

2020 Dietary Guidelines Advisory Committee: Dietary Fats and Seafood Subcommittee

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Subcommittee Status

- NESR staff screening articles and preparing evidence portfolios
 - **40,523** articles have been or are in the process of being screened and additional searches underway
 - Implementing protocols:
 - **Dietary fats** and cardiovascular disease
 - **Dietary fats** and all-cause mortality
- Subcommittee drafted conclusions
 - **Seafood** during pregnancy/lactation and neurocognitive development
 - **Seafood** during childhood/adolescence and neurocognitive development/health
 - **Seafood** during childhood/adolescence and cardiovascular disease
- Remaining work
 - **Dietary fats** and neurocognitive development/health
 - **Dietary fats** and cancer

Key Definitions

- **Seafood** – Marine animals that live in the sea and in freshwater lakes and rivers. Seafood includes fish (e.g., salmon, tuna, trout, tilapia) and shellfish (e.g., shrimp, crabs, oysters) (Source: 2015-2020 DGA)

3 Seafood Systematic Review Questions

Intervention/Exposure		Outcomes
1	Seafood consumption during pregnancy and lactation	Neurocognitive development of the child <ul style="list-style-type: none">• Developmental outcomes (4 domains)• ADD /ADHD• ASD• Academic Performance• Anxiety & Depression
2	Seafood consumption during childhood and adolescence	Neurocognitive development and health <ul style="list-style-type: none">• Developmental outcomes (4 domains)• ADD /ADHD• ASD• Academic Performance• Anxiety & Depression (childhood & adulthood)• Cognitive decline (adulthood)
3	Seafood consumption during childhood and adolescence	Risk of CVD <ul style="list-style-type: none">• Intermediate: BP, HDL, LDL, TC, TG• End-point: CVD, stroke, venous thrombosis

Seafood Question #1

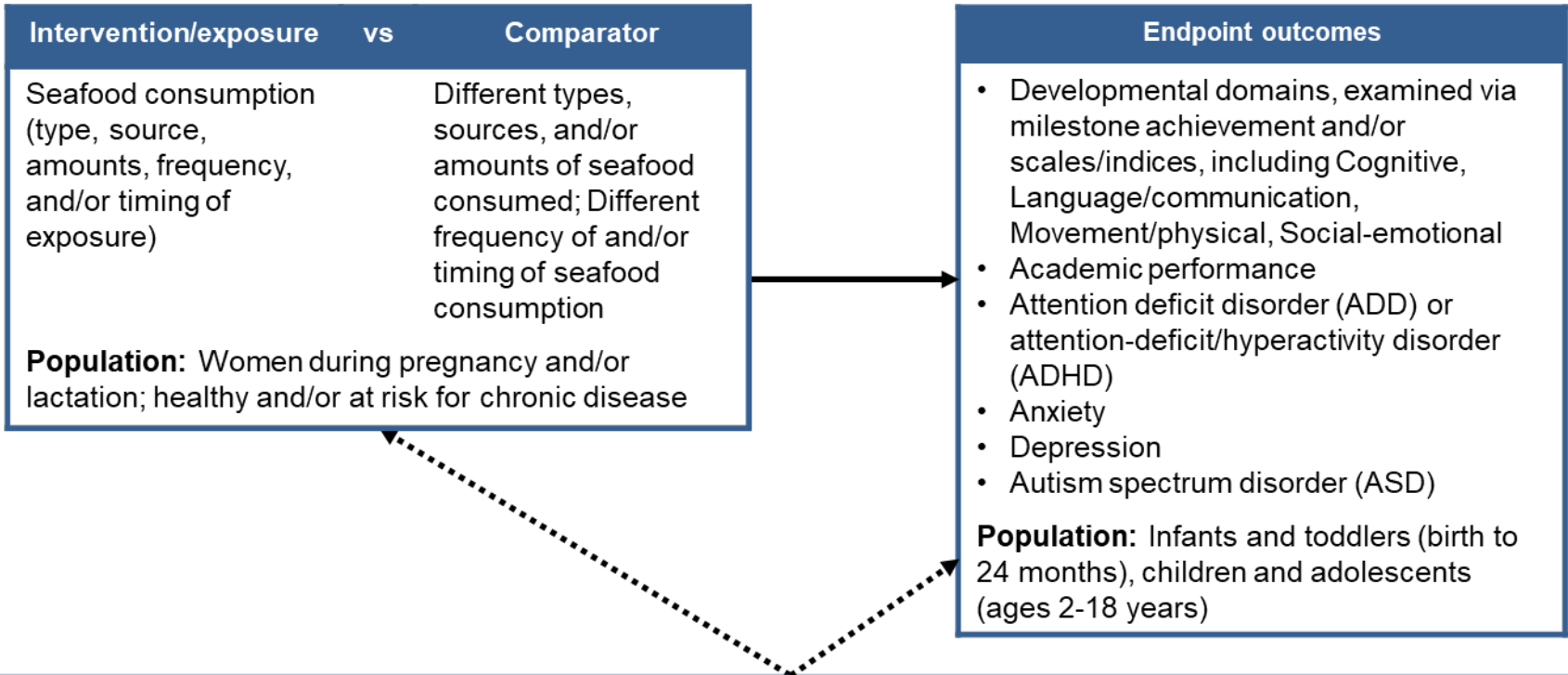
What is the relationship between **seafood consumption** during pregnancy/lactation and **neurocognitive development** of the infant?

