Subcommittee 5:
Food Sustainability and Food Safety

Miriam Nelson
Steven Abrams
Thomas Brenna
Frank Hu
Timothy Griffin (consultant)
Michael Hamm (consultant)

Barbara Millen

Subcommittee 5 Scope

- To address food and nutrition issues that will inform public health action and policies to promote the health of the population through food safety and long-term food security.

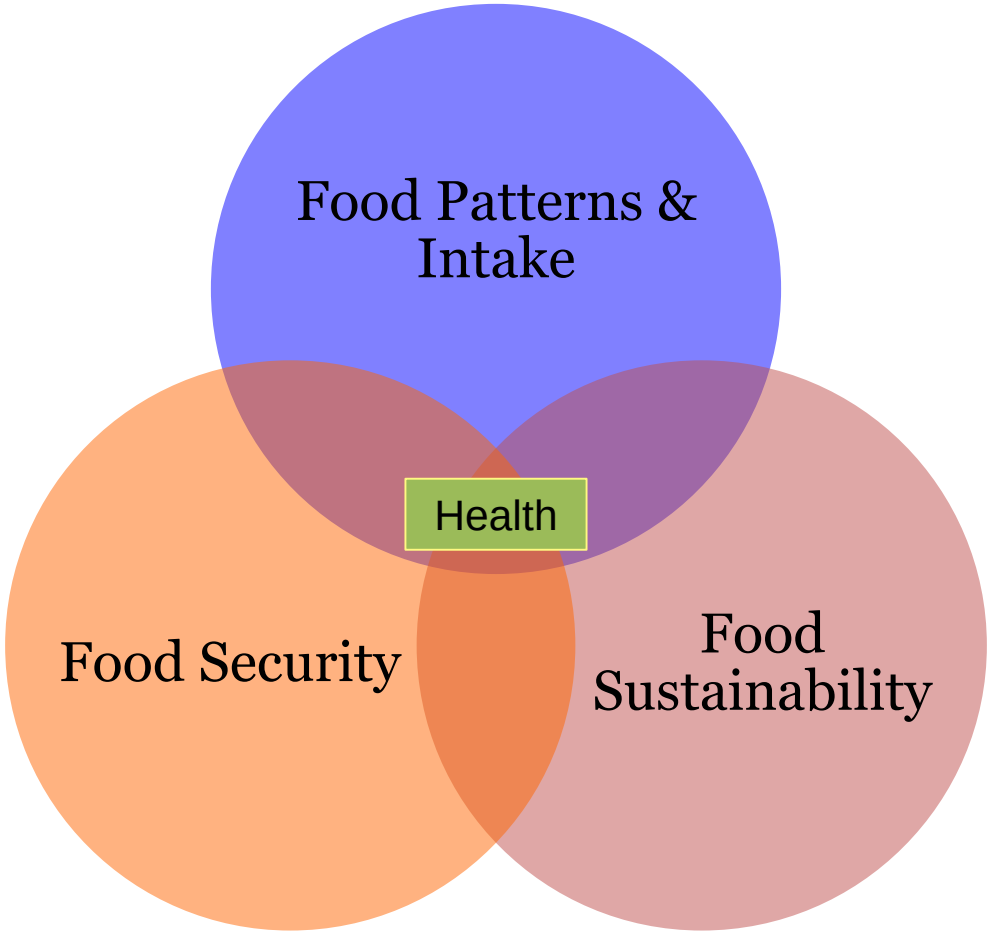
Food Security: *Draft* definition operationalized for the DGAC

- Exists when all people living in the United States now and in the future have physical and economic access to sufficient, safe, and nutritious food to meet their dietary needs for an active and healthy life.

Sustainable Diets: *Draft* definition operationalized for the DGAC

- Sustainable diets are a pattern of eating that promotes health and well-being, and provides food security for current and future populations while sustaining human and natural resources.

SC 5 Framework



Key Topic Areas

- Food Safety
  - Normal coffee/caffeine consumption
  - High-dose caffeine consumption
  - Aspartame
  - 2010 DGAC food safety individual behavior
- Food Sustainability
  - Dietary patterns
  - Fish

Invited Experts and Consultants

Invited Experts

Individuals invited by the SC, usually on a one-time basis, to provide their expertise to inform the SC's work. Invited experts do not participate in decisions at the SC level.

Consultant SC Members

Individuals sought by the SC to participate in SC discussions and decisions on an ongoing basis but who are not members of the full DGAC. Like DGAC members, consultants complete training and have been reviewed and cleared through a formal process within the Federal government.

