PART C. METHODOLOGY

INTRODUCTION

The 2020 Dietary Guidelines Advisory Committee was established to review scientific evidence to be considered by the U.S. Departments of Agriculture (USDA) and Health and Human Services (HHS) as the Departments develop the next edition of the *Dietary Guidelines for Americans*. The Committee's work culminated in the development of this report, which summarizes the Committee's review of the evidence. More than 270,000 articles were screened to identify the nearly 1,500 primary research articles included in 33 original systematic reviews supported by USDA's Nutrition Evidence Systematic Review (NESR) team. In addition, 16 existing NESR systematic reviews were considered; more than 155 analyses of Federal data sets were conducted; and numerous food pattern modeling analyses that represented, for the first time the entire lifespan, were carried out.

The Methodology outlined in this chapter has many similarities to that described in the reports of the 2010 and 2015 Dietary Guidelines Advisory Committees, but has evolved with the fields of nutrition science and systematic review methods to ensure the processes remain state-of-the-art and rigorous. In 2016, Congress directed the Secretary of Agriculture to engage the National Academies of Sciences, Engineering, and Medicine to conduct a comprehensive study of the process used to establish the *Dietary Guidelines*. The study culminated in 2 reports, one on the process for selecting the Dietary Guidelines Advisory Committee[1] and another on the remaining aspects of the *Dietary Guidelines* development process.[2] As the Departments are committed to supporting a transparent, inclusive, and science-driven process, USDA and HHS added some new steps to the 2020 Committee process in response to recommendations from the National Academies' recommendations and stakeholder feedback, and also adopted updated best practices of reviewing nutrition science and developing guidance. These new steps are noted throughout this chapter. As an example, and as described below, before establishing the Committee, the Departments identified, and asked for public comments on, the topics and scientific questions to be examined in the Committee's review of the evidence.

IDENTIFYING THE TOPICS AND SCIENTIFIC QUESTIONS

For the first time, USDA and HHS identified topics and scientific questions to be examined by the 2020 Committee before establishing the Committee. The Departments added this step for a number of reasons, including to promote a deliberate and transparent process, identify

expertise needed on the Committee, help manage resources, and ensure the scientific review conducted by the Committee would address Federal nutrition policy and program needs.

About the Topic Identification Process

The process used to identify topics and scientific questions was led by the USDA Center for Nutrition Policy and Promotion and the HHS Office of Disease Prevention and Health Promotion, and vetted by the USDA Acting Deputy Under Secretary of Food, Nutrition, and Consumer Services and HHS Assistant Secretary for Health.

Other Federal agencies and the public also contributed to the process. Federal nutritionists, including scientists and programmatic experts from USDA, HHS, U.S. Department of Veterans Affairs, U.S. Environmental Protection Agency, and U.S. Agency for International Development, participated in developing proposed topics and supporting questions. The initial list was informed by the needs of Federal nutrition-related programs and initiatives. It also reflected the Agricultural Act of 2014, which mandated that starting with the 2020-2025 edition, the *Dietary Guidelines* provide guidance for women who are pregnant, as well as for infants and toddlers from birth to age 24 months.

Next, USDA and HHS posted the topics and supporting scientific questions for public comment. During the open public comment period of February 28, 2018, to March 30, 2018, the public sent in more than 12,000 comments through more than 6,000 submissions to Regulations.gov. (Form letters accounted for 74 percent of all comments.) Simultaneously, Federal agencies also provided comments on the topics and scientific questions.

In refining the topics and questions, USDA and HHS considered each public and agency comment in relation to the following 4 criteria:

- Relevance to creating the *Dietary Guidelines for Americans,*
- Importance to public health,
- Potential impact on Federal food and nutrition programs, and
- Desire to avoid duplication of Federal efforts.

USDA and HHS posted the revised topics and scientific questions reflecting public and Federal agency comments on September 6, 2018, with the call for public nominations to the Committee. The main topic areas remained the same, with changes reflecting priority issues.

The topics and questions reflect USDA's and HHS' decision that the *2020-2025 Dietary Guidelines* will take a lifespan approach, spanning from birth through older adulthood. In addition, the topics and supporting scientific questions reflect a continued focus on what

individuals eat and drink *as a whole*, on average and over time, from birth into older adulthood to support development of guidance on dietary patterns that can help people prevent disease and stay healthy.

CHARTERING THE 2020 DIETARY GUIDELINES ADVISORY COMMITTEE

As required by the Federal Advisory Committee Act (FACA), a charter must be prepared and filed with Congress before a Federal advisory committee can meet or take any action. The charter provides the advisory committee's mission or charge, specific duties, and general operational characteristics. More information about Federal advisory committee charters and other information related to the FACA is available through the U.S. General Services Administration (GSA). The charter for the 2020 Dietary Guidelines Advisory Committee was filed with Congress on October 5, 2018.

The responsibility for chartering a Dietary Guidelines Advisory Committee every 5 years rotates between the USDA and HHS. USDA was responsible for chartering the 2020 Dietary Committee and serving as the administrative lead for the *2020-2025 Dietary Guidelines*.

Recent Dietary Guidelines Advisory Committees have had Co-executive Secretaries from both USDA and HHS. Legally required changes were made to the 2020 Committee's charter in response to an issue raised by the GSA Committee Management Secretariat, the Federal entity that is responsible for all matters relating to Federal advisory committees (5 U.S.C. App. 2 § 7(a)). Section 708 of the Consolidated Appropriations Act, 2018, a government-wide provision, prohibits the interagency financing of advisory committees. Additionally, the FACA requires that only 1 agency may be responsible for support services at any one time, even if the advisory committee reports to more than 1 agency (5 U.S.C. § App. 2 § 12(b)). For these reasons, the Co-executive Secretaries for the 2020 Dietary Guidelines Advisory Committee are from USDA. However, in accordance with the National Nutrition Monitoring and Related Research Act, USDA and HHS continue to work together to support development of the *Dietary Guidelines*, and the Committee's report is submitted to the Secretaries of USDA and HHS.

New to the charter for the 2020 Committee is reference to the Agricultural Act of 2014, which mandates the addition of dietary guidance for women who are pregnant and infants and toddlers from birth to age 24 months beginning with the 2020-2025 edition of the *Dietary Guidelines*. Additionally, the charter notes the new step the Departments took to identify the topics and scientific questions to be examined in the review of evidence by the Committee.

The charter also outlines the Committee's specific duties or charge. The Committee was re-established to examine the evidence on the topics and questions identified by the Departments, including new scientific evidence and current resource documents, and then develop a report to be submitted to the Secretaries of USDA and HHS that outlines its science-based recommendations and rationale, which will be considered by the Secretaries in developing the *2020-2025 Dietary Guidelines*.

COMMITTEE APPOINTMENT

The Committee was formed and governed under the FACA. The process to re-establish the Committee included a public call for nominations, review of nominations by programmatic staff and ethics officials, including screening for financial conflicts of interest, agreement on membership by USDA and HHS leadership, and appointment to the Committee.

Call for Nominations

On September 6, 2018, USDA and HHS issued a 30-day public request for nominations to the 2020 Committee (USDA Press Release No. 0173.18). Information on what was required in the nomination package was identified in the *Federal Register* notice (Docket ID: FNS-2018-0039), and the Departments outlined factors that would be considered in reviewing nominations:

- **Educational background**—Advanced degree in nutrition- or health-related field, including registered dietitians, nutrition scientists, physicians, and those with public health degrees.
- **Professional experience**—At least 10 years of experience as an academic, researcher, practitioner, or other health professional in a field related to 1 or more of the topics to be examined; consideration of leadership experience and participation on previous committees or panels.
- **Demonstrated scientific expertise**—Expertise related to 1 or more of the topics to be examined by the Committee, as demonstrated by number and quality of peer-reviewed publications and presentations.

Two additional factors were important to the formation of the Committee:

- Selection of members to ensure that the Committee was balanced fairly in points of view and type of expertise was an **obligation of the Federal Advisory Committee Act**.
- Including, to the extent possible, women, persons with disabilities, and representatives from different races and ethnicities, geographic areas, and institutions fulfilled **requirements regarding a balanced membership**.

The list of topics and supporting scientific questions were made available on DietaryGuidelines.gov so that the public could consider the areas of expertise needed when submitting nominations.

Approximately 180 complete nomination packages were received and reviewed by the Departments.

Review of Nominations

All complete nomination packages were reviewed by program staff from USDA Food, Nutrition, and Consumer Services (FNCS), the USDA Research, Education, and Economics (REE), and the HHS Office of the Assistant Secretary for Health (OASH). Nominees were then evaluated by the USDA Acting Deputy Under Secretaries of FNCS and REE, in consultation with the HHS Assistant Secretary for Health. Each nomination package was examined using the factors listed above. For the first time, USDA and HHS also outlined specific information needed in all nomination packages, including education, employment, peer-reviewed publications, presentations, blogs, funding sources, and other affiliations. These elements were reviewed and considered in establishing a Committee with broad representation and balance across many factors, including topic areas, points of view, education, and expertise.

The vetting process also included a background check by the USDA Office of the Secretary to determine whether any of the candidates had a financial, ethical, legal, and/or criminal conflict of interest that would prohibit them from serving on the Committee.

Each Committee member submitted a completed Confidential Financial Disclosure Report (known as the OGE Form 450) to the USDA Office of Ethics. By law, completed financial disclosure reports are not permitted to be shared publicly. Therefore, to be transparent about the information all Committee members were required to provide before appointment, a copy of Form 450 was posted on DietaryGuidelines.gov. Each completed Form 450 was reviewed by USDA ethics officials for financial conflicts of interest and compliance with Federal ethics rules. Officials from USDA's Office of Ethics ensured interests and affiliations of appointed Committee members complied with applicable conflict of interest statutes, regulations issued by the U.S.

Office of Government Ethics, supplemental agency requirements, and other applicable Federal ethics rules. Some potential candidates were not moved forward for additional consideration following this review.

Appointment to the Committee

The Secretaries of USDA and HHS reviewed formal nomination recommendations, then jointly agreed on individuals to appoint to serve on the Committee, and as Chair and Vice Chair. On February 21, 2019, USDA and HHS announced the appointment of 20 nationally recognized experts to serve on the 2020 Committee (USDA Press Release No. 0022.19). See ***Dietary Guidelines Advisory Committee Membership and Federal Support Staff***. The Committee included a mix of practitioners, epidemiologists, clinical scientists, trialists, and others from every region of the United States.