Approach to Answer Question: NESR Systematic Review

Analytic Framework

Seafood intake during pregnancy/lactation

Systematic review question: What is the relationship between seafood consumption during pregnancy and lactation and neurocognitive development in infants?



Key Confounders: Child sex, Child age, Maternal age, Race/ethnicity, Socioeconomic status, Alcohol intake, Non-fish dietary exposure to n-3 polyunsaturated fatty acids (PUFAs), Smoking, Maternal anthropometrics, Child's birth weight, Gestational age, Parental education, Parity

Outcome Specific Key Confounders: ADD, ADHD, Anxiety, ASD, Depression: Family history of neurocognitive disorders.

Other factors to be considered: Key nutrients in seafood (e.g., n-3 PUFAs, iodine, selenium, iron, fish protein, vitamin D); Environmental chemicals (e.g., mercury, persistent organic pollutants, and polychlorinated biphenyls); Blood and human milk biomarkers of seafood intake (e.g., n-3 PUFA, and environmental pollutants), mother (e.g., venous/umbilical cord, placenta, red blood cell) and child (e.g., arterial/umbilical cord) EPA, DHA, iron, iodine, selenium, protein, vitamin D; infant feeding mode

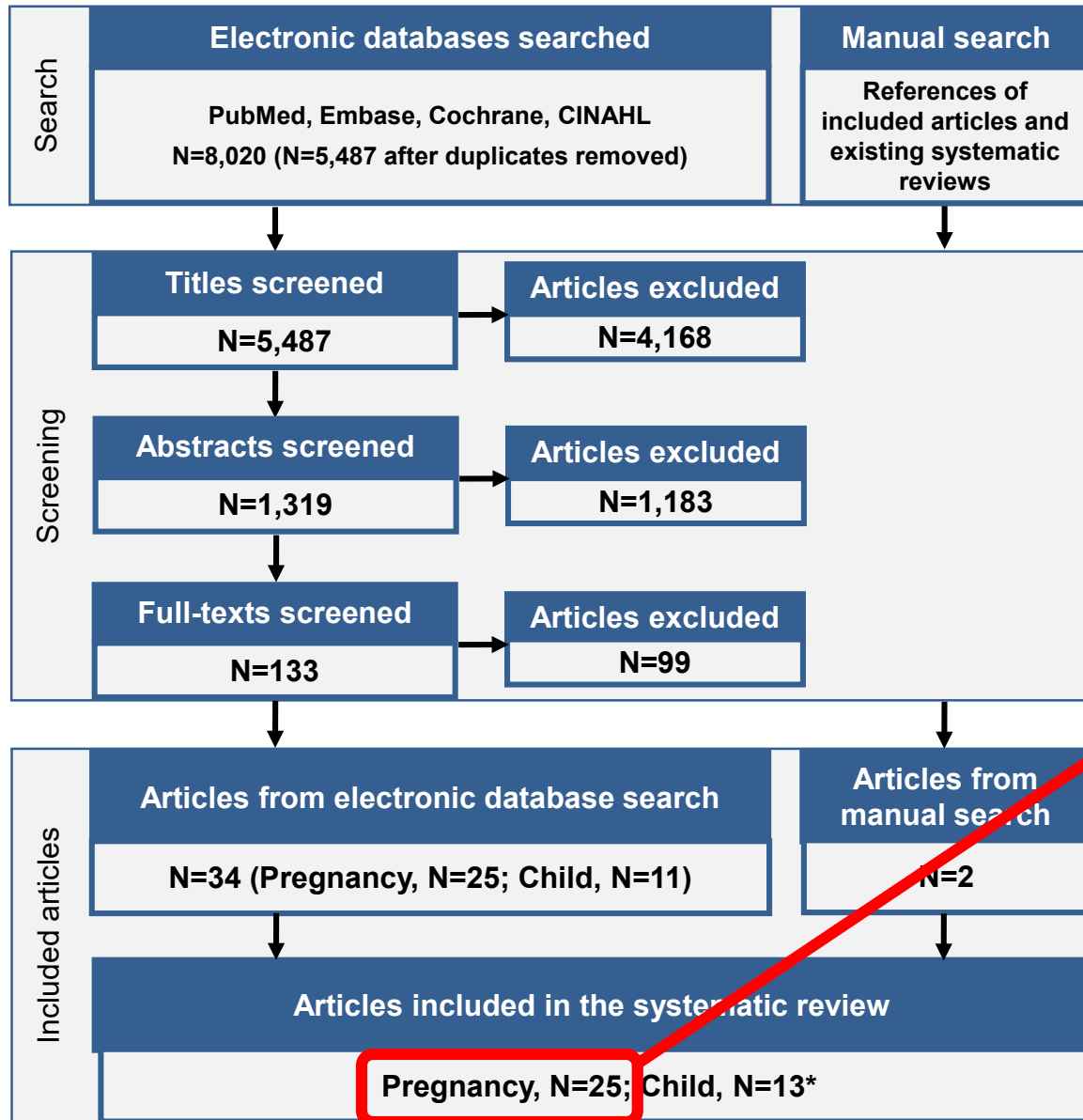
Inclusion/Exclusion Criteria

Seafood intake during pregnancy/lactation

Category	Inclusion Criteria	Exclusion Criteria
Intervention/ exposure	<ul style="list-style-type: none"> ● Seafood consumption measured prior to outcome assessment <ul style="list-style-type: none"> ○ Type (e.g., salmon, tuna bass) ○ Source (e.g., sea fresh water, farmed, wild) ○ Amount/frequency of intake ○ Timing of exposure (e.g., age at intake) ● Dietary intake (e.g., from food frequency questionnaires, dietary recall, fish/seafood screeners) may be validated with biomarkers for PUFA or MeHg, but not substituted. 	