

Subcommittee 2:
Dietary Patterns,
Foods and Nutrients,
and Health Outcomes

Anna Maria Siega-Riz

Cheryl Anderson

Tom Brenna

Steven Clinton

Frank Hu

Marian Neuhouser

Rafael Pérez-Escamilla

Alice H. Lichtenstein

Scope

- To examine the relationship between dietary patterns, foods, and nutrients, *and* preventable diet-related diseases, obesity, and mortality
 - Primary focus is to consider foods and nutrients in the context of dietary patterns
 - Considering evidence on specific foods and nutrients, as needed

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 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.

Experts & Consultants

Invited Experts (July to Sept 2014)

Microbiome: “Examining Probiotic Functional Food Benefits in the Context of the Human Microbiome”

- Linda Duffy, PhD, MPH, NIH National Center for Complementary and Alternative Medicine
- Van Hubbard MD, PhD, NIH Division of Nutrition Research Coordination and National Institute of Diabetes and Digestive and Kidney Diseases
- Pam Starke-Reed, PhD, USDA Agricultural Research Service

Consultant SC Members

None

Questions Addressed Today

- Dietary patterns and:
 - Neurological-psychological illness (Tom Brenna)
 - Congenital anomalies (Anna Maria Siega-Riz)
 - Bone health (Barbara Millen)
- Saturated fat and cardiovascular disease (Frank Hu)
- Alcohol (Anna Maria Siega-Riz)

Dietary Patterns and Neurological-Psychological Illness

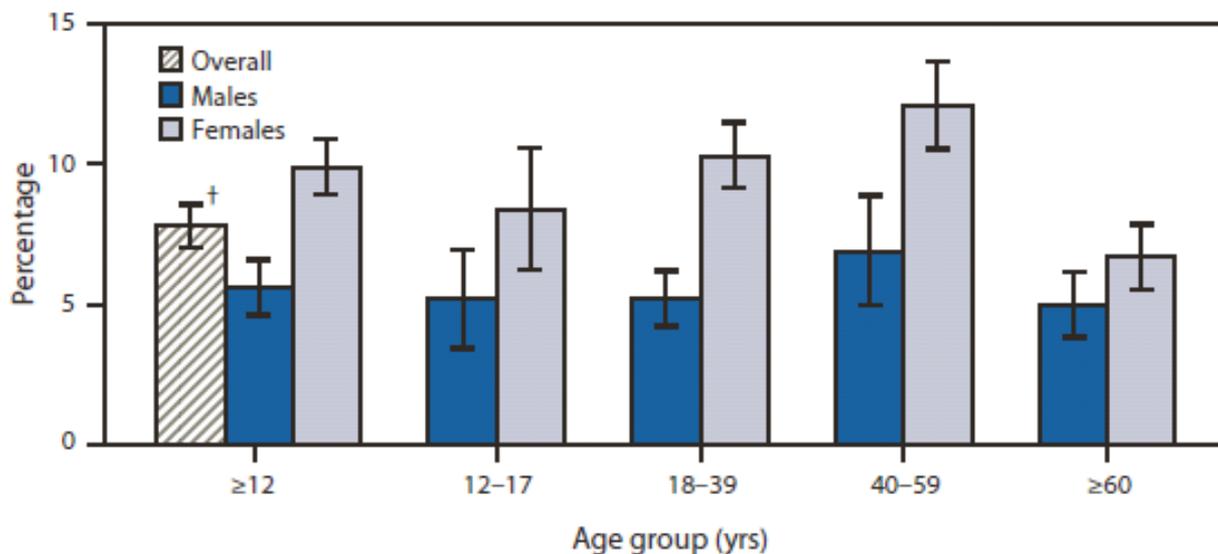
What is the relationship between dietary patterns and depression?

What is the relationship between dietary patterns and age-related cognitive impairment, dementia, and Alzheimer's disease?

NEL Systematic Review

Tom Brenna

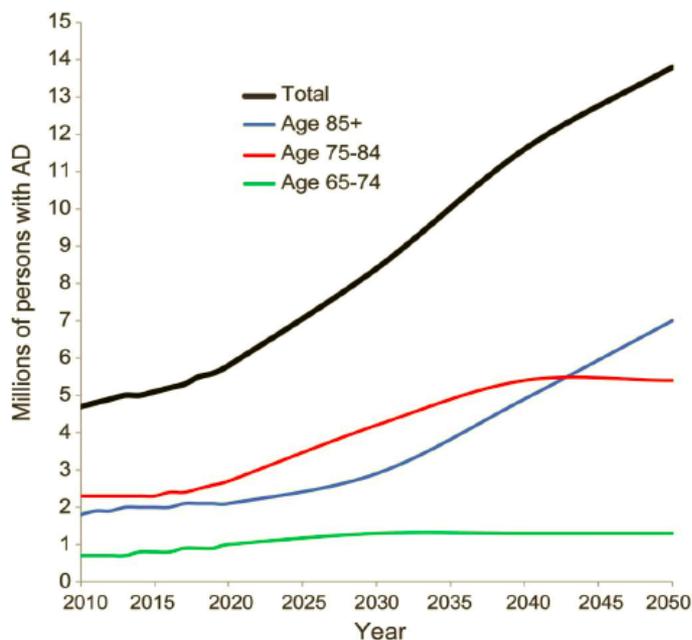
U.S. Scope of Depression



- In any 2-week period, 8% of Americans 12 years of age and older experienced depression
 - **21.3 million Americans**, were depressed according to NHANES screening 2007-2010
- Approximately 80% of persons with depression reported some level of functional impairment because of their depression, and 27% reported serious difficulties in work and home life.

Challenge & Cost of Age-related Cognitive Impairment/AD/Dementia

Figure 1 Estimated number of people with Alzheimer disease (AD) in the United States in 2010 and projections through 2050



- Total Alzheimer's disease is projected to triple by 2050, considering an aging population and current rates.
- Alzheimer's Association estimates 2012 cost of care for AD and dementia at \$216 billion.