The Committee served without pay and worked under the regulations of the FACA. As with previous Dietary Guidelines Advisory Committees, members of the 2020 Committee were appointed as Special Government Employees (SGEs), selected based on recognized expertise or expert knowledge relevant to the Committee. As SGEs, the Committee members were subject to Federal employee ethics laws and regulations while serving in this role. Ethics training was provided to members of the 2020 Committee by USDA ethics officials before the first public meeting.

Management of Conflicts of Interest During Committee Selection

Managing potential conflicts of interest and minimizing bias throughout the *Dietary Guidelines* development process is critical. As described above, in preparation for selecting the 2020 Committee, all individuals under final consideration for appointment were required to submit a Confidential Financial Disclosure Report before being appointed. This was the first time this review was completed before appointing Committee members and as part of the selection process. Historically, this review was completed after the Committee was appointed. The completed report was reviewed by USDA ethics officials with extensive expertise in this area, as USDA was the administrative lead for the 2020 Committee. The USDA ethics official concluded that “none of the 20 committee members reported any entries on their OGE Form 450 that would prevent them from being appointed and providing the complete range of duties required of a Dietary Guidelines Advisory Committee member in full compliance with the Federal ethics rules applicable to Special Government Employees.”

The specific information USDA and HHS required in all nomination packages—education, employment, peer-reviewed publications, presentations, blogs, funding sources, and other affiliations—were reviewed and considered by the Departments when establishing the Committee to ensure the Committee had broad representation and balance across many considerations, including topic areas, points of view, education, and expertise. Additional information on managing conflicts of interest during the Committee's service is provided below.

THE COMMITTEE PROCESS

Committee Meetings

To prepare for its work in conducting the scientific review for USDA and HHS, the 2020 Committee participated in administrative training on March 7, 2019, before its first meeting. This session was offered to the members by webinar and included an overview of the Committee's charter, operations, and timeline; ethics training; a public affairs briefing; an overview of DietaryGuidelines.gov; and an introduction to the FACA. Slides and materials from the training were posted at DietaryGuidelines.gov for full public access.

All meetings of the full Committee were held publicly. The Committee initiated its work at its first meeting on March 28-29, 2019, and concluded its work when it submitted this report to the Departments. The Committee met 6 times to discuss its review of the scientific evidence and make plans for future Committee work. Meetings of the Committee were open for the public to attend through webcast. Meetings 1 through 4 also allowed for in-person attendance. Meeting 5 was originally scheduled for in-person attendance, but the format was changed to webcast in response to COVID-19. For the first time in the Dietary Guidelines process, the 6th and final meeting focused on the Committee's draft report. This meeting was added to allow discussion and deliberation by the full Committee before submitting its report. This meeting was originally scheduled for May 11, 2020, but the date was changed to June 17, 2020, with an extension to the Committee's timeline by 1 month in response to COVID-19. Also for the first time in the Dietary Guidelines process, the public had the opportunity to provide oral comments to the Committee twice, rather than once. Meetings 2 and 4 provided this opportunity for oral public comments to the Committee (see ***Appendix F-2: Public Comments***). For the first time in 20 years, the Committee held a meeting outside the Washington, DC, metro area, in Houston, TX. The meeting dates and host cities were as follows:

- Meeting 1: March 28-29, 2019 (Washington, DC)

- Meeting 2: July 10-11, 2019 (Washington, DC)
- Meeting 3: October 24-25, 2019 (Washington, DC)
- Meeting 4: January 23-24, 2020 (Houston, TX)
- Meeting 5: March 12-13, 2020 (Webcast only)
- Draft Report Meeting: June 17, 2020 (Webcast only)

Meeting materials, including transcripts, recordings, and presentation slides were posted at DietaryGuidelines.gov following the meetings.

Public Comments

Throughout the Committee's review of the scientific literature and data, over almost 16 months, the public was encouraged to submit written comments to the Committee related to the topics and supporting scientific questions being examined. A general description of the types of comments received and the process used for collecting public comments is described in ***Appendix F-2: Public Comments***.

Committee Working Structures and Processes

The Committee's scientific review was directed by the topics and supporting questions, and focused on what individuals eat and drink as a pattern over time, from birth into older adulthood.

To accomplish its objectives, Committee members worked within Subcommittees. The 2020 Committee had 6 topic area Subcommittees (Pregnancy and Lactation, Birth to 24 Months, Dietary Patterns, Dietary Fats and Seafood, Beverages and Added Sugars, and Frequency of Eating) and 1 cross-cutting working group (Data Analysis and Food Pattern Modeling) that corresponded to the topics and questions specified by the Departments. The purpose of Subcommittees was to review evidence for the topics and questions specified by the Departments. Each Subcommittee conducted its work between Committee meetings and reported on its work to the full Committee at its meetings, all of which were held publicly.

The Subcommittees were made up of 4 to 8 Committee members, with 1 Committee member serving as the Subcommittee Chair. In addition, the Committee's Chair or Vice Chair served as a representative on each Subcommittee. The membership of each Subcommittee is listed in ***Appendix F-4: Membership of Dietary Guidelines Advisory Committee Subcommittees and Groups***.

Subcommittees typically met weekly by webinar and communicated regularly by e-mail. Subcommittees also met in person in association with the full Committee meetings. At meetings of the full Committee, which were all open to the public, each Subcommittee was responsible for presenting its evidence reviews and findings, describing the rationale for its draft conclusion statements and advice to the full Committee, responding to questions from the Committee, and making changes based on the discussion. The advice included in this report reflects the consensus of the entire Committee from deliberations in the public meetings.

The Committee members were supported by a Designated Federal Officer (DFO) from USDA's Center for Nutrition Policy and Promotion. The DFO led the administrative effort for the Committee's work and served as one of two Co-executive Secretaries. The second Co-executive Secretary, from USDA's Agricultural Research Service, was responsible for coordinating peer review of NESR systematic reviews (discussed below). Support staff for managing Committee operations consisted of more than 60 HHS and USDA staff, including invaluable administrative support from the HHS Office of Disease Prevention and Health Promotion, staff from USDA's Nutrition Evidence Systematic Review Team, and the Federal Data Analysis Team. Staff support are listed in ***Dietary Guidelines Advisory Committee Membership and Federal Support Staff.***

APPROACHES USED TO ANSWER QUESTIONS

The 2020 Committee used 3 approaches to examine the evidence: data analysis, food pattern modeling, and NESR systematic reviews. Each of these approaches has its own rigorous, protocol-driven methodology, and played a unique, complementary role in examining the science. For each approach, staff from USDA and HHS supported the Committee's review of the evidence. The type of information the Committee needed to answer each scientific question determined which approach they would use to review the evidence.

- **Data analysis:** A collection of analyses that uses national data sets to describe the current health and dietary intakes of Americans. These data help make the *Dietary Guidelines* practical, relevant, and achievable.
- **Food pattern modeling:** Analyses that illustrates how changes to the amounts or types of foods and beverages in a dietary pattern might affect meeting nutrient needs across the U.S. population.

- **NESR systematic review:** Research projects that answer questions on diet and health by searching for, evaluating, and synthesizing all relevant, peer-reviewed studies within a specified date range.

To answer each scientific question, the Committee developed a protocol—or a plan—that described how the Committee would apply the methodology of 1 of the 3 approaches to examine the evidence related to that specific question. A protocol was created before the Committee examined any evidence, and, for the first time, was posted online for the public to view to understand how a specific scientific question would be answered and to have the opportunity to submit public comments.

For all topics and questions, regardless of the path used to identify and evaluate the scientific evidence, the Committee developed conclusion statements. Each draft conclusion statement described the state of the science, based on the evidence considered, in order to answer the specific question examined. The Committee took the strengths and limitations of the evidence base into consideration when formulating conclusion statements. As described below, for questions answered using NESR systematic reviews, evidence was graded as Strong, Moderate, Limited, or Grade Not Assignable. The grading rubric used for questions answered using NESR systematic reviews does not apply to questions answered using data analysis or food pattern modeling. Therefore, data analysis and food pattern modeling conclusion statements were not graded.

As it finalized its work, the Committee looked across all of the conclusion statements to develop overarching advice for USDA and HHS to consider as the Departments develop the next edition of the *Dietary Guidelines*. More information about the methodologies for each of the 3 scientific approaches is provided below. Each of the chapters in ***Part D. Evidence on Diet and Health*** has a methodology section that provides additional details on how the approach was applied to answer each specific question.

Management of Conflicts of Interest During the Committee's Scientific Review

As noted above, members of the 2020 Committee were appointed as SGEs. SGEs are selected based on recognized expertise or expert knowledge relevant to the Committee. In contrast, none of the members was appointed as Representative Members, who are individuals appointed for the purpose of presenting the points of view of outside interest groups or stakeholders.

USDA ethics officials conducted an annual review of each Committee member's OGE Form 450 to manage potential conflicts of interest throughout the proceedings. As noted above, USDA ethics officials provided ethics training on 2 occasions to members of the 2020 Committee.

The approaches the Committee used to examine the evidence—systematic reviews, data analyses, and food pattern modeling—are rigorous, objective, and protocol-driven, and are designed to minimize bias. Protocols for each question being addressed were developed before examining any evidence and were presented at the Committee's meetings and posted to DietaryGuidelines.gov, providing transparency to the public throughout the Committee's deliberations.

The review of evidence was not based on any one member's expertise, nor were the final decisions for the scientific evaluation reached on an individual-by-individual basis. The Committee's review of the evidence was completed in a collaborative manner. The Committee came to its conclusions and advice to USDA and HHS together.

Data Analysis

Data analysis is 1 of the 3 scientific approaches that the 2020 Committee used to review the current scientific evidence. Data analysis provides insights into current eating habits of the U.S. population and diet-related chronic disease rates in the United States.