<ul style="list-style-type: none"> ● No measure of seafood consumption (i.e., studies that only examined biomarkers for consumption) ● Omega-3 supplement studies which do not evaluate seafood consumption ● Studies evaluating infant formula with added DHA and/or EPA
Comparator	<ul style="list-style-type: none"> ● Different types, sources, amounts, frequency, and/or timing of exposure of seafood consumption 	<ul style="list-style-type: none"> ● No comparator

Literature Search and Screening Results

Seafood intake during pregnancy/lactation



This search addressed **two** systematic review questions related to **seafood consumption** and **neurocognitive outcomes**.

- Pregnancy studies:**
- Developmental Domains: 24 studies
 - ADD/ADHD: 4 studies
 - ASD: 3 studies

Seafood during pregnancy/lactation and neurocognitive development
2020 Dietary Guidelines Advisory Committee: Meeting 4

*2 articles included in both reviews

Multiple Outcomes = Multiple Conclusion Statements

Developmental Domains:

- Cognitive
- Language and communication
- Movement and physical
- Social-emotional and behavioral

Academic Performance

Attention deficit disorder (ADD) or attention-deficit/hyperactivity disorder (ADHD)

Autism spectrum disorder (ASD)

Anxiety

Depression

Previously Presented Conclusion Statements

Seafood intake during pregnancy/lactation

Grade not assignable:

- Attention deficit disorder (ADD) or attention-deficit/hyperactivity disorder (ADHD)
- Autism spectrum disorder (ASD)
- Academic Performance
- Anxiety
- Depression

Insufficient evidence

No evidence

New Draft Conclusion Statements

Seafood intake during pregnancy/lactation

What is the relationship between **seafood consumption** during pregnancy/lactation and **neurocognitive development** of the infant?