Analytical Framework: Dietary Patterns and Neurological-Psychological Illness

Target Population
Children and adults (2y+), healthy and at risk for chronic disease

{Literature will be examined by age group, sex, race/ethnicity, and geographic location as appropriate. Age/lifestage groups of interest include children, adolescents, adults, including pregnant, lactating, and peri-postmenopausal women, and older adults}

Intervention/Exposure
Adherence to a dietary pattern (e.g., a priori patterns (indices/scores), data driven patterns (factor or cluster analysis), reduced rank regression, or patterns derived from other methods (DASH, vegetarian))
Comparator
Different levels of adherence to a dietary pattern; Adherence to a different dietary pattern

Endpoint Health Outcomes
• Depression
• Dementia/cognitive decline/Alzheimer's Disease

Key Definitions:

• **Dietary patterns:** The quantities, proportions, variety, or combination of different foods, drinks, and nutrients (when available) in diets, and the frequency with which they are habitually consumed.

Potential Confounders

- Total energy intake
- BMI
- Age
- Race/ethnicity
- Sex
- SES
- Smoking
- Alcohol intake
- Physical activity
- Family history

Systematic Review Questions:

- What is the relationship between dietary patterns and risk of depression?
- What is the relationship between dietary patterns and risk of dementia/cognitive decline/Alzheimer's disease?

Dietary Patterns and Neuro-Psych Literature Search: Inclusion/Exclusion Criteria

Date Range:

- Published between January 1980 and August 2014 (in English in a peer-reviewed journal)

Study Design:

- Randomized or non-randomized controlled trial, or prospective cohort study

Study Subjects:

- Children, adolescents, and adults aged 2 years and older
- From countries with high or very high human development (per the 2012 Human Development Index)
- Healthy or at elevated chronic disease risk

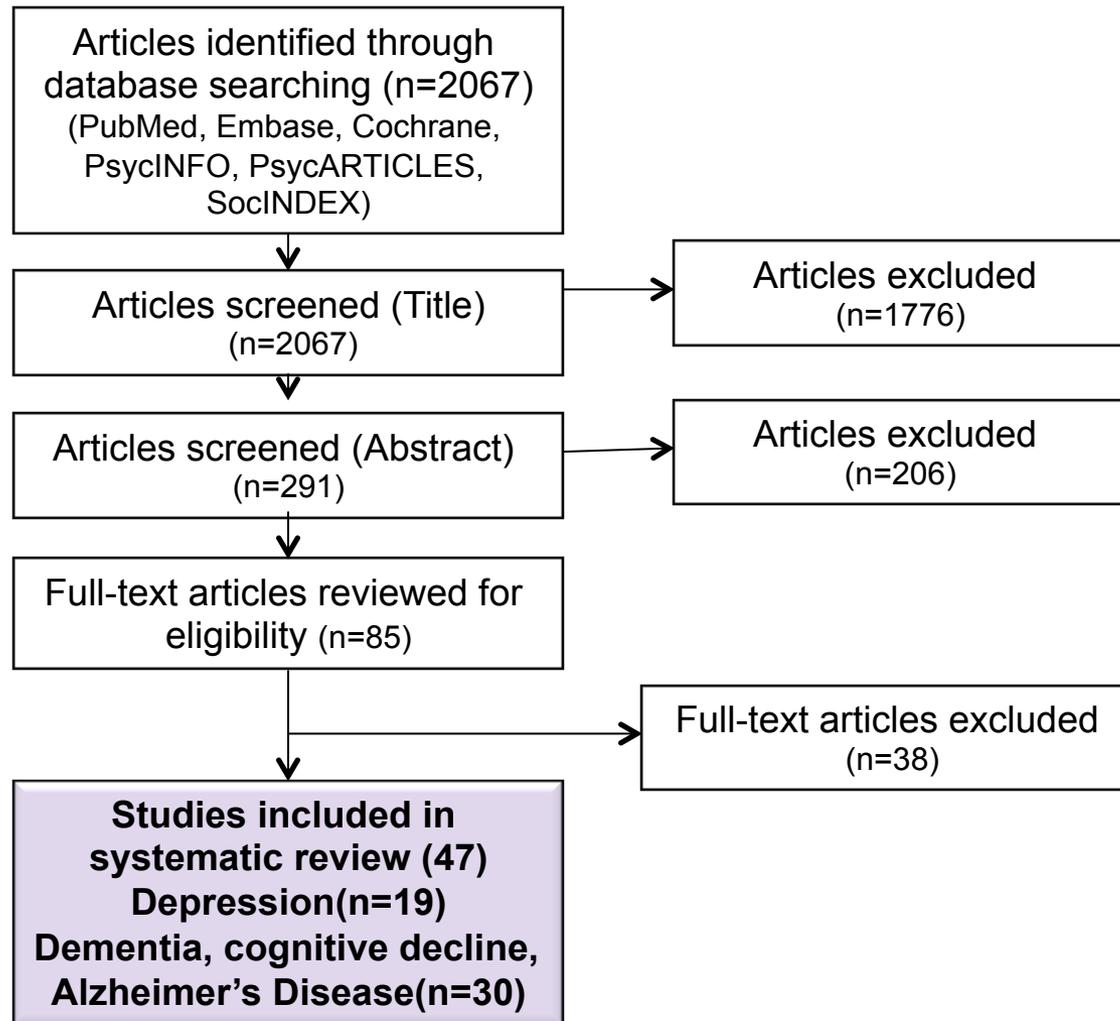
Intervention/Exposure:

- Dietary patterns (indices/scores, factor or cluster analysis, reduced rank regression, and other methods)
- The dietary patterns were clearly defined by the foods and beverages consumed

Outcomes:

- Depression, cognitive decline/function, dementia, or Alzheimer's Disease

Dietary Patterns and Neuro-Psych Literature Search Results



Dietary Patterns and Depression

Description of the Evidence

- Includes 19 articles (17 prospective cohort studies, and 2 analyzed data from RCTs)
 - 2 analyzed data from RCTs that tested/described dietary patterns, 6 used indices/scores, 10 used data-driven methods, 1 used reduced rank regression
- Despite methodological and outcome heterogeneity in this body of evidence, some protective dietary patterns emerged:
 - Patterns emphasizing seafood, vegetables, fruits, and nuts, were generally associated with reduced risk
 - Patterns emphasizing red and processed meats and refined sugar were generally associated with increased risk

Dietary Patterns and Depression

Description of the Evidence

- Limitations make it difficult to draw stronger conclusions, including variation in assessment of dietary patterns and ascertainment of depression outcomes, potential for residual confounding, and few studies conducted in the U.S.
- Additional research is needed in children, adolescents, young adults, and postpartum women

Dietary Patterns and Depression

Draft Conclusion Statement

Limited evidence suggests that dietary patterns emphasizing seafood, vegetables, fruits, nuts, and legumes are associated with lower risk of depression in men and non-perinatal women. However, the body of evidence is primarily composed of observational studies and employs a range of methodology in study design, definition, and measurement of dietary patterns and ascertainment of depression/depressive symptoms, and the possibility of reverse causality cannot be ruled out. Studies on dietary patterns in other populations, such as post-partum women, children and adolescents, as well as those in various ethnic and cultural subgroups, is too limited to draw conclusions.

DGAC Grade: Adults – *Limited*, Post-partum women, children and adolescents – *Grade not assignable*

Dietary Patterns and Cognitive Impairment, Dementia, Alzheimer's

Description of the Evidence

- Includes 30 articles (28 prospective cohort studies, and 2 analyzed data from RCTs)
 - 2 analyzed data from RCTs that tested/described dietary patterns, 23 used indices/scores, 3 used data-driven methods, 3 used reduced rank regression
- Most (18 of 28) articles found an association between dietary patterns and age-related cognitive impairment, dementia, and/or Alzheimer's disease, and some commonalities emerged:
 - Patterns higher in fruits, vegetables, nuts, legumes, and seafood were generally associated with reduced risk
 - Patterns higher in red and/or processed meats were generally associated with greater risk
 - Relatively few studies reported on refined sugar and added salt, and patterns including these nutrients tended to report greater risk

Dietary Patterns and Cognitive Impairment, Dementia, Alzheimer's

Description of the Evidence

- Limitations make it difficult to draw stronger conclusions, including variation in assessment of dietary patterns and ascertainment of depression outcomes, measures taken at a single time point, and potential for residual confounding.

Dietary Patterns and Cognitive Impairment, Dementia, Alzheimer's

Draft Conclusion Statement

- Limited evidence suggests that a dietary pattern containing an array of fruits, vegetables, nuts, legumes and seafood consumed during adulthood is associated with lower risk of age-related cognitive impairment, dementia, and/or Alzheimer's disease. Although the number of studies available on dietary patterns and neurodegenerative disease risk is expanding, this body of evidence, which is made up of high quality observational studies, is modest and employs a wide range of methodology in study design, definition and measurement ascertainment of cognitive outcomes, dietary pattern assessment, and the possibility of reverse causality cannot be ruled out.

DGAC Grade: Limited

Dietary Patterns and Neurological-Psychological Illness

What is the relationship between dietary patterns and depression?

What is the relationship between dietary patterns and age-related cognitive impairment, dementia, and Alzheimer's disease?

Discussion

Topic Team:
Tom Brenna, Alice H. Lichtenstein,
and Steven Clinton

Dietary Patterns and Congenital Anomalies

Dietary Patterns and Congenital Anomalies

What is the relationship between dietary patterns and risk of congenital anomalies?

(Neural tube defects, congenital heart defects, and cleft lip/palate)

NEL Systematic Review

Anna Maria Siega-Riz

Analytical Framework: Dietary Patterns and Congenital Anomalies

Target Population
Adolescent girls and women capable of becoming pregnant; during the preconception period

{Literature will be examined by age group, race/ethnicity, and geographic location as appropriate}

Intervention/Exposure
Adherence to a dietary pattern (e.g., a priori patterns (indices/scores), data driven patterns (factor or cluster analysis), reduced rank regression, or patterns derived from other methods (DASH, vegetarian))
Comparator
Different levels of adherence to a dietary pattern; Adherence to a different dietary pattern

Endpoint Health Outcomes

- Neural tube defects
- Congenital heart defects
- Cleft lip/cleft palate

Key Definitions:

•**Dietary patterns:** The quantities, proportions, variety, or combination of different foods, drinks, and nutrients (when available) in diets, and the frequency with which they are habitually consumed.

Potential Confounders

- Total energy intake
- BMI
- Age
- Race/ethnicity
- Sex
- SES
- Smoking
- Alcohol intake
- Family history of birth defect
- Multivitamin use
- Fetal screening and abortion (underestimation of NTDs)
- Folate fortification status

Systematic Review Questions:

- What is the relationship between dietary patterns and risk of neural tube defects?
- What is the relationship between dietary patterns and risk of congenital heart defects?
- What is the relationship between dietary patterns and risk of cleft lip/palate?