Invited Experts

- **Laurel Bryant**, Chief, External Affairs National Oceanic and Atmospheric Administration Fisheries Communications Office

- **Michael B. Rust**, Science Coordinator, Office of Aquaculture, National Oceanic and Atmospheric Administration Fisheries

Consultant SC 5 Members

- **Michael Hamm**, C.S. Mott Professor of Sustainable Agriculture, Departments of Community Sustainability and Food Science and Human Nutrition, College of Agriculture and Natural Resources, Michigan State University

- **Timothy Griffin**, Director for the Agriculture and Environment Program and Associate Professor at the Friedman School of Nutrition Science and Policy at Tufts University

Questions Addressed Today

1. What is the relationship between normal caffeine consumption and health? (Frank Hu)
2. What is the relationship between high-dose caffeine consumption and health? (Frank Hu)
3. What is the relationship between aspartame consumption and health? (Steve Abrams)
4. What is the relationship between population-level dietary patterns and long-term sustainability and related food security? (Mim Nelson)

Food Safety: Normal Caffeine

What is the relationship between usual coffee/caffeine consumption and health?

Overview of Systematic Reviews

Normal Caffeine Background

- Coffee is one of the most widely consumed beverages in the US population and represents a major source of caffeine
- The effects of coffee/caffeine consumption have not been evaluated by any prior Dietary Guidelines Advisory Committee
- The Committee conducted an overview of systematic reviews and meta-analyses published since 2000 on coffee/caffeine and various health outcomes

Normal Caffeine Review of the Evidence

Overview of Systematic Reviews/Meta-Analyses [AMSTAR Scores 8/11 – 11/11]

Total Mortality
- 2 Systematic Reviews/Meta-analyses

Cardiovascular Diseases (*coronary heart disease, stroke, atrial fibrillation, blood pressure, blood lipids*)
- 15 Systematic Reviews/Meta-analyses

Type 2 Diabetes
- 5 Systematic Reviews/Meta-analyses

Cancer
- 22 Systematic Reviews/Meta-analyses

Cognition and Parkinson's Disease
- 6 Systematic Reviews/Meta-analyses

Normal Caffeine
Key Findings: Chronic Diseases

- Moderate coffee consumption in adults (3-5 cups/d, up to 400mg/d caffeine) was inversely associated with total mortality, especially CVD mortality
- Moderate coffee consumption was inversely associated with CVD risk; lowest risk at 3-5 cups/d
  - No evidence of an association between long-term coffee consumption and increased BP
  - Unfiltered but not filtered coffee increased blood lipids
- Coffee consumption was inversely associated with T2D risk in a dose-response manner (7% decrease per 1 cup/d)
  - Regular coffee and de-caffeinated coffee conferred similar benefits

Normal Caffeine
Key Findings: Chronic Diseases

- Coffee consumption was consistently associated with a lower risk of liver cancer and endometrial cancer.
- Null or a weak inverse association was observed for postmenopausal breast cancer, ovarian cancer, prostate cancer, pancreatic cancer, and colorectal cancer.
- Confounding by smoking was observed for the association between coffee intake and lung cancer and bladder cancer.

Normal Caffeine and Chronic Diseases *Draft* Conclusion Statements

- Strong and consistent evidence shows that consumption of coffee/caffeine within the moderate range (3-5 cups/d or up to 400 mg/d caffeine) is not associated with increased risk of major chronic diseases such as cardiovascular diseases and cancer in healthy adults.

- Strong and consistent evidence shows that moderate coffee consumption is associated with lower risk of cardiovascular disease and type 2 diabetes in healthy adults. There is no evidence that higher coffee consumption is associated with an increased risk of cardiovascular disease.

- Consistent evidence indicates that regular consumption of coffee is associated with lower risk of cancer of the liver and endometrium; slightly inverse or null associations are observed for other cancer sites.

Grade: Strong

Normal Caffeine
Key Findings: Neurodegenerative Disease

- Some evidence suggests an inverse association between caffeine from different sources and cognitive impairment and Alzheimer's disease; caffeine intake was associated with a moderately lower risk of various measures of cognitive decline/impairment

- An inverse association was consistently found between higher caffeine intake and lower risk of Parkinson's disease

Caffeine and Neurodegenerative Disease *Draft* Conclusion Statements

- Strong and consistent evidence indicates a protective association between caffeine intake and risk of Parkinson's disease.

Grade: Strong

- Limited evidence indicates that caffeine consumption is associated with a modestly lower risk of cognitive decline or impairment and lower risk of Alzheimer's disease.

Grade: Limited

Normal Caffeine: Chronic Diseases and Neurodegenerative Disease *Draft* Implications

- Moderate coffee/caffeine consumption can be incorporated with other healthy behaviors, such as refraining from smoking, consuming a nutritionally balanced diet, and being physically active.

- Coffee as it is normally consumed can contain added calories from cream, milk, and added sugars. It is important to be aware of these caloric additions.

Normal Caffeine and Chronic Diseases *Draft* Research Recommendations

- Prospective cohort studies with adequate control for smoking should examine the association between coffee (caffeinated and decaffeinated) and cancers.

- Investigate biological mechanisms for the inverse associations between coffee and risk of type 2 diabetes and CVD in animal and human experimental studies.

