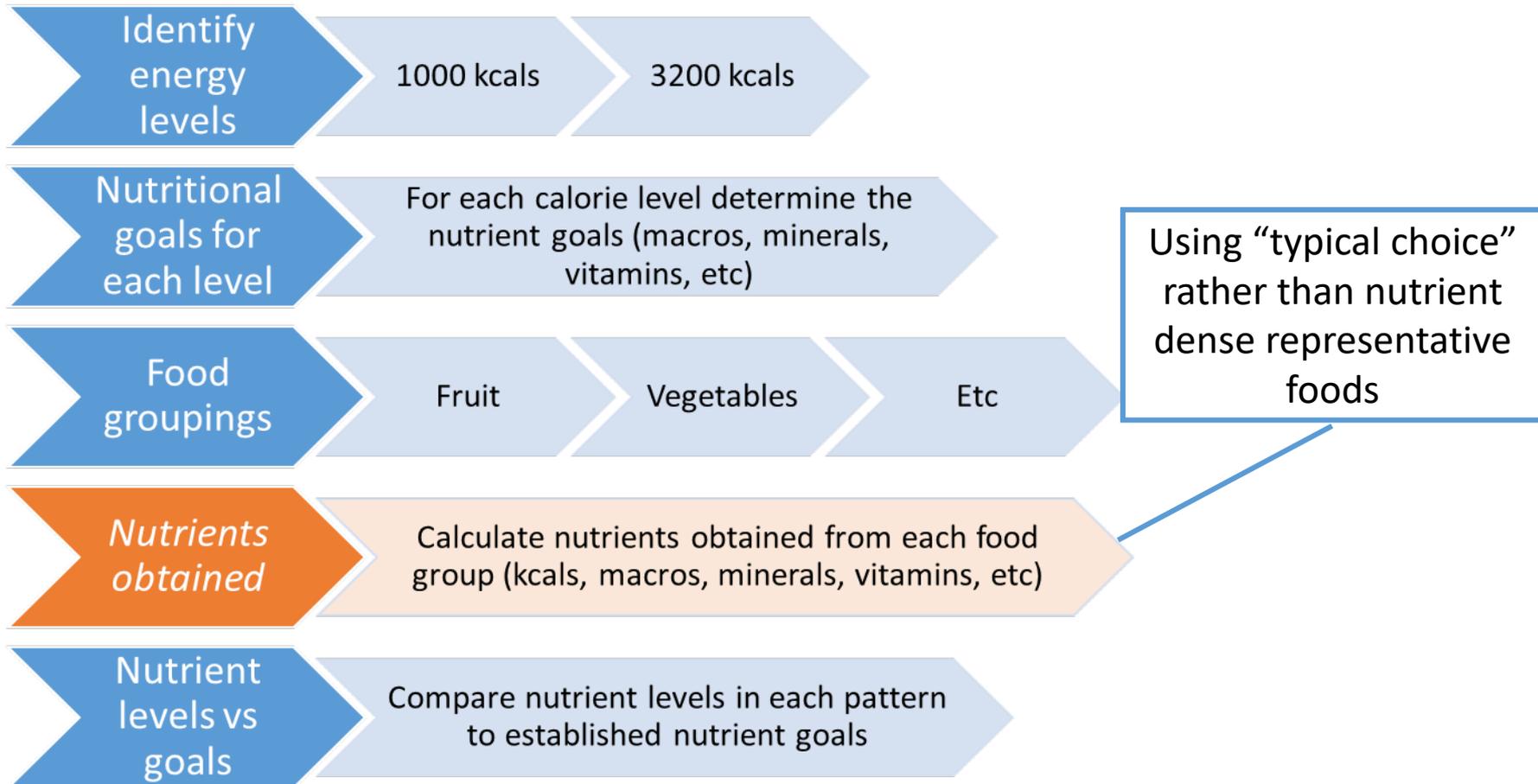| Step 5	Example using 14-18 yr old female and the Dairy Foods Group
discuss the food group and nutrient gaps that could be addressed by redistributing calories in this way	If females ages 14-18 yr consumed 1.4 additional cup-eq of low-fat or fat-free dairy foods, we predict they would increase nutrients that are underconsumed in the subpopulation by the following amounts: 13 g protein 429 mg calcium 419 mg potassium 96 IU vitamin D

Exercise 1. Estimating the number of the calories in the USDA Food Patterns that could be used for added sugars.

Exercise 2. Redistributing calories from top reported sources of added sugars to foods and beverages that achieve food group and nutrient goals.