The 2020 Dietary Advisory Committee used data analysis to address topics and supporting scientific questions from USDA and HHS. These questions looked at:

- Current dietary patterns and beverage consumption
- Current intakes of food groups and nutrients
- Nutrients of public health concern
- Prevalence of nutrition-related chronic health conditions
- Relationships between eating habits and achieving nutrient and food group recommendations

The Committee, with support from Federal staff, developed a protocol for how each question would be answered using data analysis. The protocol, or plan, included an *analytic framework* that described the overall scope and the approach used to answer the question and an *analytic plan* that detailed the data and subsequent analysis to be considered. The *analytic results* of each analysis that were used to answer a data analysis question are summarized in the report.

The Committee examined a collection of analyses to inform their deliberations. Key nationally representative, Federal data sources included the National Health and Nutrition Examination Survey (NHANES), the National Health Interview Survey (NHIS), and Surveillance, Epidemiology and End Results (SEER). Each of these data sources is described below:

National Health and Nutrition Examination Survey

NHANES is a Federal program of studies designed to assess the health and nutritional status of children and adults in the United States. This nationally representative survey includes both interviews and physical examinations that measure dietary intakes and diet-related chronic disease rates in the U.S. population. It is managed by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC).

NHANES data are collected continuously and released in 2-year cycles. The most recently available data are from NHANES 2015-2016. In many cases, analysis included data from 2 cycles of NHANES (2013-2014 and 2015-2016) to ensure an appropriate sample size for subgroup analysis. Dietary intakes of infants and toddlers ages 6 to 12 and 12 to 24 months included NHANES 2007-2016 to achieve a sample size stratified by infants receiving human milk and complementary foods and beverages (CFB) or infants receiving any infant formula and CFB. Sample weights for these analyses were recalibrated.

What We Eat in America, NHANES

The dietary component of NHANES, called What We Eat In America (WWEIA)[3] is the only nationally representative survey of total food and beverage consumption that captures intakes across life stages on a population level in the United States. The dietary data are collected using the gold standard for dietary assessment: a multiple pass, 24-hour dietary recall.

USDA developed the Automated Multiple-Pass Method 24-hour dietary recall (AMPM), which is conducted by a trained dietary interviewer in the WWEIA portion of NHANES. The AMPM is designed to systematically help participants report their food and beverage intake in great detail while minimizing respondent burden. A standard set of measuring guides is used to help participants report the volume and dimensions of the food items consumed. The AMPM is a research-based, multiple-pass approach designed to enhance complete and accurate food recall using 5 steps that are applied consistently in data collection.

The 5 steps are:

1. Quick List - Participant recalls all foods and beverages consumed the day before the interview (midnight to midnight).

2. Forgotten Foods - Participant is asked about consumption of foods commonly forgotten during the Quick List step.
3. Time and Occasion - Time and eating occasion are collected for each food.
4. Detail Cycle - For each food, a detailed description, amount eaten, and additions to the food are collected. Eating occasions and times between eating occasions are reviewed to elicit forgotten foods.
5. Final Probe – Information on additional foods not remembered earlier is collected.

Each step is based on a strategy to enhance dietary recall. The initial recall is self-defined by the participant and the subsequent steps help the participant to associate eating occasions with the day's events. The interviewer asks about frequently forgotten foods and assists in the placement of foods with eating occasions. The repetition provides opportunities for adding detail to each reported food or beverage.

Using NHANES Data to Understand Eating Habits of the U.S. Population

The strengths and challenges of self-report dietary assessment are well-recognized. Self-report dietary data are valuable for providing important information at a population level regarding intakes (and sources) of foods and beverages and to describe dietary patterns and assess diet quality. Established statistical approaches accounting for day-to-day variability and energy adjustment are used to help reduce potential bias in describing dietary intakes at a population level.

The dietary data collected during the AMPM is linked to databases that are used to identify the nutrient values and food group contribution of foods reported by participants. The following databases were integrated into the analyses of dietary data that provides comprehensive insight into eating habits of the U.S. population.

- Nutrients: USDA Food and Nutrient Database for Dietary Studies (FNDDS) is a database that provides the nutrient values for foods and beverages. Data are available on energy and 64 nutrients for nearly 9,000 foods and beverages. FNDDS allowed the Committee to examine nutrient intakes from foods and beverages reported by Americans.
- Food-guidance Based Food Groups: USDA Food Pattern Equivalents Database (FPED) converts foods and beverages in the FNDDS to 37 USDA Food Patterns components. The FPED allowed the Committee to examine food group intakes (e.g., Whole Fruit, Total Vegetables) from foods and beverages reported by participants.

Using NHANES Data to Assess Physical and Biochemical Indicators of Health

NHANES physical exams and laboratory data are useful components of the broader data used to understand the U.S. population's health. Examples of physical exam measurements include measured height, weight, and blood pressure. The laboratory tests allow for ongoing assessment of U.S. population status of blood and urine biochemical indicators of nutrients consumed and other markers with public health relevance.

National Health Interview Survey

NHIS is a survey on health conducted using in-person, confidential household interviews. Like NHANES, this survey is managed by the NCHS within CDC. It provides data on the U.S. civilian noninstitutionalized population for analyzing health trends and tracking progress toward achieving national health objectives.

These data, continuously collected throughout the year, are used to characterize those with various health conditions.

Surveillance, Epidemiology, and End Results

The Surveillance, Epidemiology, and End Results (SEER) Program is the authoritative source for cancer statistics in the U.S. population. SEER is supported by the Surveillance Research Program (SRP) in the National Cancer Institute's Division of Cancer Control and Population Sciences (DCCPS).

SEER collects and publishes cancer incidence and survival data from population-based cancer registries. These registries routinely collect data on patient demographics, primary tumor site, tumor morphology and stage at diagnosis, first course of treatment, and follow-up for survival status. These data are collected on every cancer case reported from 19 U.S. geographic areas.

The geographic area of data collection is representative of the demographics of the entire U.S. population. This broad coverage allows SEER to account for diverse populations throughout the United States. SEER data can be used to define the rates of diet-related cancers in the U.S. population.

Data Analysis Team

The data analysis team supported the work of the Committee to answer specific topics and questions. The team, which comprised Federal scientists with advanced degrees in nutrition, statistics, and epidemiology, included scientists from the following Departments and agencies:

- United States Department of Agriculture
  - Center for Nutrition Policy and Promotion; Food and Nutrition Service; Food, Nutrition, and Consumer Services
  - Agricultural Research Service; Research, Education, and Economics
- United States Department of Health and Human Services
  - Office of Disease Prevention and Health Promotion; Office of the Assistant Secretary for Health
  - National Cancer Institute; National Institutes of Health
  - National Center for Health Statistics; Centers for Disease Control and Prevention

Food Pattern Modeling

Food pattern modeling is the second of 3 scientific approaches that the Committee used in its review of evidence. The food pattern modeling analysis approach helps explain how changes to food-based dietary recommendations could potentially affect Americans' ability to meet their nutrient needs.

Food pattern modeling is a way to evaluate the impact of specific changes in amounts or types of foods and beverages in a dietary pattern on meeting food group recommendations and nutrient needs. These food pattern modeling tests inform USDA's development of relevant dietary patterns for the American population that reflect health-promoting patterns identified in systematic reviews and meet nutrient recommendations.

Food pattern modeling was used to answer a portion of the topics and supporting scientific questions the 2020 Committee examined. These questions looked at:

- The ability to meet nutrient recommendations for each stage of life through variations in USDA Food Patterns.
- The relationship between added sugars consumption and achieving nutrient and food group recommendations.

The Committee, with support from Federal staff, determined a protocol that included an *analytic framework* that described the overall scope and approach used to answer the question and an *analytic plan* that detailed the data and subsequent analysis to be conducted.

Food Pattern Modeling Process

Food pattern modeling is possible through the modification of food groups and nutrient profiles of each food group. The current USDA Food Patterns provide amounts of 5 major food groups and subgroups, including:

- Fruits
- Vegetables: Dark-green, red and orange, beans and peas, starchy, and other
- Dairy, including calcium-fortified soy beverages
- Grains: Whole grains and refined grains
- Protein Foods: Meats, poultry, and eggs; seafood; nuts, seeds; and soy products

Food groups used in food pattern modeling have a nutrient profile based on a weighted average of nutrient-dense forms of foods. The most nutrient-dense forms of foods are those prepared with the lowest amounts of sodium, saturated fat, and added sugars. The weighted average calculation considers a range of American food choices, but in nutrient-dense forms, and results in a food pattern that can be adapted to fit an individual's preferences.

The food group structure and corresponding nutrient profiles of the food patterns allowed the Committee to use food pattern modeling tests to see how proposed changes to food pattern elements might affect food group amounts and nutrient adequacy across the lifespan. The nutrient content for patterns at 12 energy levels were compared to the Dietary Reference Intakes for more than 30 nutrients.

Four elements can be modified in a food pattern modeling test:

1. Food group amounts and amounts of added sugars, oils, and saturated fat in the patterns
2. Inclusion or exclusion of certain foods or food groups
3. Nutrient goals and constraints
4. Nutrient profiles for a food group or subgroup

The results of food pattern modeling tests are interpreted under the premise of 2 key assumptions. First, modeling tests are based on nutrient profiles of nutrient-dense foods in the U.S. food supply and U.S. population-based dietary data. Population-based patterns articulate

the evidence on the relationships between diet and health in ways that might be adopted by the American public. Second, modeling tests assume population-wide compliance with all food intake recommendations. As with other types of modeling, food pattern modeling is hypothetical and does not predict the behaviors of individuals.

Food Pattern Modeling Team

The food pattern modeling team supported the work of the Committee to answer specific topics and questions. It was comprised of nutrition scientists and data analysts on the Nutrition and Economic Analysis Team at the USDA Center for Nutrition Policy and Promotion within the Food and Nutrition Service.

NESR Systematic Review Process

Systematic review was the third approach that the Committee used to review scientific evidence. Systematic reviews are research projects that answer important public health questions by evaluating scientific evidence on topics relevant to Federal policy and programs. The staff at USDA's NESR specializes in conducting food- and nutrition-related systematic reviews. The systematic review process involves a series of steps, described in the following sections.