Dietary Patterns and Congenital Anomalies Literature Search: Inclusion/Exclusion Criteria

Date Range:

- Published between January 1980 and April 2014 (in English in a peer-reviewed journal)

Study Design:

- Randomized or non-randomized controlled trial, prospective cohort study, or a case-control study

Study Subjects:

- Adolescent girls and women capable of becoming pregnant
- From countries with high or very high human development (per the 2012 Human Development Index)
- Healthy or at elevated chronic disease risk

Intervention/Exposure:

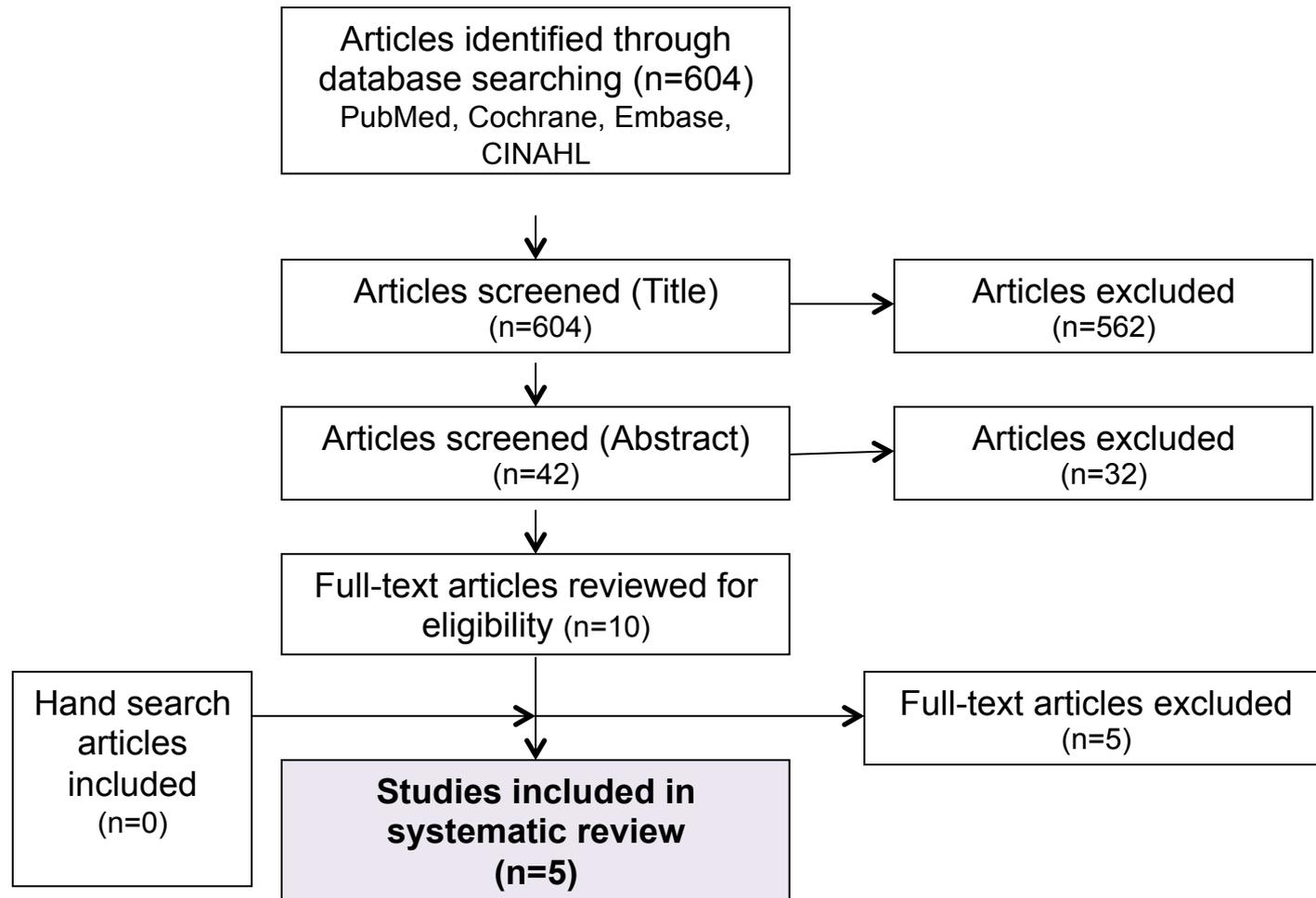
- Dietary patterns (indices/scores, factor or cluster analysis, reduced rank regression, and other methods)
- The dietary patterns were clearly defined by the foods and beverages consumed

Outcome:

- Incidence of neural tube defects, congenital heart defects, cleft lip, cleft palate

Dietary Patterns and Congenital Anomalies

Literature Search Results



Dietary Patterns and Congenital Anomalies

Description of the Evidence

- 5 case-control studies (using data from three cohorts)
 - 3 on neural tube defects, 2 on congenital heart defects, and 2 on orofacial clefts
- All studies reported significant associations between dietary patterns and risk of congenital anomalies, independent of folic acid supplementation
 - The variability of dietary patterns methodology used and composition of dietary patterns identified makes it difficult to draw conclusions
- All studies found that folate delivered periconceptionally in food or as a supplement was associated with lower risk of congenital anomalies.

Dietary Patterns and Congenital Anomalies

Draft Conclusion Statement

Limited evidence suggests that maternal dietary patterns high in fruits, vegetables, and grains, and low in red and processed meats, and sweets were associated with lower risk of developing of neural tube defects, particularly among women who do not take folic acid supplements. Whereas some dietary patterns were associated with lower risk of developing anencephaly others were associated with lower risk of developing spina bifida.

There is insufficient evidence to determine an association between maternal dietary patterns and congenital heart defects or cleft lip/palate.

All studies were consistent in demonstrating that folic acid supplementation periconceptionally was associated with a decreased risk of having a child with neural tube defects, congenital heart defects, cleft lip/palate.

DGAC Grade: Neural Tube Defects – *Limited*; Congenital Heart Defects – *Grade not assignable*; Cleft Lip/Palate – *Grade not assignable*

Dietary Patterns and Congenital Anomalies

Draft Implications

Women of reproductive age should continue to take a folic acid containing supplement in addition to consuming a diet rich in fruits, vegetables and grains and low in red and processed meats and sweets.

Dietary Patterns and Bone Health

Dietary Patterns and Bone Health

What is the relationship between dietary patterns and bone health?