Normal Caffeine and Chronic Diseases *Draft* Research Recommendations

- Although strong evidence supports a protective effect of moderate coffee consumption on chronic disease risk in healthy adults, its association among those with existing diseases has been less studied.

- Because coffee is a known stimulant, future studies should examine the effects of coffee/caffeine on sleep quality, dependency, addiction, and overall quality of life measures.

Normal Caffeine and Neurodegenerative Disease *Draft* Research Recommendations

- Given the limited evidence on neurodegenerative diseases, well-designed prospective studies should examine the association between coffee/caffeine and cognitive decline, depression, and Alzheimer's disease.

Note

- As discussed at the DGAC meeting 3, we will be conducting an updated and targeted NEL search regarding the association of normal caffeine and pregnancy outcomes.

Food Safety: Normal Caffeine

What is the relationship between usual coffee/caffeine consumption and health?

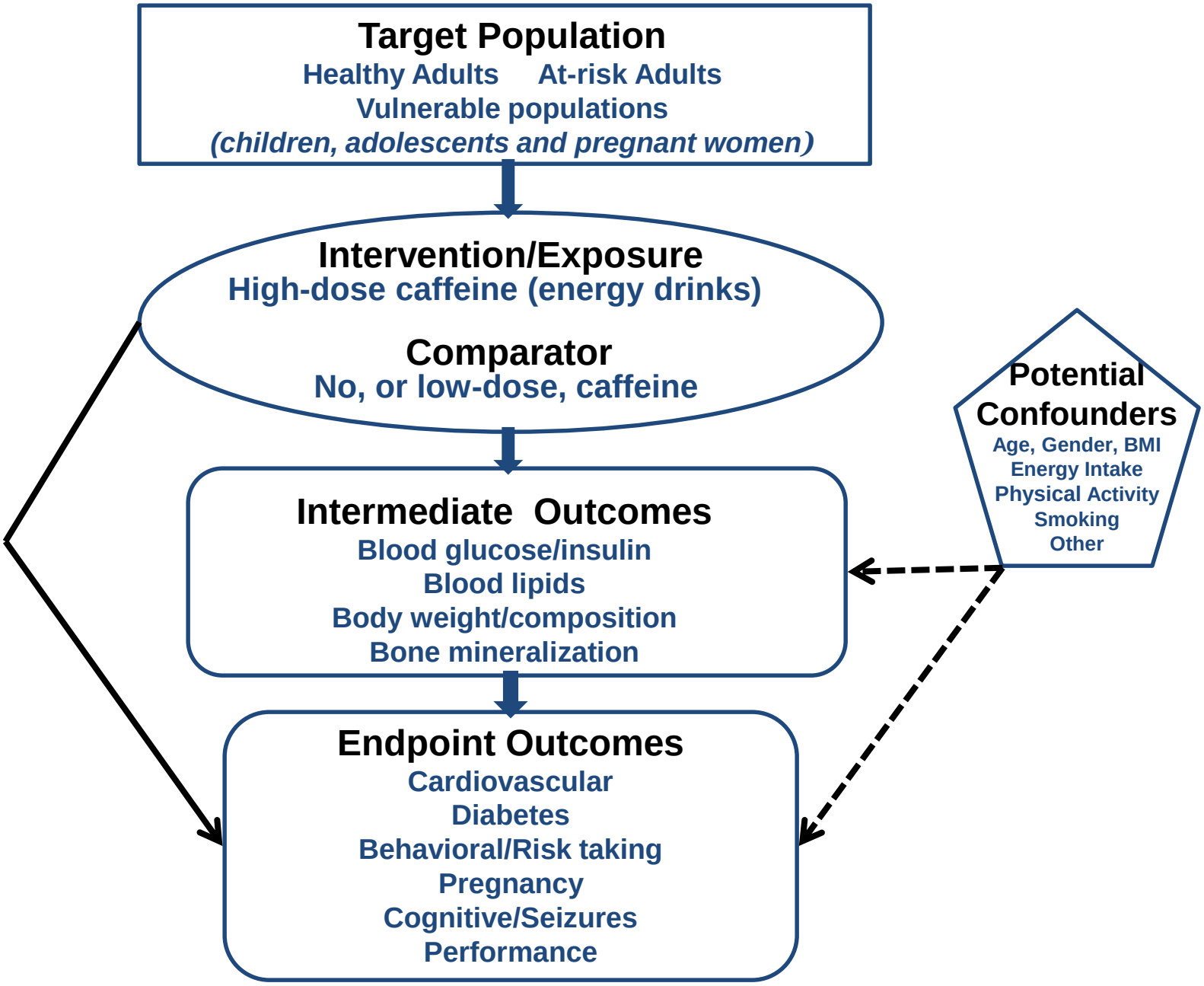
Discussion

Food Safety: High-Dose Caffeine

What is the relationship between high-dose caffeine consumption and health?