Develop a Systematic Review Protocol

For each systematic review question, the Committee developed a systematic review protocol. A systematic review protocol is a plan for how a specific systematic review will be conducted, and includes:

- Analytic framework
- Literature search and screening plan
  - Inclusion and exclusion criteria
  - Electronic databases and search terms
- Literature search and screening results
  - Flow chart of literature search and screening results
  - List of included articles
  - List of excluded articles, with rationale

The Committee established their protocols before any evidence was reviewed and synthesized. This allowed the Committee to establish protocols that would capture the most appropriate, relevant, and direct body of evidence to answer each question. All systematic review protocols were posted online to provide transparency and an opportunity for the public to provide comments. Protocols also were presented and discussed at meetings of the full Committee. Any revisions to protocols that occurred during the course of the Committee's work were documented, posted online, and presented at meetings. The literature search plan (i.e., search terms) and screening results (i.e., flow chart, included and excluded articles) were added to the protocols as they were finalized.

A description of NESR's methodology for developing an analytic framework is below. NESR's methodology for developing inclusion and exclusion criteria and the search strategy, as well as processes related to screening and selecting studies for inclusion in a review, is described, below, in "Search for, Screen, and Select Literature."

Develop an Analytic Framework

The Committee developed an analytic framework for each systematic review question. An analytic framework defines the core elements of the systematic review question, includes definitions for key terms, identifies key confounders and other factors that could affect the relationships examined, and helps ensure that important contributing elements in the causal chain will be examined and evaluated. The analytic framework serves as the foundation for the rest of the systematic review process, and informs the inclusion/exclusion criteria and literature search strategy, data extraction and risk of bias assessments, and the strategy for synthesizing the evidence to develop and grade conclusion statements.

A standard framework, called the PICO framework, was used to define core elements of each systematic review question. The elements of the PICO framework are the Population (for both the intervention/exposure and for the outcome), Intervention and/or exposure, Comparator (i.e., the alternative being compared to the intervention or exposure), and Outcomes. The key terms defined in the Committee's analytic framework were based, when possible, on definitions already established by U.S. Federal government entities, or other leading national and international entities, as appropriate. Committee members identified key confounders and other factors to be considered (i.e., mediators, moderators, covariates) based on their knowledge of the literature and experience as subject matter experts).[4] Key confounders are considered

during review and evaluation of the evidence, particularly during risk of bias assessment (see "Assess Risk of Bias," below) and evidence synthesis.

Search for, Screen, and Select Literature

Systematic searching, screening, and selecting the scientific literature is a process through which NESR sought to identify the most complete and relevant body of evidence to answer a systematic review question. The process started with defining inclusion and exclusion criteria a priori (i.e., up front), followed by developing and implementing literature search strategies, and finally screening and selecting search results. The entire process was documented, including a complete list of articles that met criteria for inclusion in the systematic review, and a list of excluded articles, with the rationale for exclusion.

Define Inclusion and Exclusion Criteria

The Committee established inclusion and exclusion criteria to provide an objective, consistent, and transparent framework for determining which articles to include in each systematic review. These criteria were developed before any studies were reviewed to guide selection of the most relevant and appropriate body of evidence for each systematic review question. Additionally, these criteria were framed to increase the utility of the systematic review to inform U.S. Federal policy and programs. To minimize bias, revisions to the criteria after studies had been reviewed were discouraged. Any revisions to the criteria that occurred were documented with dates and rationales.

NESR analysts worked jointly with the Committee members to establish inclusion and exclusion criteria that were tailored to the systematic review question addressed. Considering the perspectives of both NESR and the Committee members helped ensure that the evidence reviewed was:

- Applicable to the U.S. population, including those who are healthy and/or those at risk of chronic disease,
- Relevant to public health nutrition policies and programs, and
- Rigorous from a scientific perspective.

Criteria were established for a number of study characteristics, such as:

- Study design
- Language
- Publication status

- Health status of study subjects
- Publication date
- Country in which the study was conducted
- Subject age
- Independent and dependent variables
- Study duration
- Group size

Although criteria were tailored to the unique characteristics of each systematic review question being addressed, NESR also applied several standard criteria. These standard criteria were designed to align with common practice within the field of systematic review, or to reflect that NESR reviews are used to inform U.S. Federal policy and programs. If there was a strong rationale for why a question-specific deviation from standard criteria was appropriate, the change was discussed between the Committee, NESR, and project leadership, and the justification was documented in the protocol. Following is a description of NESR's standard criteria, and considerations made by the Committee when establishing inclusion and exclusion criteria.

Study Design

NESR systematic reviews are used to inform Federal policies and programs, and thus include study designs that offer the strongest evidence to establish a relationship (e.g., randomized controlled trials [RCTs] and non-RCTs and prospective cohort studies [PCSs]). NESR recognizes RCTs as a strong study design, and NESR's grading process ensures that the strengths and weaknesses of each design, as well as each grading element, are thoroughly considered.

NESR systematic reviews typically include RCTs (e.g., individual, cluster, and crossover trials), non-RCTs, Mendelian randomization studies, PCSs, retrospective cohort studies, and nested case-control studies. They generally exclude uncontrolled trials, cross-sectional studies, and case-control studies. The decision whether or not to include study designs other than those described above, was determined by the Committee based on what was most appropriate for each systematic review question.

- Relying on RCTs is important, but it is also important to consider that rigorously conducted observational studies (particularly PCSs) can provide important evidence that complements that of RCTs.[2] For example, including observational studies allowed for

examination of diet as it occurs in daily life, or for the study of certain population groups (e.g., infants, toddlers, children, women who are pregnant, the elderly) or long-term or rare outcomes (e.g., childhood leukemia) that are not typically examined in RCTs.[5]

- When determining and describing a study's design, NESR analysts considered the data relevant to the systematic review question. In some cases, the study design for a particular analysis or publication differed from the design of the original study. For example, data from a PCS may have been analyzed cross-sectionally, and therefore, was excluded if cross-sectional study designs were not part of the inclusion criteria.
- In addition, the NESR systematic review process included a number of steps in which study design was considered, ensuring that the conclusions drawn and the strength of evidence grades assigned reflected a thorough assessment and consideration of the strengths and limitations of various study designs.

Language

NESR included studies published in English, and excluded studies published in languages other than English. NESR does not have the ability to translate manuscripts. It is rare for NESR literature searches to identify studies published in languages other than English, as the searches are designed to identify evidence that pertains to studies that are relevant to U.S. national policies and programs.

Publication Status

NESR included peer-reviewed studies, and excluded grey and/or unpublished literature. Relying on peer-reviewed studies supported the quality and objectivity of information used to inform Federal programs and policies. Issues related to publication bias were addressed in the NESR systematic review process during synthesis and grading of the strength of evidence. In addition, the search and screening process was conducted thoroughly to ensure that articles from predatory journals, or those journals without adequate peer review processes, and retracted articles were not included.[6,7]

Health Status of Study Participants

To reflect the U.S. population as a whole, the evidence base that informs the *Dietary Guidelines* must be comprised of studies conducted with people who are representative of the general public. This includes healthy people and those with a range of diet-related chronic diseases, including obesity and type 2 diabetes. Studies focused solely on people who already

have a diet-related chronic disease and are being treated for that disease were excluded from NESR reviews. This was done because nutrition in these cases becomes part of broader *clinical practice* guidance—that is, medical guidance that physicians and allied health professionals use to develop a specialized disease treatment or management plan to meet each individual patient's needs and to care for individuals with specific diseases and conditions.

Thus, NESR included studies that comprise participants who are representative of the general public, including studies done in participants who are healthy and/or who are at risk for a chronic disease. NESR also included studies that enroll some subjects with a disease, including those with obesity, or with the health outcome of interest (intermediate or health outcomes). NESR excluded studies that exclusively enrolled participants with a disease or the health outcome of interest (i.e., studies designed to medically treat individuals who already have the disease outcome of interest). In systematic reviews that examined the relationship between diet and risk of obesity, for example, studies that enrolled some participants classified as having obesity, as well as people at risk of obesity and healthy people were included; studies that *exclusively* enrolled individuals with obesity, like those that aim to treat individuals with obesity, were excluded.

Publication Date

All NESR reviews require that criteria for publication date be established, The Committee determined the appropriate date range criteria for each question. When establishing publication date range criteria, the Committee considered a number of factors, including whether:

- The question built on evidence reviewed by a previous Dietary Guidelines Advisory Committee or evaluated as part of an existing NESR systematic review,
- Research on the topic was emerging, and therefore, little research existed before a certain date, and
- A new analytical technique had recently been established in the field, making previous research findings less valid or reliable.

Country

NESR relied on the Human Development Index (HDI), which ranks and categorizes countries based on a summary measure of average achievement in key dimensions of human development.[8] NESR's standard criteria included studies conducted in countries ranked as high or very high on the HDI, and excluded studies conducted in countries ranked as medium or low. NESR applied the HDI classification based on the year the study intervention occurred or data

were collected. If the study did not report the year in which the intervention occurred or data were collected, the HDI classification for the year of publication was applied. HDI values are available from 1980, and then from 1990 to present. If a study was conducted before 1990, the HDI classification from 1990 was applied. When a country was not included in the HDI ranking, the current country classification from the World Bank was used instead.[9]

Study Duration

For some NESR reviews, the Committee established criteria for study duration. NESR did not have standard criteria for study duration that was uniformly applied to all reviews because the appropriate study duration is dependent on the intervention or exposure, outcomes, and populations of interest. Therefore, the Committee determined whether or not study duration criteria was necessary for a particular question, and then tailored the criteria to that question. For example, when establishing criteria for study duration, the Committee considered both the appropriate duration for the intervention or exposure of interest, as well as the appropriate duration for the outcomes of interest to occur. For questions where study duration criteria was established, the rationale for the criteria selected is documented in the chapter's methodology section.

Risk of Bias

NESR included all studies regardless of their risks of bias. The Committee considered risk of bias when synthesizing and grading the strength of evidence.

Developing and Implementing the Literature Search Strategy

Once the inclusion and exclusion criteria were set, the NESR librarian used the analytic framework and inclusion and exclusion criteria to guide development of a comprehensive literature search strategy. The literature search strategy included selecting and using the appropriate bibliographic databases (e.g., PubMed/MEDLINE, Cochrane, Embase, CINAHL), identifying search terms appropriate for the databases being searched, and employing search refinements, such as search filters. The librarian worked in collaboration with the NESR staff and Committee members to construct a preliminary search strategy using PubMed operators and search terms. This was used to conduct a test search, preview the results, and correct any syntax, spelling, or grammatical errors. The search strategy underwent multiple revisions to refine and adjust the search before it was finalized for use, and was peer-reviewed by a second

designated librarian to provide additional rigor to the process. The peer-review librarian reviewed the search strategy, and provided feedback regarding:

- The accuracy of translating the research questions into search concepts and terminology,
- Proper use of search operators, fields, limiters or filters, and spelling and syntax of search terms/strings,
- The accuracy of adapting the search strategy for each database interface,
- Inclusion of relevant subject headings, such as Medical Subject Headings (MeSH), and Emtree thesaurus with free-text search terms, and
- Provision of additional relevant search terms and/or original databases.