NEL Systematic Review

Barbara Millen

Analytical Framework: Dietary Patterns and Bone Health

Target Population
Children and adults (2y+), healthy and at risk for chronic disease

{Literature will be examined by age group, sex, race/ethnicity, and geographic location as appropriate. Age/lifestage groups of interest include children, adolescents, adults, including pregnant, lactating, and peri-postmenopausal women, and older adults}

Intervention/Exposure
Adherence to a dietary pattern (e.g., a priori patterns (indices/scores), data driven patterns (factor or cluster analysis), reduced rank regression, or patterns derived from other methods (DASH, vegetarian))
Comparator
Different levels of adherence to a dietary pattern; Adherence to a different dietary pattern

Intermediate Outcomes
• Bone mass: Bone mineral density; Bone mineral content

Endpoint Health Outcomes
• Osteoporosis
• Rickets
• Risk of fracture

Key Definitions:

• **Dietary patterns:** The quantities, proportions, variety, or combination of different foods, drinks, and nutrients (when available) in diets, and the frequency with which they are habitually consumed.

Potential Confounders

- Total energy intake
- BMI
- Age
- Race/ethnicity
- SES
- Smoking
- Alcohol intake
- Physical activity
- Vit D levels
- Sunshine exposure
- Use of Ca supplements
- ERT

Systematic Review Questions:

- What is the relationship between dietary patterns and bone health?

Dietary Patterns and Bone Health

Literature Search: Inclusion/Exclusion Criteria

Date Range:

- Published between January 2000 and April 2014 (in English in a peer-reviewed journal)

Study Design:

- Randomized or non-randomized controlled trial, prospective cohort study, or a nested case-control study

Study Subjects:

- Children, adolescents, and adults aged 2 years and older
- From countries with high or very high human development (per the 2012 Human Development Index)
- Healthy or at elevated chronic disease risk

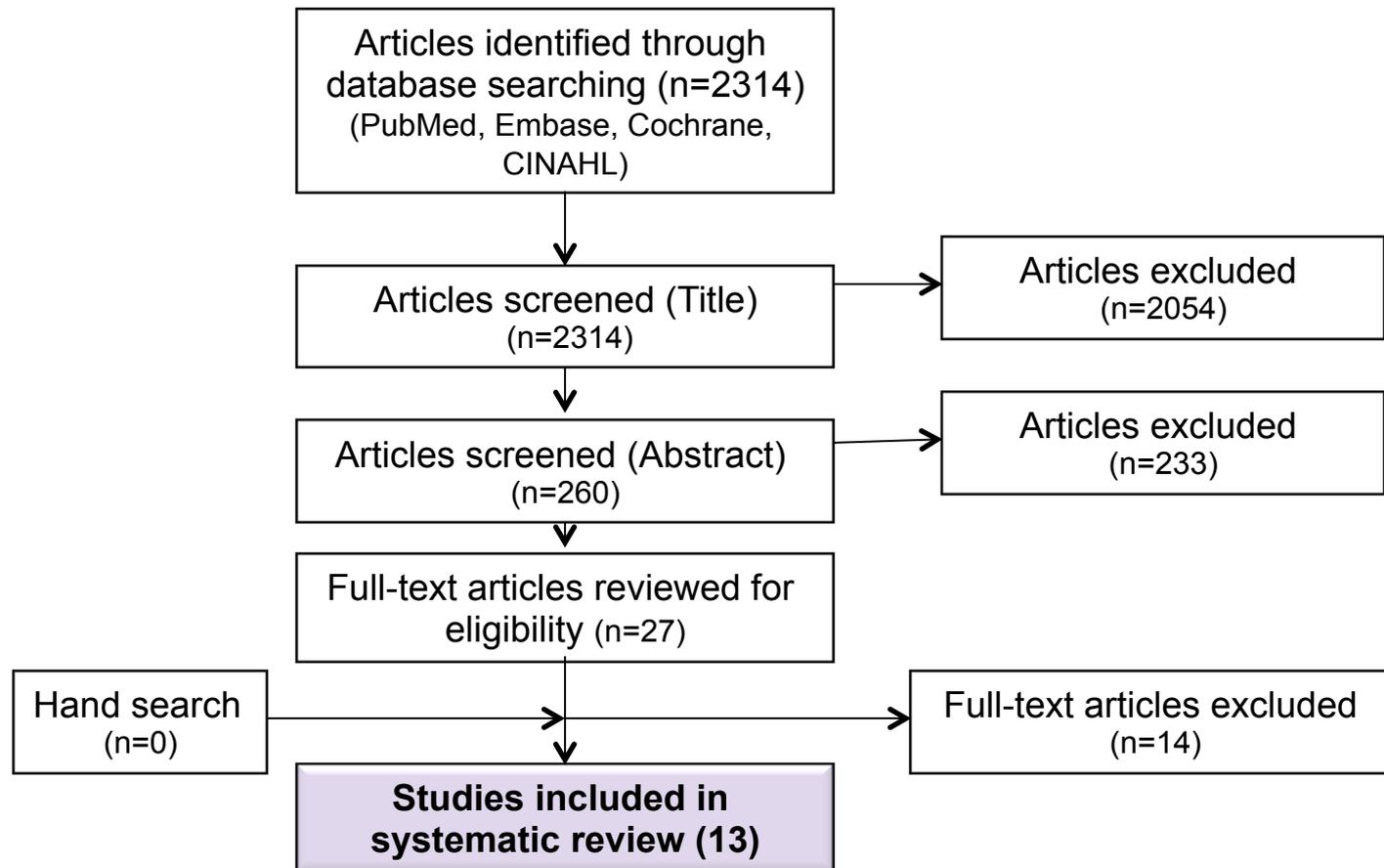
Intervention/Exposure:

- Dietary patterns (indices/scores, factor or cluster analysis, reduced rank regression, and other methods)
- The dietary patterns were clearly defined by the foods and beverages consumed

Outcomes:

- Bone mineral density, bone mineral content, rickets, osteoporosis, and risk of fracture