Systematic Reviews

Analytical Framework: High-Dose Caffeine



High-Dose Caffeine
Literature Search: Inclusion/Exclusion Criteria

Date Range:

- No limit (in English in a peer-reviewed journals)

Study Design:

- Randomized or non-randomized controlled trials, prospective cohort studies, case-control studies or case reports

Study Subjects:

- Children, adolescents, and adults aged 2 years+
- From countries with high or very high Human Development Index (HDI) (2012)
- Generally healthy population or populations with elevated chronic disease risk

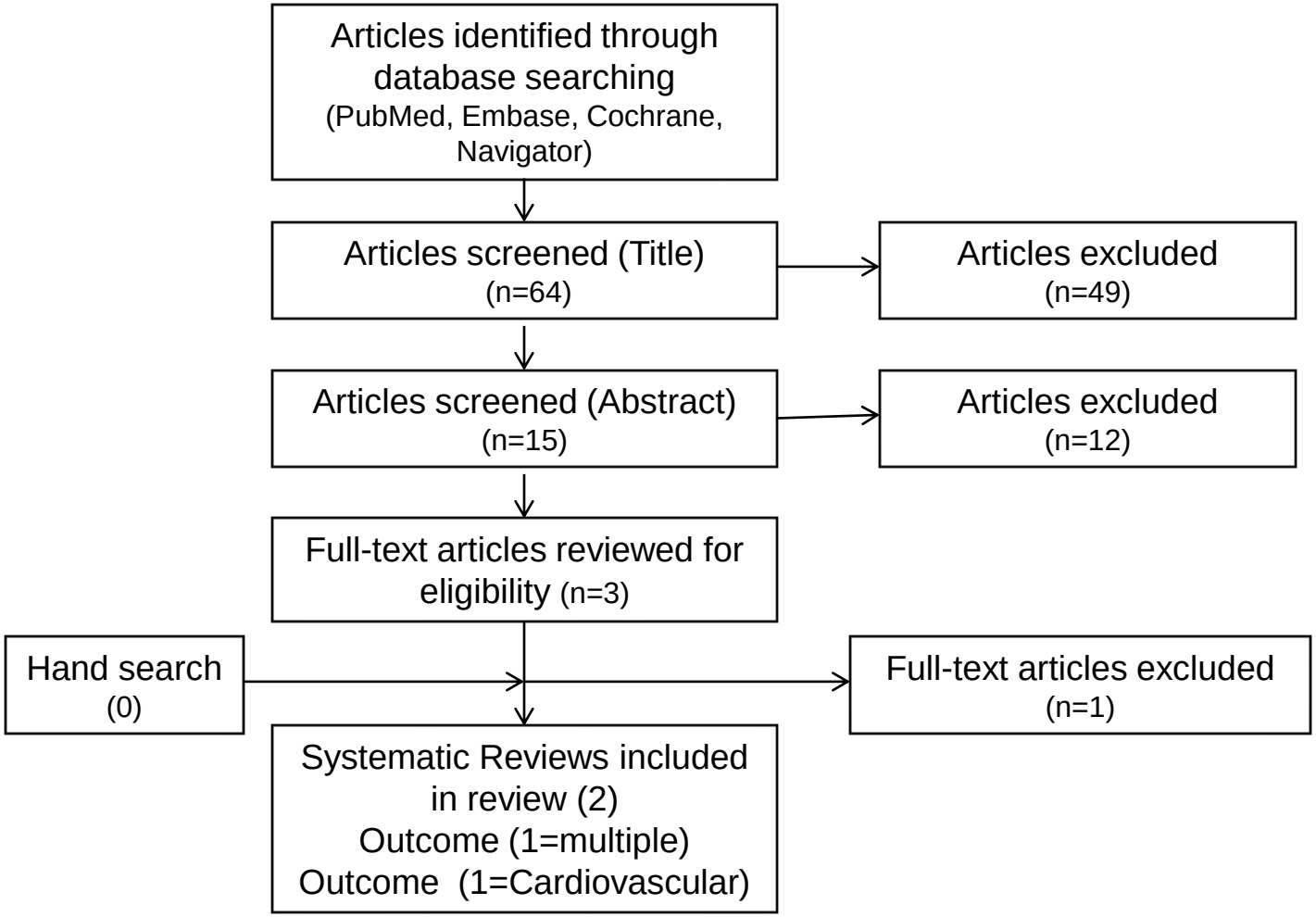
Intervention/Exposure:

- Specific level of caffeine; any source of caffeine (energy drinks)

Outcomes:

- Intermediate outcomes including blood lipids, blood glucose, body composition, and bone mineralization
- Endpoint outcomes including cardiovascular disease, diabetes, pregnancy outcomes, cognitive/behavioral outcomes, and performance