The NESR librarian used the feedback from the designated peer-review librarian to finalize the search strategies, and shared the revised search strategy with the Committee and NESR analyst(s) for final approval. The search strategy was documented and all database searches were reported to provide transparency and reproducibility of the systematic review. The search strategies were included in all of NESR's published systematic reviews. Each component of the literature search strategy described above is discussed in more detail below.

Identify Bibliographic Databases

The NESR librarian selected electronic bibliographic databases based on the systematic review topic. PubMed/MEDLINE, Cochrane, and Embase are the primary databases used to identify studies relevant to NESR systematic reviews on food, nutrition, and health. If the topic of the systematic review related to pregnancy, lactation, or the birth to age 24 months population, CINAHL also was searched.

Develop Search Terms

NESR analysts helped identify initial key terms and/or relevant articles to ensure that the NESR librarian had an understanding of the scope and intent of the systematic review question. The Committee also provided help on subject or topic terminology and technical terms to aid the librarian in choosing the most appropriate and comprehensive set of search terms possible. Search terms also were refined by reviewing key terms and the indexing of related publications, such as existing systematic reviews. Librarians also were responsible for checking each bibliographic database's search features to ensure that all related search terms for a particular systematic review question were captured.

Because NESR reviews often focus on health outcomes such as cardiovascular disease, type 2 diabetes, body weight (including obesity and overweight), and energy intake, standard subject/thesauri terms (such as those found from the MeSH database in PubMed) were routinely used when conducting a search. The librarian checked each database's search features to ensure that all related search terms for these common health outcomes were captured for each database.

Apply Search Filters

For NESR searches, filters that are commonly used include: English language, human studies, date, or publication type (e.g., to filter out news, editorial, and comments). Sometimes, study design also was used as a filter (e.g., systematic reviews and meta-analyses).

In some cases, searches were filtered or limited to identify studies done in subpopulations of interest, such as in a specific country or in women who are pregnant. In addition, filters or limits for sex (e.g., male or female) or specific age groups (e.g., children and adolescents [ages 2 to 18 years] or adults [ages 18 to 65 years]) were applied in some cases.

Implement the Literature Search Strategy

After finalizing the search strategies for each of the databases, the NESR librarian began the process of conducting all of the electronic searches. When searching multiple databases, overlap in the literature identified is common; the librarian electronically eliminated duplicate records at the search level using a citation management program (EndNote X9; Clarivate Analytics, Philadelphia, PA). Additional duplicates were identified by NESR analysts during the course of screening, and were removed from the search results manually. In addition, because some journals publish articles electronically, in advance of the print journal, the search captured these articles, and they were eligible for inclusion in the review, even though there was a possibility that they would be assigned an official publication date outside the window of the search date range.

Once the electronic searches were done, the librarian documented the total number of unique articles identified, indicating how many were identified from each database searched. This documentation included the total, raw search results, as well as search results after removal of duplicates.

Screen and Select Studies

Two NESR analysts independently screened all search results, which was facilitated by use of a web-based tool (i.e., DistillerSR) and screening forms that were developed based on the inclusion and exclusion criteria identified for each systematic review. In some cases, where multiple literature searches were run to identify articles for a question or family of questions, the search results were uploaded into the web-based tool, combined, and screened together. The goal of screening was to review the search results and exclude those that did not meet the inclusion criteria. Screening was done at 3 levels. The first level of screening was done using only the title of each article. If an article was not excluded by both analysts at this level, it moved forward to the second level, where the abstract was screened. Finally, if an article passed the first 2 levels, it moved to the third level, where the full text of the article was screened. After 2 NESR analysts completed independent screening of all 3 levels, the analysts reconciled any discrepancies between the 2 screenings. If necessary, a third analyst was consulted to resolve differences.

If multiple articles were identified that presented data from the same study or cohort, the article that most directly addressed the systematic review question was included to avoid duplicative data. If the articles addressed unique data related to the question, or were needed to comprehensively present information from a study or cohort, then all articles were included. Included articles from the same study or cohort were noted in the review, and this was taken into consideration when weighing the amount of evidence to answer a question.

Conduct Manual Searches

NESR analysts also completed manual searches, a mandatory part of a comprehensive search strategy, for every systematic review.[10] Manual searching was done to find peer-reviewed published articles not identified through the electronic database search. This was typically due to inadequate indexing or filtering limitations of a database. The primary approach used for the manual search was hand searching, in which an analyst systematically searched the reference sections of included articles and related systematic reviews and meta-analyses. Potential articles also may have been suggested by others engaged in the process, such as Committee members, analysts working on the project, or the general public through public comments. Two NESR analysts independently screened all relevant citations at the abstract and full-text levels to determine whether the articles addressed the systematic review question and met all inclusion and exclusion criteria, as outlined above.

If articles were identified through a manual search, the librarian reviewed the search strategy to determine why they were not found through the electronic searches. If a potential gap in the literature search strategy was identified, the electronic search was updated and rerun to include additional search terms or filters, and any new references identified were screened against the inclusion and exclusion criteria, as described above.

Document the Search Results

After the electronic and manual searches were completed, NESR analysts and librarians prepared materials to document the literature search and screening results. They compiled lists of the Committee's included and excluded citations, along with the rationale for exclusion. These lists were provided to the Committee for review and approval. The analysts and librarian also documented the search strategy and results, including:

- Inclusion and exclusion criteria
- Search strings (e.g., search terms, filters, and limits) used for each electronic database searched
- Date of each search
- A brief description of how the search was developed and implemented
- A flow chart of the number of included and excluded citations retrieved through electronic and manual searching
- A list of all included articles
- A table that listed all excluded articles with rationales for exclusion

The list of articles excluded after full text review is publicly available on the NESR website. The list of articles excluded after title or abstract review is documented and archived by NESR.

It is uncommon for a literature search to be updated after other steps in the NESR systematic review process are under way. This was true for the Dietary Guidelines Advisory Committee because of the number of questions under review. The timeframe for each review, however, was documented transparently.

Extract Data and Assess Risk of Bias

NESR analysts extracted and summarized data from each included article to objectively describe the body of evidence available to answer a systematic review question. In addition, NESR analysts assessed the risk of bias for each included article. The extracted data and assessment of risk of bias were used to populate evidence tables. Using one consistent format,

the evidence tables presented the key data from all studies included in the systematic review that the Committee used to synthesize the body of evidence (described, below, in "Synthesize Evidence, Develop Conclusion Statements, Grade the Evidence, and Identify Research Recommendations").

Extract Data

Determine Types of Data to Extract

With Committee guidance, NESR analysts determined the specific types of data to extract from each included study. The focus was on information that was critical for answering the systematic review question. Types of data typically extracted include study design, sample size (i.e., baseline and analytic sample size, attrition) and participant characteristics (i.e., age, sex, race/ethnicity, socioeconomic status, and health status), the independent and dependent variables and their measurement methods, statistical adjustments, results, limitations, and funding sources.

Extract the Data

Once the types of data to be extracted were determined, a data extraction form was developed and used to facilitate accurate and consistent data extraction. This form ensured that the same information from each article was formatted consistently, which made the content easier to compare and contrast during synthesis. NESR analysts typically used web-based tools to extract data (e.g., DistillerSR).

One NESR analyst extracted data from each included article using the data extraction form. In some cases, the required data were not reported in the article. In those situations, the data were recorded as "not reported." However, if the required data were reported in an article's protocol or related publication, the analyst extracted the data and noted the publication from which it was extracted. Next, a second analyst reviewed the extracted data for completeness, accuracy, and consistent presentation and formatting. Discrepancies noted by the second analyst, if any, were discussed and resolved. If a discrepancy could not be resolved or needed additional clarification, the analysts consulted with a third NESR analyst and/or the Committee to reach resolution.

Create Evidence Tables

When data extraction was completed for all studies included in the systematic review, the analyst created evidence tables. The number of evidence tables created varied depending on the size and scope of the systematic review. NESR analysts and the Committee determined the content and organization of evidence tables based on the analytic framework. For example, some tables provided descriptive information about the studies' design, methods, study participants, and funding sources. Other tables presented studies' results. Evidence tables were used to facilitate and provide transparency to the Committee's review, synthesis, and grading of the body of evidence available to answer the systematic review question.

Assess Risk of Bias

Each article included in a systematic review conducted by NESR underwent a formal risk of bias assessment. Risk of bias is the likelihood of a systematic error or deviation from the truth, in results or inferences, which can lead to underestimation or overestimation of either the true effect of an intervention on an outcome or the true association between an exposure and outcome. The design and conduct of a study affects the extent to which its results are at risk of bias. Studies with lower risk of bias (i.e., studies with rigorous designs and sound analytic methods) are more likely to report results that are closer to the truth. The assessment is specific to identifying the *risk* of bias because the results of a study may in fact be unbiased despite a methodological flaw).[11-13]

Conducting a formal risk of bias assessment is a critical part of the systematic review process. The assessment provided important information regarding each included article and the body of evidence under review, which the Committee considered when synthesizing the evidence, drawing conclusions, and grading the strength of evidence underlying those conclusions.[14]

Use of a risk of bias tool was key to ensuring that risk of bias assessments were done consistently across studies, and that the results of the assessment were transparent. Systematic review methodology, including that related to risk of bias, is continuously evolving. NESR has followed these evolutions, routinely evaluating and refining its methods to ensure they remain state-of the-art. In order to align with other systematic review organizations, NESR used several tools, and applied their respective guidance, to assess risk of bias for primary studies included in its systematic reviews.