Dietary Patterns and Bone Health Literature Search Results



Dietary Patterns and Bone Health

Description of the Evidence

- Included 2 articles using data from RCTs and 11 articles from prospective cohort studies:
 - Dietary patterns: Index/score (4 studies), factor/principal components analysis (6 studies), reduced rank regression (2 studies), and intervention study (2 studies)
 - Bone health outcomes: Fracture (7 studies), bone mineral density/content or bone mass (6 studies), osteoporosis (1 study)
- Common dietary patterns characteristics emerged, despite heterogeneity:
 - Patterns emphasizing vegetables, fruits, legumes, nuts dairy, and cereals/grains/pasta/rice, unsaturated fats were generally associated with more favorable bone health outcomes
 - Patterns higher in meats and saturated fats were generally associated with increased risk of adverse bone health outcomes
 - Results were less consistent for added sugars, alcohol, and sodium
- Many studies included a range of race/ethnic, socioeconomic groups, but there are some subgroups for which conclusions cannot yet be determined (i.e., children, adolescents)

Dietary Patterns and Bone Health

Draft Conclusion Statement

Adults: Limited evidence suggests that a dietary pattern higher in vegetables, fruits, grains, nuts, and dairy products, and lower in meats and saturated fat, is associated with more favorable bone health outcomes (decreased risk of fracture and osteoporosis, improved bone mineral density) in adults. Although there are a growing number of available studies examining the relationship between dietary patterns and bone health in adults, the number of high quality studies is modest and those available employ a wide range of methodologies in study design, dietary assessment techniques, and varying bone health outcomes.

DGAC Grade: Limited

Children and adolescents: Definitive conclusions regarding the relationship between dietary patterns and bone health outcomes (bone mineral density and bone mineral content) in children and adolescents cannot be drawn due to the limited evidence from a small number of studies with wide variation in study design, dietary assessment methodology, and bone health outcomes.

DGAC Grade: Grade not assignable

Dietary Patterns and Bone Health

Draft Implications

Only limited evidence is available on the relationships between *dietary patterns* and bone health outcomes in adults and other age groups. Although there is strong evidence on the roles of vitamin D and calcium in bone health across the age spectrum, further research is needed on dietary patterns that are most beneficial.

Dietary Patterns and Bone Health

What is the relationship between dietary patterns and bone health?

Discussion

Topic Team:

Barbara Millen, Marian Neuhouser,
and Steven Clinton

Saturated Fat and Cardiovascular Disease

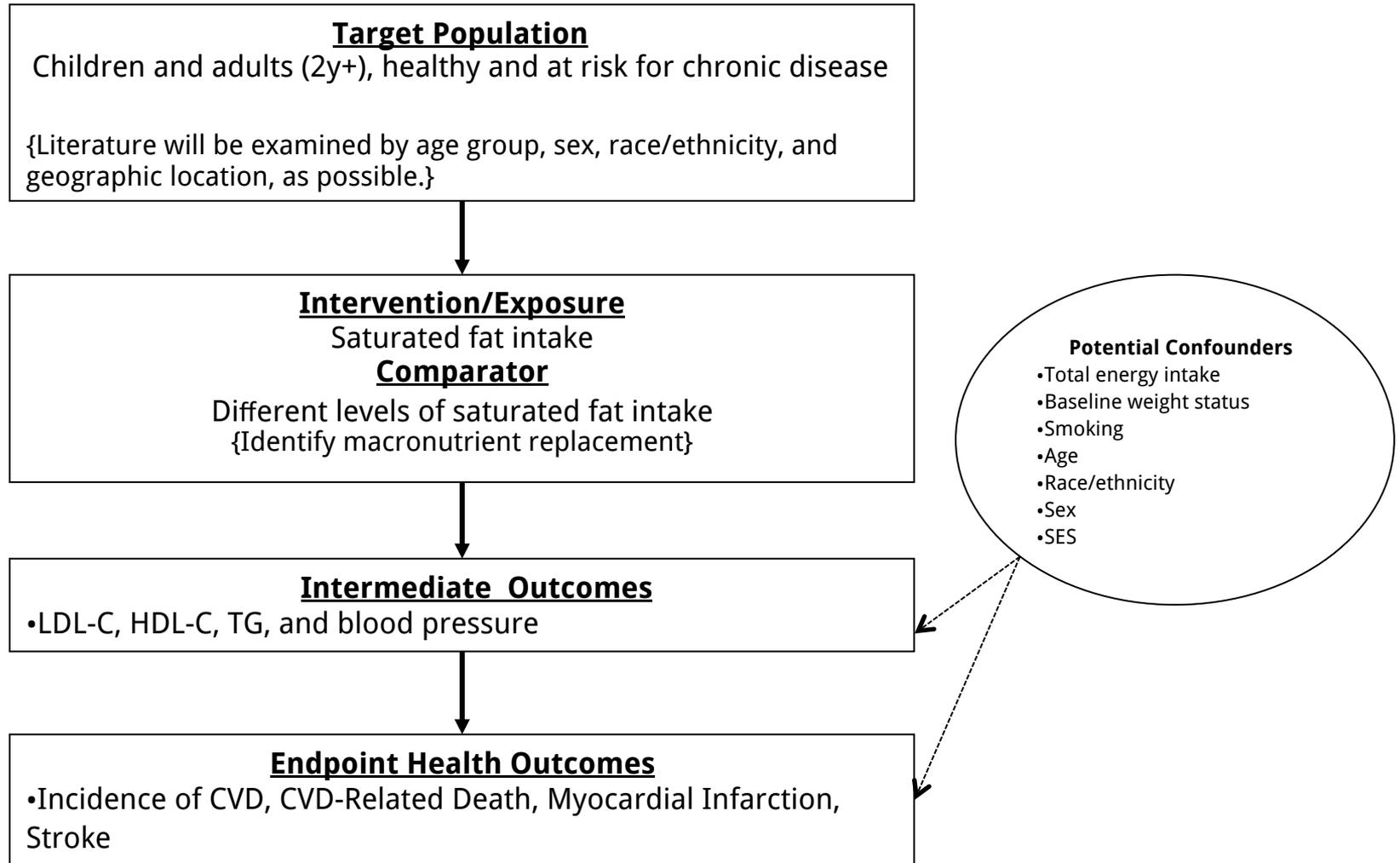
Saturated Fat and Cardiovascular Disease

What is the relationship between saturated fat intake and risk of cardiovascular disease?