High-Dose Caffeine Literature Search Results



High-Dose Caffeine Review of the Evidence

- 1 SR of 15 RCTs (Burrows 2013): short term effects of energy drinks
  - 5 studies conducted in the US, 4 in the UK, 2 in Germany, and 1 in Canada, Brazil, Sweden and Australia
  - N Range = 10-69 (mostly crossover); Mean N = 25
  - 32-70% Women; 3 trials only Men
  - Mean Age = 25 y; Range = 18-45 y
  - Health outcomes included cardiorespiratory effects, physiological and pathological measures, body composition, and performance
  - AMSTAR score = 7/11

High-Dose Caffeine Review of the Evidence

- 1 SR of 17 case reports temporally related to energy drink (ED) consumption (Goldfarb 2014)
  - U.S. case reports
  - 15 cases <30 y, range 13-58 y
  - 13 Men; 4 Women
  - No predisposing cardiac abnormality or previous cardiac disease (1 minor)
  - 11 cases related to serious events (cardiac arrest, ventricular arrhythmias, and ST-segment elevations)
  - AMSTAR score = 7/11

High-Dose Caffeine Review of the Evidence

- Interventions included mostly standard calorie energy drinks at a mean dose of 389 ml (~1.5 cans) per study session (range = 250-750 ml).
- Two of the studies investigated the combination of energy drink and alcohol consumption.

High-Dose Caffeine Key Findings

- All studies that measured BP(4/4) found no change in BP with energy drink doses of 250-500 ml.
- Other outcomes, including heart rate, arrhythmias, blood glucose and fatty acids, body composition, and aerobic endurance, were inconsistent across studies.
- Two studies that examined energy drinks + alcohol reported different outcomes:
  - One reported a decrease in motor coordination and visual acuity in healthy young men (Ferreira 2006)
  - One reported no effects on arrhythmias within 6 h of ingestion in healthy young adults (Wiklund 2009)

High-Dose Caffeine
Key Findings continued

- The limitations to this body of evidence included a lack of homogeneity across studies, including the type of intervention, dosage, and energy drink type, making comparisons difficult.

- A relatively small number of studies assessed each outcome, and these had small sample sizes and short follow-up time intervals.

- Overall, studies investigating long-term consumption of energy drinks were lacking.

High-Dose Caffeine Context

- The American Academy of Pediatrics, the International Society of Sports Nutrition, and the American Medical Association have issued position statements on energy drinks, advising no or limited consumption among children and adolescents.

- The FDA determined that caffeine added to alcoholic beverages was not generally recognized as safe, leading to withdrawal of premixed, caffeinated alcoholic beverages from the market.

- The CDC has issued a position statement on the dangers of mixing alcohol and energy drinks:
  - Energy drinks mask the depressant effects of alcohol
  - Energy drinks have no effect on the metabolism of alcohol by the liver
  - Energy drinks result in an “awake” state of intoxication, increasing risk of alcohol-related problems

High-Dose Caffeine
Draft Conclusion Statement

- Studies examining the health effects of excessive caffeine intake were limited in both adults and children. Some evidence links energy drinks to certain adverse outcomes, such as caffeine toxicity and adverse cardiovascular events. Randomized clinical trials that examined the association of energy drinks with cardiovascular and other health outcomes found mixed results.
- Few studies have evaluated the health effects of mixing alcohol with energy drinks, but they suggest energy drinks may mask the effects of alcohol intoxication and increase risk of alcohol-related problems.

Grade: Limited

High-Dose Caffeine *Draft* Implications

- Early safety signals consisting of case reports of adverse events associated with high-caffeine energy drink consumption, including increased emergency room visits, indicate a potential public health problem.

- Caution is warranted for the consumption of high-caffeine energy drinks for vulnerable populations, such as youth and adolescents.

- Energy drinks with high levels of caffeine and alcoholic beverages should not be consumed together, either mixed together or consumed at the same sitting. This is especially true for vulnerable populations.

High-Dose Caffeine
Draft Research Recommendations

- Research is needed to define excessive caffeine intake and safe levels of consumption for children and adolescents.
- More data on the prevalence of excessive caffeine intake in children and adults beyond intake of energy drinks are needed.
- Prospective studies of associations of excessive caffeine and energy drink intake with health outcomes in children and adults are necessary, as randomized controlled trials may not be feasible given ethical constraints.
- More research examining the health effects of alcohol mixed with energy drinks is needed.

High-Dose Caffeine

What is the relationship between high-dose caffeine consumption and health?

Discussion

Food Safety: Aspartame

What is the relationship between aspartame consumption and health?

Expert Report

Aspartame
Review of the Evidence

European Food Safety Authority (EFSA)

Title: Scientific Opinion on the Re-evaluation of Aspartame as a Food Additive

EFSA Panel of Food Additive and Nutrient Sources added to Food

(2013)

Aspartame
Draft Key Findings

- Overall, intakes of aspartame are not associated with an increased risk of adverse outcomes in populations who do not have phenylketonuria (PKU).

- Some concern requiring further investigation exists for some cancers, especially hematopoetic ones, but the data do not clearly identify a relationship.