NESR assessed the risk of bias of RCTs, including parallel group trials, cluster-randomized trials, and cross-over trials, using the "Cochrane risk-of-bias tool for randomized trials" (RoB 2.0; August 2016 version).[15] This tool addressed the following types of bias:

- Bias arising from the randomization process
- Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomization (cluster randomized trials only)
- Bias due to deviations from intended interventions
- Bias due to missing outcome data
- Bias in measurement of the outcome
- Bias in selection of the reported result

NESR assessed the risk of bias of non-RCTs using the "Risk of Bias in Non-randomized Studies-of-Interventions" tool (ROBINS-I).[16] The tool addressed the following types of bias:

- Bias due to confounding
- Bias in selection of participants into the study
- Bias in classification of interventions
- Bias due to deviations from intended interventions
- Bias due to missing data
- Bias in measurement of the outcome
- Bias in selection of the reported result

NESR assessed the risk of bias of observational studies using the Risk of Bias for Nutrition Observational Studies tool (RoB-NObs) (Table C-1). NESR created the RoB-NObs by making modifications to the ROBINS-I and a preliminary instrument designed to assess risk of bias in non-randomized studies of exposures because a universally accepted tool for assessing risk of bias in observational studies does not currently exist.[17,18] Modifications were made to ensure that the tool was applicable to observational studies of food, nutrition, and public health, though many questions and the guidance for answer the questions are nearly identical.[19,20] The tool addressed the following types of bias:

- Bias due to confounding
- Bias in selection of participants into the study
- Bias in classification of exposures
- Bias due to departures from intended exposures
- Bias due to missing data

- Bias in measurement of the outcome
- Bias in selection of the reported result

Table C-1. Risk of Bias for Nutrition Observational Studies (RoB-NObs) Tool

Bias due to confounding
1.1 Is there potential for confounding of the effect of exposure in this study?
1.2. *If Y or PY to 1.1*: Was the analysis based on splitting follow-up time according to exposure received?
1.3. *If Y or PY to 1.2*: Were exposure discontinuations or switches likely to be related to factors that are prognostic for the outcome?
1.4. *If N or PN to 1.3:* Did the authors use an appropriate analysis method that adjusted for all the critically important confounding variables at baseline?
1.5. *If N or PN to 1.3:* Were confounders that were adjusted for measured validly and reliably by the variables available in this study?
1.6. *If N or PN to 1.3:* Did the authors avoid adjusting for post-exposure variables?
1.7. *If Y or PY to 1.3:* Did the authors use an appropriate analysis method that adjusted for all the critically important confounding variables, including baseline and time-varying confounding?
1.8. *If Y or PY to 1.7*: Were confounders that were adjusted for measured validly and reliably by the variables available in this study?
Bias in selection of participants into the study
2.1. Was selection of participants into the study (or into the analysis) based on participant characteristics observed after the start of exposure?
2.2. *If Y or PY to 2.1:* Were the post-exposure variables that influenced selection of participants (into the study or analysis) associated with exposure?
2.3. *If Y or PY to 2.2*: Were the post-exposure variables that influenced selection of participants (into the study or analysis) associated with the outcome?
2.4 Do start of follow-up and start of exposure coincide for most participants?
2.5 *If Y or PY to 2.2 and 2.3, or N or PN to 2.4*: Were adjustment techniques that were likely to correct for the presence of selection biases used?
Bias in classification of exposures
3.1. Is the exposure that was assessed clearly defined?
3.2. Does the exposure that was assessed represent the exposure of interest?
3.3. Were the methods used to assess the exposure clearly described?
3.4. Were the methods used to measure the exposure valid and/or reliable?
3.5. Were the same methods used to assess the exposure status for all participants/groups?
3.6. Were the methods used to define exposure status for participants/groups clearly described?
3.7. Were the methods used to define exposure status for participants/groups likely to result in minimal random or systematic exposure misclassification?
3.8. Could classification of exposure status been affected by the presence of the outcome, knowledge of the outcome or risk of the outcome?
Bias due to departures from intended exposures
4.1. Is there concern that changes in exposure status occurred among participants that were unbalanced across groups and likely to impact the outcome?
4.2 Were any critical co-exposures that occurred unbalanced between exposure groups and likely to impact the outcome?
4.3. *If Y or PY to 4.1, or 4.2:* Were adjustment techniques that are likely to correct for these issues (i.e., changes in exposure status and/or unbalanced co-exposures) used?

Bias due to missing data
5.1 Were there missing outcome data?
5.2 Were participants excluded due to missing data on exposure status?
5.3 Were participants excluded due to missing data on other variables (besides outcome data and exposure status) needed for the analysis?
5.4 *If Y or PY to 5.1, 5.2 or 5.3*: Are the proportion of participants and reasons for missing data similar across exposure groups?
5.5 *If Y or PY to 5.1, 5.2 or 5.3*: Were appropriate statistical methods used to account for missing data?
Bias in measurement of outcomes
6.1 Could the outcome measure have been influenced by knowledge of the exposure received?
6.2 Were outcome assessors aware of the exposure received by study participants?
6.3 Were the methods of outcome assessment the same across exposure groups?
6.4 Were any systematic errors during measurement of the outcome related to exposure received?
Bias in selection of reported result
7.1. Is the reported effect estimate likely to be selected on the basis of the results from multiple *outcome measurements* within the outcome domain?
7.2 Is the reported effect estimate likely to be selected on the basis of the results from multiple *analyses* of the exposure-outcome relationship?
7.3 Is the reported effect estimate likely to be selected on the basis of the results from different *subgroups*?

Each of these tools included signaling questions that address several types, or domains, of bias, and guidance that provided instructions and considerations for answering the individual signaling questions and for making overall judgements for each type of bias. The guidance for both the ROBINS-I and RoB-NObs specify that the signaling questions be answered by considering how the non-randomized or observational study compares to a randomized "target" trial conducted in the same population that had no flaws in its conduct.[4] Thus, they identify potential biases that may arise due to lack of randomization. In addition, the systematic review protocol developed by the Committee helped to further inform how the guidance was applied (i.e., which key confounders were evaluated). The ROB 2.0 tool had domain-level judgements of low, high, and some concerns, whereas the ROBINS-I and RoB-NObs had domain-level judgements of low, moderate, serious, critical, and no information.

NESR used a dual, independent process for risk of bias assessments. For each article included in a NESR systematic review, 2 NESR analysts independently completed the risk of bias tool appropriate for the study's design. Analysts answered the signaling questions based only on the data that was extracted for the systematic review. Risk of bias assessments were completed at the results level. Therefore, if a study included multiple results that were extracted to answer the systematic review question (i.e., continuous and categorical analyses of the exposure, or multiple different outcomes of interest), the NESR analysts considered each result

when responding to the items, and in some cases, completed multiple iterations of the tool to address each result independently. If necessary, analysts referred to previous and/or related publications to obtain information to complete items in the tool. The analysts' responses were compared, and disagreements, if any, were discussed and reconciled. If a disagreement could not be resolved by the 2 analysts, an additional member of the NESR staff was asked to provide a third-party consultation. The Committee also was consulted, as needed, to ensure consistency and accuracy of risk of bias assessments.

The results of each risk of bias assessment were displayed in a risk of bias table. This table reported on each study included in the review, and provided transparency to the domain-level risk of bias judgements using a color-coded system. If a study included multiple results to be considered in the systematic review, and their risk of bias judgements differed, then each result's risk of bias was reported separately.

Later in the process of conducting the systematic review, NESR's predefined criteria were used to evaluate and grade the strength of the evidence supporting each conclusion statement. One of the criteria was risk of bias. The risk of bias criterion considers the likelihood that systematic errors in the design and conduct of the studies could have affected reported results across the body of evidence. The criterion relied on a review of the domain-level judgements of risk of bias. NESR's process for grading the strength of evidence is described in the following section in "Synthesize Evidence, Develop Conclusion Statements, Grade the Evidence, and Identify Research Recommendations."

Synthesize Evidence, Develop Conclusion Statements, Grade the Evidence, and Identify Research Recommendations

Synthesize Evidence

Evidence synthesis is the process by which evidence from multiple studies is described, compared and contrasted, and combined qualitatively, or narratively, to answer the systematic review question. This synthesis of the body of evidence involves identifying overarching themes or key concepts from the findings, identifying and explaining similarities and differences between studies, and determining whether certain factors may have affected the relationships being examined.

NESR analysts drafted a description of the studies included in the systematic review to begin the process of synthesizing the evidence. This description included information about the study designs, sample sizes (i.e., baseline and analytic sample size, attrition) and subject characteristics (i.e., age, sex, race/ethnicity, socioeconomic status, and health status), the

independent and dependent variables and their measurement methods, statistical adjustments, results, limitations, and funding sources. NESR analysts used the analytic framework and systematic review protocol to guide how the evidence was organized and described.

Next, the Committee synthesized the evidence. NESR analysts provided the Committee with the description of the evidence, along with the raw extracted data, risk of bias assessments, and full-text articles for their review. The Committee reviewed these materials, assessing the included articles individually, and the body of evidence collectively. In their review, they considered study design, key associations between the intervention/exposure and outcome(s) of interest in the systematic review question, along with key factors addressed in grading the strength of the evidence (risk of bias, consistency, directness, precision, and generalizability). Patterns of agreement and disagreement among the findings were examined, and methodological differences between the studies were assessed to potentially help explain disagreement. Gaps in the body of evidence also were identified.

The Committee provided their feedback to the NESR analysts, who drafted text that synthesized the evidence. In addition, the analysts created evidence tables to describe the body of evidence and provide transparency to the Committee's review, synthesis, and grading of the body of evidence available to answer the systematic review question.

Develop Conclusion Statements

After the Committee synthesized the body of evidence, they drafted a conclusion statement. A conclusion statement is one or more summary statement(s) carefully constructed to answer the systematic review question. It reflects the evidence reviewed, as outlined in the analytic framework (e.g., PICO elements), and does not take evidence from other sources into consideration. Conclusion statements do not draw implications, and should not be interpreted as dietary guidance.

Conclusion statements should:

- Indicate the strength of the evidence grade,
- Focus on general agreement among the studies and/or acknowledge areas of disagreement where they exist,
- Identify the relevant parameters, when appropriate (e.g., if cited papers studied only 1 sex, age group, ethnicity, or level of health risk), and
- Be concise and written using elements of "plain language" so they can be understood by a broad audience.

The Committee members reviewed, discussed, and revised the conclusion statement until they reached agreement on wording that accurately reflected the body of evidence.