Existing Reports

Frank Hu

Analytical Framework: Saturated Fat and Cardiovascular Disease



Question:

What is the relationship between saturated fat intake and risk of cardiovascular disease?

Saturated Fat and Cardiovascular Disease Literature Search: Inclusion/Exclusion Criteria

Date Range:

- Published between January 2009 and August 2014 (in English in a peer-reviewed journal)

Study Design:

- Systematic review and/or meta-analysis that included RCTs and/or prospective cohort studies

Study Subjects:

- Reviews that included studies from high or very high human development (2012 Human Development Index)
- Healthy or at elevated chronic disease risk

Intervention/Exposure:

- Saturated fat

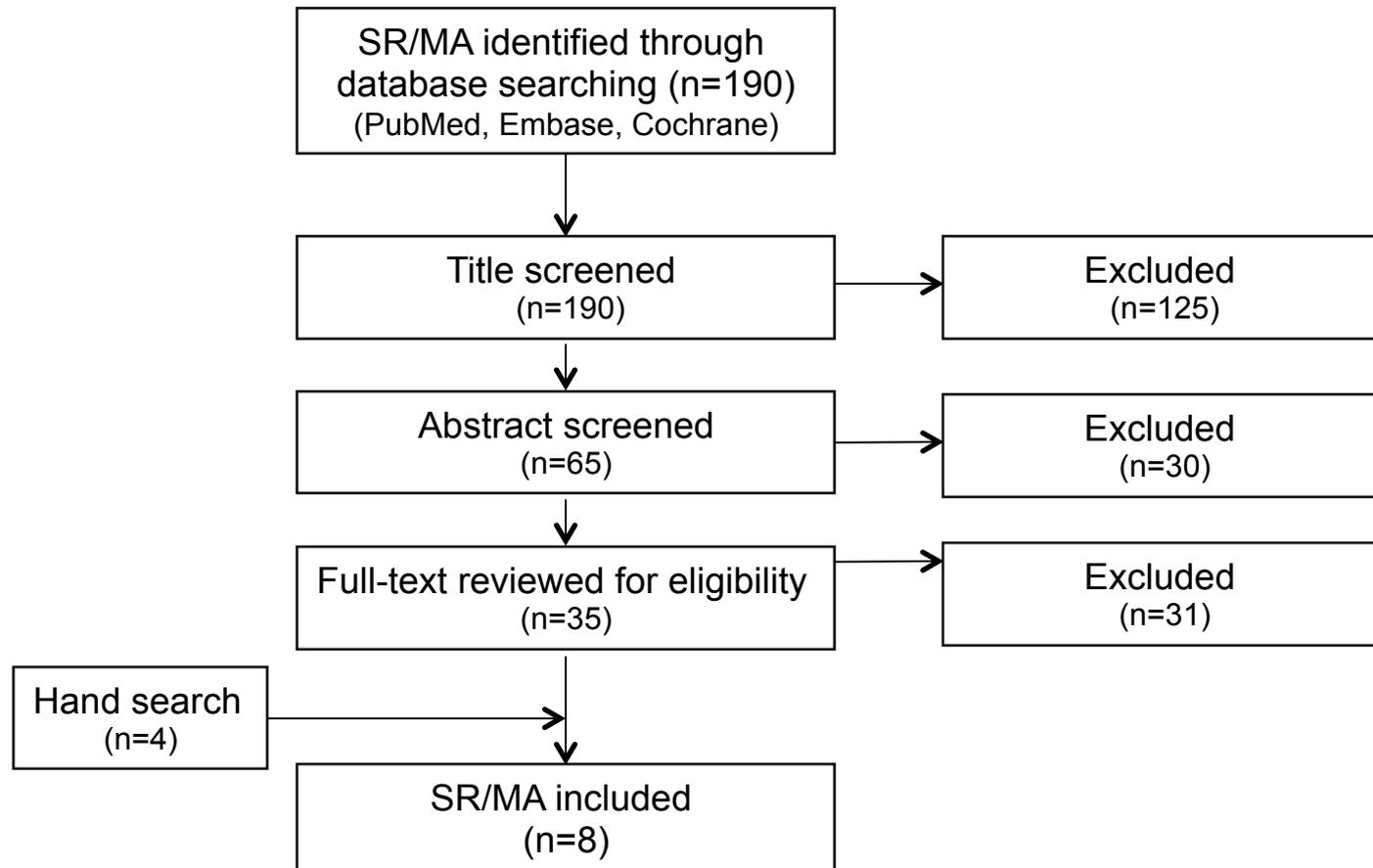
Outcome:

- LDL-cholesterol, HDL-cholesterol, triglycerides, blood pressure, incidence of CVD, CVD-related death, myocardial infarction, or stroke

Quality:

- Reviews rated 8-11 on AMSTAR

Saturated Fat and Cardiovascular Disease Literature Search Results



Saturated Fat and Cardiovascular Disease

Description of the Evidence

- 2 systematic reviews and 6 meta-analyses published from Jan 2009 to Aug 2014
- 1 review focused on intermediate outcomes and 7 examined endpoint health outcomes
- 4 reviews examined prospective cohort studies, 3 focused on randomized controlled trials, and 1 included both PCSs and RCTs
 - In total, 166 articles were considered in these reviews, of which 24 were included in two or more reviews
- Particular emphasis was placed on reviews that examined the macronutrient replacement for saturated fat

Saturated Fat and Cardiovascular Disease

Draft Conclusion Statement

Strong and consistent evidence from randomized clinical trials (RCTs) shows that replacing saturated fat with polyunsaturated (PUFA) or monounsaturated (MUFA) fat significantly reduces total and LDL cholesterol. Replacing saturated fat with carbohydrates also reduces total and LDL cholesterol, but significantly increases triglycerides and reduces HDL cholesterol.