- The possibility that intakes amongst ~~the~~ higher exposure groups during pregnancy could be associated with preterm delivery requires further evaluation and research.

Aspartame
Draft Conclusion Statements

- The DGAC concurs with the European Food Safety Authority (EFSA) Panel on Food Additives that aspartame in amounts commonly consumed is safe and poses minimal health risk for healthy individuals without phenylketonuria (PKU). This includes risk of most cancers, seizures, and cognitive/behavioral problems in children and adults.

DGAC Grade: Moderate

Aspartame
Draft Conclusion Statements continued

- Limited and inconsistent evidence suggests a possible association between aspartame and risk of hematopoietic cancer (non-Hodgkin lymphoma and multiple myeloma) in men, indicating the need for more long-term studies.
- Limited and inconsistent evidence indicates a potential for risk of preterm delivery, although the risk is likely to be small.
- Very limited evidence does not allow for any conclusion on the relationship between aspartame consumption and headaches.

DGAC Grade: Limited

Aspartame: *Draft* Implication and Research Recommendations

- Individuals should be encouraged to stay at or below the aspartame acceptable dietary intake (ADI) of no more than 50 mg/kg/day.

- Further investigation is necessary regarding the risks of aspartame related to some cancers, especially hematopoietic ones, and pregnancy outcomes.

Aspartame

What is the relationship between aspartame consumption and health?

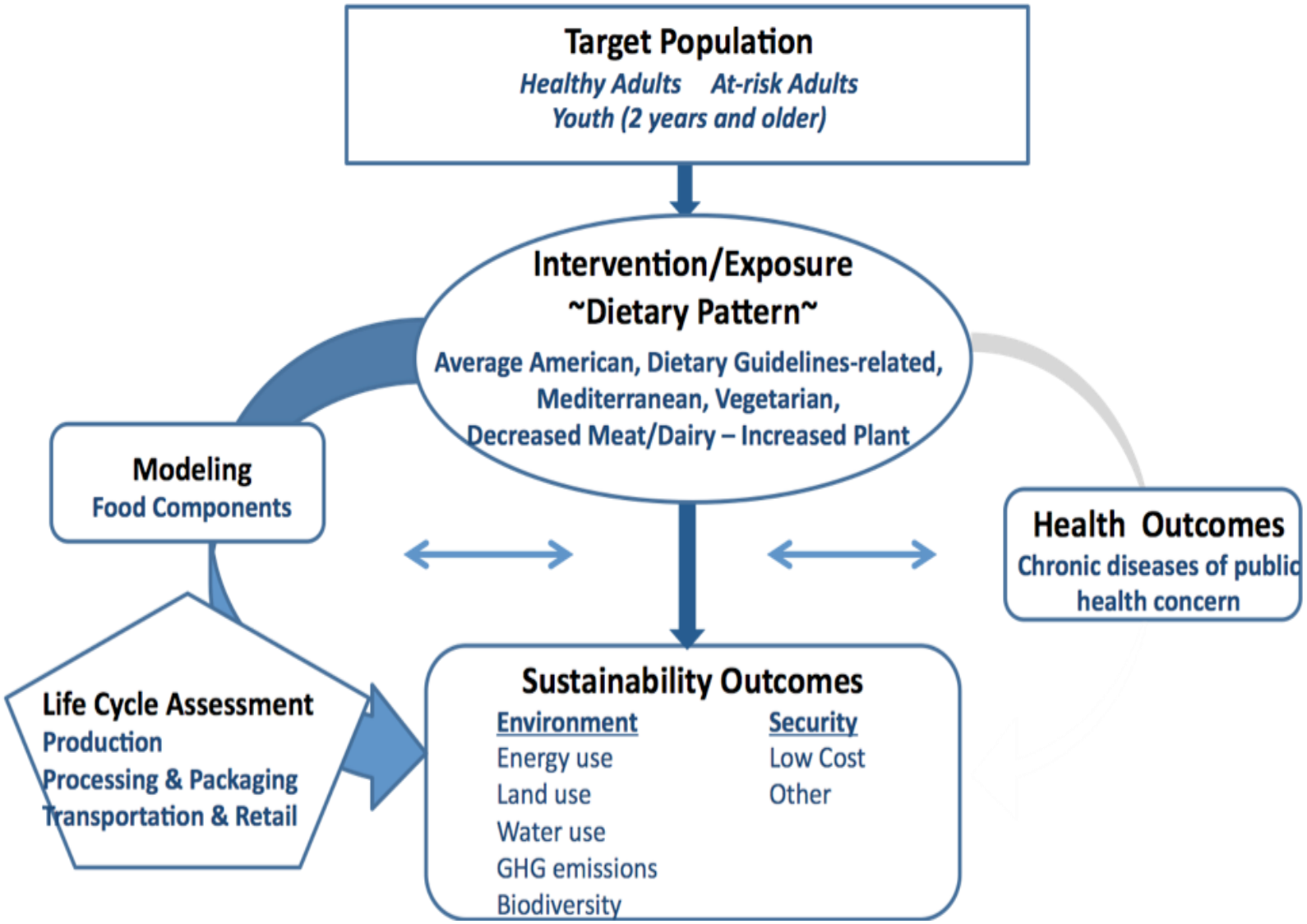
Discussion

Food Sustainability: Dietary Patterns

What is the relationship between population-level dietary patterns and long-term food sustainability and related food security?