Grade the Evidence

The Committee then assigned a grade to each conclusion statement. The grade communicates the strength of the evidence supporting a specific conclusion statement to decision makers and stakeholders.

NESR has predefined criteria, based on 5 grading elements that the Committee used to evaluate and grade the strength of the evidence supporting each conclusion statement. The 5 grading elements are: risk of bias, consistency, directness, precision, and generalizability of the evidence. Study design was also considered during the grading process. NESR's grading rubric (Table C-2) is a tool used to facilitate the Committee's grading process. Use of the grading rubric ensures that the final grade reflects consideration of *all* of the grading criteria, promotes consistency across systematic reviews, and allows for the Committee's assessment of each element to be transparently documented.

Each element of NESR's grading criteria is described below. Development of these elements was informed by other grading approaches, including the GRADE approach, and methods used by the Agency for Healthcare Research and Quality and the Office of Health Assessment and Translation.[21-23]

- **Risk of Bias** considers the likelihood that systematic errors resulting from the design and conduct of the studies could have affected the accuracy of the reported results across the body of evidence. Assessment of this element is informed by a review of the risk of bias domain-level judgements across the body of evidence. NESR's process for assessing risk of bias for each study included in the body of evidence is described above, in "Assess Risk of Bias."
- **Consistency** considers the degree of similarity in the direction and magnitude of effect across the body of evidence. It also considers whether any inconsistency can be explained by differences in study designs and methods (e.g., differences in populations, exposure measurement methods).
- **Directness** considers how well the primary research studies are designed to address the systematic review question. Specifically, directness occurs when the populations, intervention, comparators, and outcomes of interest are directly related to the systematic review question.

- **Precision** considers the degree of certainty around an effect estimate for a given outcome. This assessment includes consideration of sample size, number of studies, and variability within and across studies.
- **Generalizability** considers whether the study participants, interventions and/or exposures, comparators, and outcomes examined in the body of evidence are applicable to the U.S. population.

Study design also was a critical consideration in the process of grading. The evidence was grouped by study design to determine the overall grade, or strength, of the evidence supporting the conclusion statement. Evidence from each design (e.g., RCTs, longitudinal cohort studies) was assessed collectively against the elements of the NESR grading rubric. This assessment ensured that the strengths and weaknesses of each design, as well as each grading element, were thoroughly considered. In addition, because the risk of bias tools used by NESR are inherently designed to capture potential biases in non-randomized and observational studies that arise due to lack of randomization, the grading element of risk of bias also allows for consideration of study design in the process of grading.

It should be noted that some other grading methodologies consider publication bias as a formal criterion, whereas NESR does not. NESR acknowledges that publication bias is important and is prevalent in nutrition research (as in other biomedical research). Because of the challenges associated with relying on funnel plots for assessing publication bias and given that no other gold-standard tools exist, particularly for observational studies, NESR does not address it as a separate grading element. Rather, NESR considers it in the evidence synthesis process by considering the extensiveness of the search, and whether large and small studies were included in the review, in particular small studies with null findings.

Next, the assessments made using the NESR grading rubric were used to facilitate the Committee's discussion and selection of an overall grade. A conclusion statement received a grade of Strong, Moderate, or Limited. If a conclusion statement could not be drawn due to no or insufficient evidence, no grade was assigned (i.e., Grade Not Assignable). A summary of the grades used by the NESR team is found in Table C-3. Rationale for the determination of a grade was documented by the NESR analysts.

Table C-2. NESR grading rubric

Elements	Strong	Moderate	Limited	Grade Not Assignable
Risk of bias	Across the body of evidence, there is a **strong** likelihood that the design and conduct of the studies has prevented or minimized bias such that the reported results are the true effects of the intervention/ exposure, and plausible bias and/or potential limitations are unlikely to alter the results	Across the body of evidence, there is a **moderate** likelihood that the design and conduct of the studies has prevented or minimized bias such that the reported results are the true effects of the intervention/ exposure, and plausible bias and/or potential limitations are unlikely to alter the results	Across the body of evidence, there is a **limited** likelihood that the design and conduct of the studies has prevented or minimized bias such that the reported results may not be the true effects of the intervention/ exposure, and plausible bias and/or potential limitations may have altered the results	A **grade is not assignable** for this element because it cannot be adequately assessed
Consistency	The body of evidence demonstrates findings with **strong** consistency in direction and magnitude of effect; or, any inconsistencies in findings can be explained by methodological differences	The body of evidence demonstrates findings with **moderate** consistency in direction and magnitude of effect; some of the inconsistencies in findings can be explained by methodological differences	The body of evidence demonstrates findings with **limited** consistency in direction and magnitude of effect; few of the inconsistencies in findings can be explained by methodological differences	A **grade is not assignable** for this element because it cannot be adequately assessed
Directness	The body of evidence demonstrates **strong** directness, such that studies are designed to directly examine the relationships among intervention/exposure, comparator, and outcomes of primary interest in the systematic review question	The body of evidence demonstrates **moderate** directness, such that some studies are designed to directly examine the relationships among intervention/exposure, comparator, and/or outcomes of primary interest in the systematic review question	The body of evidence demonstrates **limited** directness, such that few studies are designed to directly examine the relationships among intervention/exposure, comparator, and/or outcomes of primary interest in the systematic review question	A **grade is not assignable** for this element because it cannot be adequately assessed
Precision	The body of evidence demonstrates **strong** precision based on a substantial number of sufficiently-powered studies with a narrow assessment of variance	The body of evidence demonstrates **moderate** precision based on an adequate number of sufficiently-powered studies with a narrow assessment of variance	The body of evidence demonstrates **limited** precision based on an inadequate number of sufficiently-powered studies with a narrow assessment of variance	A **grade is not assignable** for this element because it cannot be adequately assessed
Generalizability	The body of evidence demonstrates **strong** generalizability to the	The body of evidence demonstrates **moderate** generalizability to the U.S.	The body of evidence demonstrates **limited** generalizability to the	A **grade is not assignable** for this element

	U.S. population of interest with regard to: a) the participant characteristics b) the intervention/exposure and outcomes studied	population of interest with regard to: a) the participant characteristics b) the intervention/exposure and outcomes studied	U.S. population of interest with regard to the: a) participant characteristics b) intervention/ exposure and outcomes studied	because it cannot be adequately assessed

Table C-3. Definitions of grades used by NESR for the 2020 Committee

Grade	Definition
Strong	The conclusion statement is based on a strong body of evidence as assessed by risk of bias, consistency, directness, precision, and generalizability. The level of certainty in the conclusion is strong, such that if new evidence emerges, modifications to the conclusion are unlikely to be required.
Moderate	The conclusion statement is based on a moderate body of evidence as assessed by risk of bias, consistency, directness, precision, and generalizability. The level of certainty in the conclusion is moderate, such that if new evidence emerges, modifications to the conclusion may be required.
Limited	The conclusion statement is based on a limited body of evidence as assessed by risk of bias, consistency, directness, precision, and generalizability. The level of certainty in the conclusion is limited, such that if new evidence emerges, modifications to the conclusion are likely to be required.
Grade Not Assignable	A conclusion statement cannot be drawn due to either a lack of evidence, or evidence that has severe limitations related to risk of bias, consistency, directness, precision, and/or generalizability.

Identify Research Recommendations

The Committee identified and documented research gaps and methodological limitations throughout the systematic review process. These gaps and limitations were used to develop research recommendations that describe the research, data, and methodological advances that are needed to strengthen the body of evidence on a particular topic. Rationales for the necessity of additional or stronger research also may have been provided with the research recommendations.

Develop Systematic Review Reports

To help meet goals for transparency and reproducibility, all of the Committee's NESR systematic reviews were made accessible to the public when complete. A complete report for each systematic review was peer-reviewed and published on the NESR website at nesr.usda.gov.

Each systematic review report contains complete documentation from each step of the review process, and includes a plain language summary, a technical abstract, and a full systematic review.

Write Plain Language Summaries

NESR plain language summaries provide an overview of NESR systematic reviews using concise, non-technical language for a range of audiences, regardless of their technical or scientific expertise.

The NESR plain language summaries include the systematic review question and the answer to that question, as well as a brief description of why the question was asked, how it was answered, what evidence was found, and how up-to-date the systematic review was.

NESR plain language summaries were drafted by NESR analysts and reviewed by the Committee.

Write Technical Abstracts

The purpose of a NESR technical abstract is to provide a short, technical synopsis of the systematic review. The technical abstract is structured to help readers quickly determine the overall scope, methodology, and findings of the systematic review, without having to read the entire report. A technical abstract is typically longer and more detailed than abstracts prepared for peer-reviewed publications and/or scientific meetings. The intended audiences of a NESR technical abstract include those with a scientific background, including scientific experts, Federal stakeholders, and researchers, as well as the general public.

A NESR technical abstract contains the following sections:

- **Background:** Describes (3-4 sentences) the rationale and objective of the systematic review.
- **Conclusion Statement(s) and Grade(s):** Answers the review question, with a grade that represents the strength of evidence supporting that conclusion statement.
- **Methods:** Describes the literature search strategy and processes used to extract data, assess risk of bias, synthesize evidence, develop conclusion statements, and grade the strength of evidence.
- **Summary of Evidence:** Summarizes the body of evidence included in the review, including a description of included studies, study results, and gaps and limitations.

NESR technical abstracts were drafted by NESR analysts and reviewed by the Committee.

Write Full Systematic Review

The purpose of the full systematic review is to present comprehensive details of the entire systematic review, including details about the methodology and protocol, as well as in-depth information about the body of evidence reviewed. The intended audiences of the full systematic review includes those with a scientific background, including scientific experts, Federal stakeholders, and researchers, as well as the general public.

The full systematic review contains the following sections:

- **Methodology:** Briefly describes the systematic review methodology used. .
- **Protocol:** Provides information about the systematic review protocol, including the analytic framework, inclusion and exclusion criteria, literature search strategy, and literature search and screening results (flow chart of screening results, list of included articles, and list of excluded articles with rationale for exclusion).
- **Conclusion statement(s) and grade(s):** Answer(s) the review question, with a grade that represents the strength of evidence supporting that conclusion statement.
- **Summary of the evidence:** Provides the key points from the review.
- **Description of the evidence:** Describes the included articles, focusing on subject characteristics, interventions/exposures and outcomes examined, methodology used, and a summary of study results.
- **Evidence synthesis:** Discusses overall themes in the body of evidence and provides an assessment of the strength of the evidence.
- **Research recommendations:** Suggests future research based on the gaps and limitations identified in the evidence.
- **Included articles:** Provides reference list of articles included in the review.