Strong and consistent evidence from RCTs and statistical modeling in prospective cohort studies shows that replacement of saturated fat with PUFA reduces the risk of cardiovascular (CVD) events and coronary mortality. For every 1% of energy intake from saturated fat replaced with PUFA, incidence of CHD is reduced by 2-3%.

Strong and consistent evidence from RCTs and prospective cohort studies shows that reducing total fat (replacing total fat with carbohydrates) does not lower CVD risk.

Continued...

Saturated Fat and Cardiovascular Disease

Draft Conclusion Statement

Strong evidence from prospective cohort studies shows that higher saturated fat intake as compared to carbohydrates (replacement of SFA with carbohydrates) is not associated with CVD risk. In some studies, the comparison or replacement nutrient was not specified, but was largely carbohydrates (sources not defined), and in these studies this replacement was not associated difference in risk of CVD.

There is limited evidence regarding whether replacing saturated fat with MUFA confers CVD benefits; one reason is that the main sources of MUFA in a Western pattern diet are animal fat. However, evidence from RCTs and prospective studies has demonstrated benefits of plant sources of monounsaturated fats such as olive oil and nuts on CVD risk.

DGAC Grade: *Strong*; Replacing saturated fat with MUFA – *Limited*

Saturated Fat and Cardiovascular Disease

Draft Implications

Recommendations on saturated fat intake should specify replacement macronutrients and should be based on food and overall dietary patterns.

A reduction in saturated fat intake to 10% of energy would require a shift in dietary patterns toward those with strong evidence for cardiovascular benefits such as the USDA pattern, the Mediterranean-style pattern, the DASH-style pattern, and other dietary patterns that are rich in fiber, potassium, and unsaturated fats (see Dietary Pattern section).

The types of fat should be emphasized. Nonhydrogenated vegetable oils that are high in unsaturated fats and relatively low in saturated fat instead of animal fats or tropical oils rich in saturated fat should be recommended as the primary source of culinary fat.

Continued...

Saturated Fat and Cardiovascular Disease

Draft Implications

Although a healthy dietary pattern is relatively low in saturated fat, it can include lean meats and non- and low-fat dairy products in small to moderate amounts.

Simply reducing saturated or total fat in the diet by replacing it with any type of carbohydrates is not effective in reducing risk of CVD, and thus dietary advice should move away from the conventional low-fat message.

The types of carbohydrates that are used to replace saturated fat should be primarily fiber-rich whole grains and should minimize the consumption of refined grains and added sugars. The consumption of “low-fat” or “non-fat” products with high amounts of refined grains and added sugars should be discouraged.

Saturated Fat and Cardiovascular Disease

What is the relationship between saturated fat intake and risk of cardiovascular disease?

Discussion

Topic Team:

Frank Hu, Barbara Millen, Alice H. Lichtenstein,
and Tom Brenna

Alcohol: Approach to Examining Evidence

- Include a “risk/benefit” discussion of alcohol consumption in the Report
- Acknowledge how alcohol was discussed in the dietary patterns research reviewed by the SC
- Carry forward conclusions related to alcohol and health from the 2010 DGAC
- Add a discussion on alcohol and cancer using existing reports
- Cross-reference Subcommittee 5’s work on alcohol and energy drinks

Discussion

Next Steps

- Look across the dietary patterns evidence and describe common elements of the diet associated with health
- Incorporate evidence related to foods and nutrients and health, as needed
- Highlight “what works”

Subcommittee 2: Dietary Patterns, Foods and Nutrients, and Health Outcomes

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Cheryl Anderson

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Frank Hu

Marian Neuhouser

Rafael Pérez-Escamilla

Alice H. Lichtenstein

NEL Grading Rubric

Elements	Grade I: Strong	Grade II: Moderate	Grade III: Limited	Grade IV: Grade Not Assignable
Quality (as determined using the NEL BAT) <ul style="list-style-type: none"> Scientific rigor and validity Consider study design and execution 	Studies of strong design Free from design flaws, bias, and execution problems	Studies of strong design with minor methodological concerns OR only studies of weaker study design for question	Studies of weak design for answering the question OR inconclusive findings due to design flaws, bias, or execution problems	Serious design flaws, bias, or execution problems across the body of evidence
Quantity <ul style="list-style-type: none"> Number of studies Number of subjects in studies 	Several good quality studies Large number of subjects studied Studies have sufficiently large sample size for adequate statistical power	Several studies by independent investigators Doubts about adequacy of sample size to avoid Type I and Type II error	Limited number of studies Low number of subjects studied and/or inadequate sample size within studies	Available studies do not directly answer the question OR no studies available
Consistency of findings across studies	Findings generally consistent in direction and size of effect or degree of association, and statistical significance with very minor exceptions	Some inconsistency in results across studies in direction and size of effect, degree of association, or statistical significance	Unexplained inconsistency among results from different studies	Independent variables and/or outcomes are too disparate to synthesize OR single small study unconfirmed by other studies
Impact <ul style="list-style-type: none"> Directness of studied outcomes Magnitude of effect 	Studied outcome relates directly to the question Size of effect is clinically meaningful	Some study outcomes relate to the question indirectly Some doubt about the clinical significance of the effect	Most studied outcomes relate to the question indirectly Size of effect is small or lacks clinical significance	Studied outcomes relate to the question indirectly Size of effect cannot be determined
Generalizability to the U.S. population of interest	Studied population, intervention and outcomes are free from serious doubts about generalizability	Minor doubts about generalizability	Serious doubts about generalizability due to narrow or different study population, intervention or outcomes studied	Highly unlikely that the studied population, intervention AND/OR outcomes are generalizable to the population of interest