NEL Systematic Review

Analytical Framework: Dietary Patterns and Sustainability



Dietary Patterns and Sustainability
Literature Search: Inclusion/Exclusion Criteria

Date Range:

- From 2000 to 2014 (in English in a peer-reviewed journals)

Study Design:

- Modeling/cross-sectional studies, data analysis, and survey reports

Study Subjects:

- Children, adolescents, and adults aged 2 years+
- From countries with high or very high Human Development Index (HDI) (2012)
- Generally healthy population or populations with elevated chronic disease risk

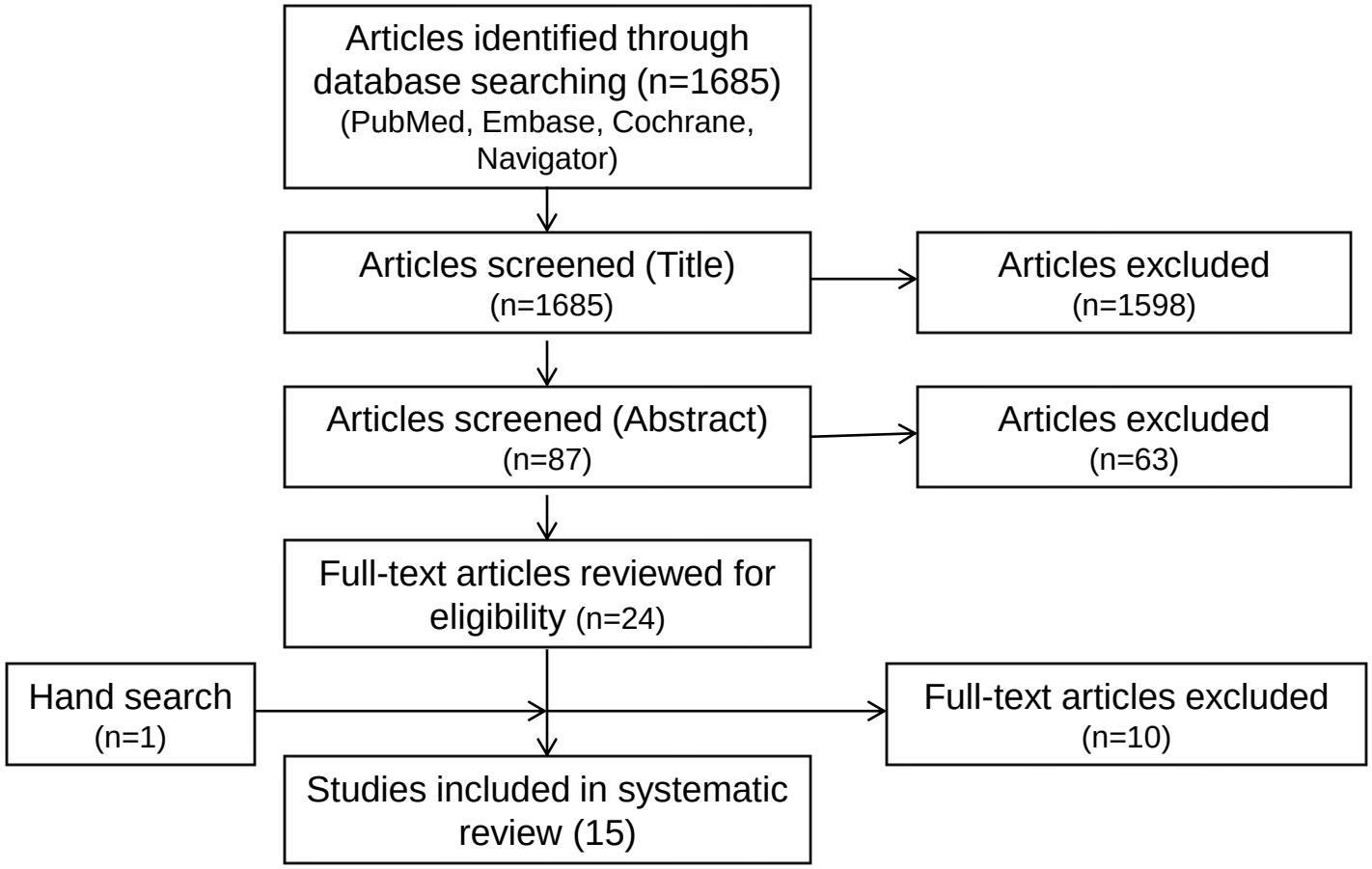
Intervention/Exposure:

- Identification of a dietary pattern, e.g. Mediterranean diet, Vegetarian diet, Dietary guidelines related diet, Average American diet

Outcomes:

- Health outcomes
- Environmental outcomes

Dietary Patterns and Sustainability Literature Search Results



Dietary Patterns and Sustainability Review of the Evidence

- Studies were conducted in the U.S., the U.K., Germany, the Netherlands, France, Spain, Italy, Australia, New Zealand, and Brazil; also one regional and one global study
- Studies were carried out between 2003-2014
- Studies used primarily a modeling approach
- Studies assessed using the Critical Appraisal Checklist (National Institute of Health Research). Study scores ranged from 6/12 - 12/12

Dietary Patterns and Sustainability Review of the Evidence

Dietary Exposure

- Dietary patterns included:
  - Average diet for the respective country
  - Dietary guidelines-related diet for the respective country
  - Mediterranean diets
  - Western diets
  - Vegetarian, lacto-ovo vegetarian, and vegan diets
  - Diet "scenarios" that modeled replacement of meat and dairy foods with plant-based foods
    - One study modeled 42 dietary patterns varying in total fat and meat servings in New York State

Dietary Patterns and Sustainability Review of the Evidence

Health Outcomes

- Health outcomes documented previously
  - Dietary guidelines-related pattern
  - Mediterranean dietary pattern
  - Vegetarian, lacto-ovo, and vegan patterns
- Diet quality assessed with *a priori* index related to health
  - Healthy Eating Index (HEI)
  - WHO Index
- Modeled health outcomes
  - DIETRON Model to estimate deaths delayed or averted for each dietary pattern

Dietary Patterns and Sustainability Review of the Evidence

Sustainability Outcomes

- Life Cycle Assessment:
  - Methodological framework for assessing environmental impacts of food components of dietary patterns
  - Life cycle for a food component typically includes agricultural production, processing and packaging, transportation and retail
- Environmental footprint:
  - Greenhouse gas emissions
  - Agricultural land use
  - Energy consumption
  - Water consumption
  - Biodiversity

Dietary Patterns and Sustainability Review of the Evidence

Food Security Outcomes

- Cost difference between average dietary pattern and sustainable dietary pattern.
- Assessed using a “food basket” constructed to reflect the weekly food purchasing of a hypothetical reference household including parents and two children.
- Food baskets were also developed according to principles of dietary guidelines of respective countries.

Dietary Patterns and Sustainability *Draft* Key Findings

- A diet should be considered in its entirety when assessing environmental impact.
- The studies were consistent in showing that, in general, higher consumption of animal-based foods was associated with a greater impact on the environment.
- The studies were consistent in showing that healthier dietary patterns that adhered to respective dietary guidelines were more environmentally sustainable than diets typically consumed by the population.
- Three studies assessed the economic cost of more sustainable diets and results were inconsistent.

Dietary Patterns and Sustainability *Draft* Conclusion Statements

- Consistent evidence indicates that, in general, a dietary pattern that is lower in animal-based foods and higher in plant-based foods has a lesser environmental impact and at the same time is more health-promoting than the current average American diet.
- The evidence suggests that a more environmentally sustainable diet can be achieved by following the 2010 Dietary Guidelines for Americans and respective guidelines elsewhere.
- An environmentally sustainable diet can be achieved without excluding any food groups completely.

Grade: Strong

Dietary Patterns and Sustainability *Draft* Implications

- Sustainability considerations provide a compelling additional rationale for following current dietary guidelines.

- The evidence supports the U.S. population moving towards the 2010 Dietary Guidelines for Americans by increasing consumption of plant-based foods and decreasing animal-based foods.

- The extension of dietary guidelines to be more inclusive and consider environmental and sustainability issues is achievable because of the large overlap between the health and environmental outcomes. Evidence supports that a more sustainable diet also promotes health and vice versa.

Dietary Patterns and Sustainability *Draft* Implications

- Promoting more sustainable diets will contribute to food security for present and future generations by conserving resources. This approach should be encouraged across all food sectors.

- Moving forward, care will be needed to be sure that the U.S. population has access to, and can afford, a more sustainable pattern of eating.

Dietary Patterns and Sustainability *Draft* Research Recommendations

- Currently being written

Dietary Patterns and Sustainability

What is the relationship between population-level dietary patterns and long-term food sustainability and related food security?

Discussion

SC 5: What's Next?

1. Complete chapter background and conceptual model
2. Finalize, update to 2010 individual behavior food safety questions
3. Conduct specific NEL search on caffeine and pregnancy
4. Complete fish sustainability in relation to dietary guidance
5. Identify research gaps for sustainability questions
6. Finalize writing of chapter

Subcommittee 5:
Food Sustainability and Food Safety

Miriam Nelson
Steven Abrams
Thomas Brenna
Frank Hu
Timothy Griffin (consultant)
Michael Hamm (consultant)

Barbara Millen