Exercise 3. Estimating excess calories from added sugars when USDA Food Patterns are used with typical vs nutrient dense choices.

Analytic Methods
Exercise 3: estimated excess from typical choices

Identify energy levels → 1000 kcals → 3200 kcals

Nutritional goals for each level → For each calorie level determine the nutrient goals (macros, minerals, vitamins, etc)

Food groupings → Fruit → Vegetables → Etc

Nutrients obtained → Calculate nutrients obtained from each food group (kcals, macros, minerals, vitamins, etc)

Using "typical choice" rather than nutrient dense representative foods

Nutrient levels vs goals → Compare nutrient levels in each pattern to established nutrient goals

Figure from similar analysis done as part of **2010 DGAC** work illustrates number of additional calories from solid fats and added sugars in each food group when typical vs nutrient dense choices are made.
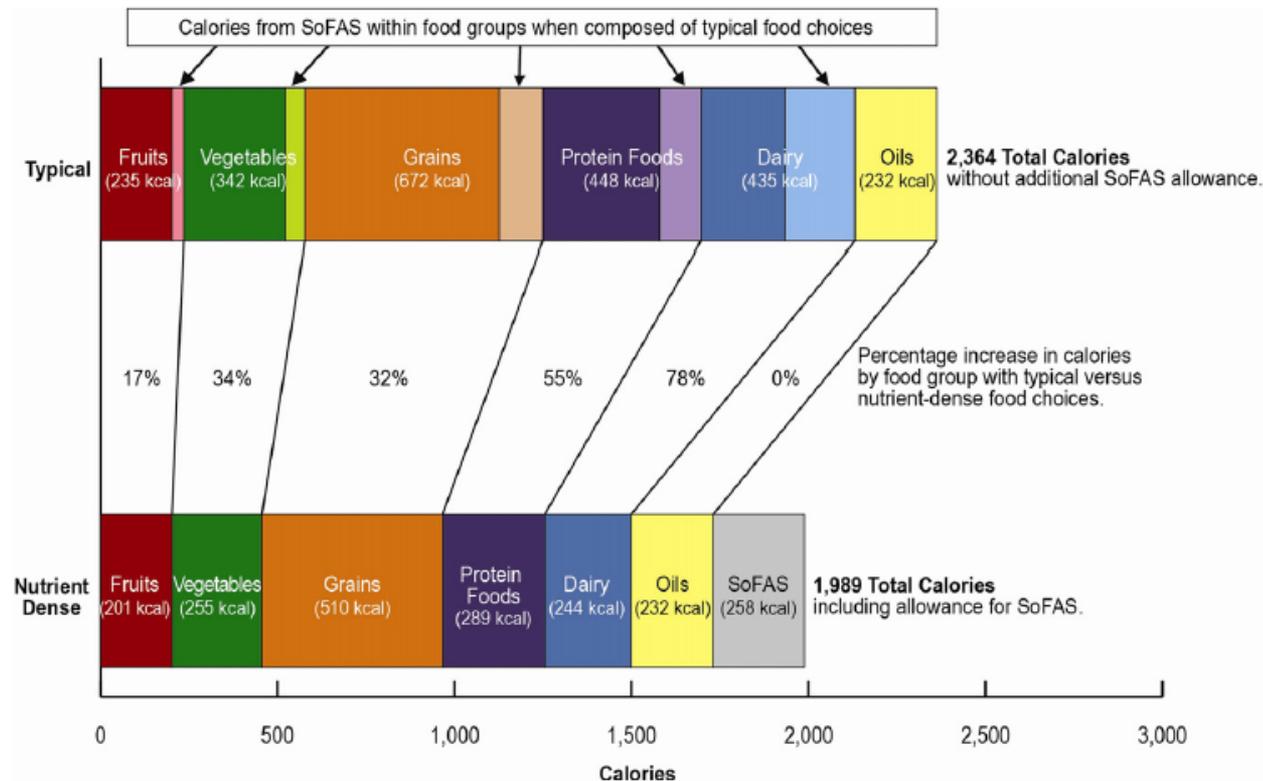

Figure. Comparison of calories from each food group in the US Department of Agriculture 2000-kcal Food Pattern with typical and nutrient-dense food choices. Typical food choices within each food group contain additional calories from solid fats and added sugars (SoFAS), as shown. In a few cases, the nutrient-dense representative foods also contain a small amount of SoFAS (not shown in the Figure but identified in Table 2). NOTE: Information from this figure is available online at www.andjrnl.org as part of a PowerPoint presentation.

DRAFT Conclusion Statement (added sugars)

Conclusion statements will be presented in May.