The full systematic review was drafted by NESR analysts throughout the course of the systematic review process and reviewed by the Committee.

Use and/or Update Existing NESR Systematic Reviews

Using an existing NESR systematic review to answer a question can prevent duplication of effort and promote time and resource management. NESR was created to meet the needs of the Federal government, which develops population-wide guidance, programs, and policies. Therefore, previous NESR work may be relevant to the work of the Advisory Committee. If an existing NESR review is out of date, it may need to be updated. This section describes NESR's methodology for how the Committee used and/or updated existing NESR systematic reviews.

The process began once the Committee developed a systematic review protocol (described above in "Develop a Systematic Review Protocol"). The protocol was used to determine whether an existing NESR systematic review was relevant to the Committee's question. An existing NESR systematic review was determined to be relevant if it addressed the same, or very similar, population, intervention and/or exposure, comparator, and outcomes outlined in the protocol. In addition, the existing review should have applied the same or very similar definitions for key terms and inclusion and exclusion criteria for selecting studies to include in the review. In some cases, existing reviews completed by a previous Dietary Guidelines Advisory Committee were determined to be relevant to a question, and the 2020 Committee used the same methods described below to build upon the review to answer a question.

Having identified existing NESR systematic reviews or non-NESR reviews completed by previous Committees that were relevant to the question being addressed, NESR analysts confirmed the determination with the Committee. At this point, the NESR analysts and librarian reviewed the included articles of the existing reviews to determine whether any articles were included in the review that had since been retracted.[7] If retracted articles had been included, the Committee determined whether the removal of the retracted article(s) would alter the conclusion statement and grade of the systematic review.

If one or more relevant existing systematic reviews were identified, a determination was made as to whether the existing review reflected the current state of science on the topic, or whether reviewing newly published evidence would likely result in changes to the conclusion statement and/or grade, thus warranting the investment of time and resources in a full systematic review update. This determination was made based on a number of considerations, such as:

- **The date range of the literature search conducted for the existing review.** For example, if the review did not include articles published in the past several years or more (e.g., more than 2 years), an update may have been needed to capture recently published evidence.
- **The Committee's knowledge of a particular field of research.** For example, if the topic was actively being researched, or a methodological advancement in the field had occurred, an update may have been needed to ensure that the current state of science was reflected.
- **The grade assigned to the conclusion statement in the existing review.** For example, if the existing review's conclusion statement had a grade of Limited or Grade

Not Assignable, review of new evidence could result in changes to the conclusion or grade.

- **A systematic evidence scan.** In a few cases, when the need for an update was uncertain, a NESR systematic evidence scan was conducted to search for and screen newly published articles. A systematic evidence scan is a type of scoping activity that provides objective data to facilitate systematic review-related decision making, but is not a full systematic review.
  - This type of evidence scan involved a formal, systematic literature search, and screening of the search results using inclusion and exclusion criteria, following previously described NESR methodology (see "Search for, Screen, and Select Literature").
  - The results of the scan were a list of all newly published articles that met inclusion criteria, and a brief description of the volume and relevant characteristics of those articles (e.g., study design, country, or age of study participants).
  - Committee members reviewed the newly published evidence to determine whether or not an update of a systematic review was warranted. To make this determination, the Committee considered whether results of the newly published articles were consistent with the body of evidence from the existing NESR systematic review, or if newly published studies address key gaps or limitations identified in the existing review. If, based on the systematic evidence scan, the existing review was determined to reflect the current state of the science, a formal update of the review was not conducted. The results of the scan were documented, including a list of all new articles that met criteria for inclusion, along with the rationale for not updating the review.

If one or more relevant existing reviews were determined to reflect the current state of science, the Committee documented their rationale, and used the existing NESR review(s) to answer the systematic review question, carrying forward the conclusion(s) and grade(s) from the review(s). If the relevant existing review(s) were determined to be out of date, the review was updated using the methods described below.

Updating a NESR systematic review was a formal process used to search for, evaluate, analyze, and synthesize newly published evidence that built on or expanded the evidence included in an existing review. NESR's systematic review methodology was implemented to search for and screen studies, extract data, assess risk of bias, and describe the evidence,

based on the updated protocol developed by the Committee. If the Committee's updated protocol differed from that of the existing review, the differences were documented. Then, the Committee synthesized the new evidence with that of the existing review. This synthesis took different forms, depending on the volume and characteristics of the new evidence. Below is a description of the synthesis approaches used by the Committee.

- **Assessment of new evidence as it relates to existing conclusions.** In one form of synthesis, the new evidence was described, and then discussed as it related to the conclusions or findings of the existing review. Revisions may have been made to the conclusion statement or grade based on the new evidence, and rationale for any changes was documented. This approach was generally used when relatively few new articles were found, and/or the methods and results reported in those articles were consistent with articles in the existing review.
- **Separate synthesis of new evidence.** In another form of synthesis, the new evidence was synthesized separately from the existing review, and used to draw and grade a conclusion statement based solely on the new evidence. This typically occurred when aspects of the updated protocol differed from the original, or the scientific methodology used to examine the topic had changed. Then, the Committee integrated both conclusions in their report, and provided a discussion about similarities and differences.

Regardless of what synthesis approach was used, NESR's systematic review methodology (described above in "Synthesize Evidence, Develop Conclusion Statements, Grade the Evidence, and Identify Research Recommendations") for developing conclusion statements and grading the strength of the evidence was applied. In addition, the complete systematic review update was documented, including details about the protocol and methodology, the full description and synthesis of the evidence, and conclusion statements and grades.

Using and/or updating an existing NESR systematic review to answer a question helped the Committee leverage work completed by previous expert groups, prevent duplication of effort, and promote time and resource management, all while ensuring that all of its conclusions reflect the current state of science on the topic.

NESR Team

The NESR is a team of scientists who are experts in systematic review methodology at USDA's Food and Nutrition Service, Center for Nutrition Policy and Promotion (CNPP).

NESR staff hold advanced degrees in nutrition, public health, epidemiology, library science, and related fields. Staff also receive extensive hands-on training and ongoing professional development to be able to independently perform each step of the systematic review process.

Each NESR project is coordinated by a team of NESR staff composed of analysts and librarians. The Committee makes all substantive decisions throughout the process of conducting its systematic reviews, and NESR analysts support the Committee by helping to facilitate and document the work necessary for timely execution of the systematic reviews in accordance with NESR methodology. Librarians work with the analysts to develop, implement, refine, and document the literature search strategies. NESR analysts and librarians are listed in ***Appendix F-5: Acknowledgements***.

Peer Review of NESR Systematic Reviews

New to the 2020 process, the Departments added a step for peer review of the NESR systematic reviews conducted by the Committee. This step was added in response to recommendations from the National Academies, as well as stakeholder comments and in acknowledgement that peer review is a best practice for conducting systematic reviews. Per the Committee's charter, peer review was coordinated by the Co-executive Secretary from USDA's Agricultural Research Service (ARS), which developed a peer-review process analogous to that used for academic journal articles.

Each systematic review was peer reviewed by 2 Federal scientists. In total, 47 Federal scientists from USDA, HHS (including the National Institutes of Health, CDC, and the Food and Drug Administration), Department of Defense, and the Department of Veterans Affairs participated in the process. Peer reviewers were asked to self-identify their systematic review question(s) of interest to review. Each reviewer was asked to provide a personal expert opinion on the systematic reviews, and not to provide comments on behalf of their position within the Federal government or their agency. The peer review process was anonymous and confidential. The peer reviewer was not identified to the Committee members or NESR staff, and in turn, the reviewers were asked not to share or discuss the review. Before peer review began, the NESR lead provided a presentation to the peer reviewers on the NESR systematic review methodology.

Peer review occurred after draft conclusion statements were discussed by the full Committee at Meetings 4 and 5. Following full Committee discussion, the NESR lead sent drafts of each systematic review to the ARS Co-executive Secretary to distribute to assigned reviewers. Peer reviewers were asked to complete their review within 14 days. Each reviewer received drafts of the full systematic review for their assigned question(s), including:

- Conclusion statement and grade,
- Summary of the evidence,
- Description and synthesis of the evidence,
- Research recommendations,
- Included articles, and
- Protocol

Following peer review, the ARS Co-executive Secretary shared peer-review comments with the NESR lead. NESR staff then reviewed the comments, addressed editorial comments, and proposed edits to the relevant Subcommittee in response to comments related to clarity and rationale for decisions made by the Committee. Substantive comments were reviewed and discussed by Subcommittees, and revisions were made to the systematic review, as needed, based on the Subcommittee's discussion. Following peer review, NESR staff sent the ARS Co-executive Secretary responses to each peer reviewer's comments, who shared them with the respective peer reviewers.

All new NESR systematic reviews underwent peer review, except for reviews with no included articles. Peer reviewers are listed in ***Appendix F-5: Acknowledgements***.

Committee Report Development and Structure

Reflecting the Committee's focus on lifespan, the bulk of this report consists of 14 science-based chapters organized by life stage: Pregnancy and Lactation, Birth to Age 24 Months, and Ages 2 Years and Older. The draft organization of the report was discussed at Meetings 3 and 5. Chapters were drafted by the members with support from Federal staff. Once developed, the chapters underwent editorial review and were shared for full Committee review. To ensure each chapter received a focused reviewed, 2 Committee members conducted a cross-review of each chapter. Each chapter summarizes the evidence assessed and evaluated by the Committee and concludes with discussion and summary sections. The Executive Summary was drafted by the Science Writer following her editorial review of each chapter. The Integration Chapter was drafted by the Chair and Vice Chair, with iterative review and contributions from the Integration

Writing Group and review by the full Committee. Future Directions were drafted by Subcommittees to highlight research recommendations that could advance knowledge in nutrition science and inform future Federal food and nutrition guidance. Committee members reviewed the draft report before the Committee meeting on June 17, 2020. The Committee then finalized the report based on member review and discussion at the meeting. The Committee's report was submitted to the Secretaries of USDA and HHS on June 30, 2020.

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