Developmental Domains:

- Cognitive
- Language and communication
- Movement and physical
- Social-emotional and behavioral

Seafood intake during lactation

Developmental domain outcomes

Description of the Evidence

No studies that met inclusion criteria assessed the relationship between maternal **seafood intake** during lactation and **neurocognitive developmental** outcomes in the child.

Seafood intake during pregnancy

Developmental domain outcomes

Description of the Evidence

Study characteristics

- 24 articles from 18 prospective cohort studies
- Primarily conducted in the US and Europe

Maternal seafood exposure

- Primarily measured via FFQ
 - Timing, type, and amounts varied
- Categorization of seafood intake varied across studies (e.g., quintiles, servings/week)

Outcomes

- Variety of tools used within each outcome domain

Seafood intake during pregnancy

Cognitive development

- 20 articles from 15 prospective cohorts
- The majority of studies detected positive or null associations between seafood intake during pregnancy and:
 - Cognitive development in children 5 months to 11 years
 - IQ or composite intelligence measures in children 4 to 11 years
- Few studies accounted for all key confounders
- Heterogeneity in:
 - Seafood intake categories used in analyses
 - Cognitive assessment methods

Seafood intake during pregnancy

Cognitive development, continued

Draft Conclusion Statements

Moderate evidence suggests that seafood intake during pregnancy is associated with improvements in cognitive development in the child.

Grade: Moderate (pregnancy)

No evidence is available to determine the relationship between seafood intake during lactation and cognitive development in the child.

Grade: Grade not assignable (lactation)

Seafood intake during pregnancy

Language & communication development

- 14 articles from 12 prospective cohorts
- Majority of studies detected a beneficial or null association
 - In children 6 months to 11 years of age
- Few studies accounted for all key confounders
- Heterogeneity in:
 - Maternal seafood intake (timing, type, amount)
 - Seafood categorization at analysis
 - Outcome assessment tools
 - Ages of children at assessment

Draft Conclusion Statements

Moderate evidence suggests that seafood intake during pregnancy is associated with improvements in language and communication development in the child.

Grade: Moderate (pregnancy)

No evidence is available to determine the relationship between seafood intake during lactation and language and communication development in the child.

Grade: Grade not assignable (lactation)

Seafood intake during pregnancy

Movement and physical development

- 13 articles from 9 prospective cohorts
- Majority of studies found either null or beneficial associations
- Few studies accounted for all key confounders
- Heterogeneity in:
 - Maternal seafood intake (timing, type, amount)
 - Types of movement and physical development examined
 - Outcome assessment tools
 - Ages of children at follow-up

Seafood intake during pregnancy

Movement and physical development, continued

Draft Conclusion Statements

Insufficient evidence is available to determine the relationship between seafood intake during pregnancy and movement and physical development in the child.

No evidence is available to determine the relationship between seafood intake during lactation and movement and physical development in the child.

Grade: Grade not assignable (pregnancy and lactation)

Seafood intake during pregnancy

Social-emotional & behavioral development

- 9 articles from 6 prospective cohorts
- No apparent trends across studies
 - Mostly non-significant associations
- Concern for risk of bias
 - Few studies accounted for all key confounders
 - Measurement of exposures and outcomes
 - Reliance on parental-report for most outcomes
- Heterogeneity in:
 - Maternal seafood intake (timing, type, amount)
 - Ages of the children at follow-up (6 months to 13 years)
 - Outcome assessment tools
 - Dimensions of social-emotional and behavioral development

Draft Conclusion Statement

Insufficient evidence is available to determine the relationship between seafood intake during pregnancy and social-emotional and behavioral development in the child.

No evidence is available to determine the relationship between seafood intake during lactation and social-emotional and behavioral development in the child.

Grade: Grade not assignable (pregnancy and lactation)

Seafood Question #2

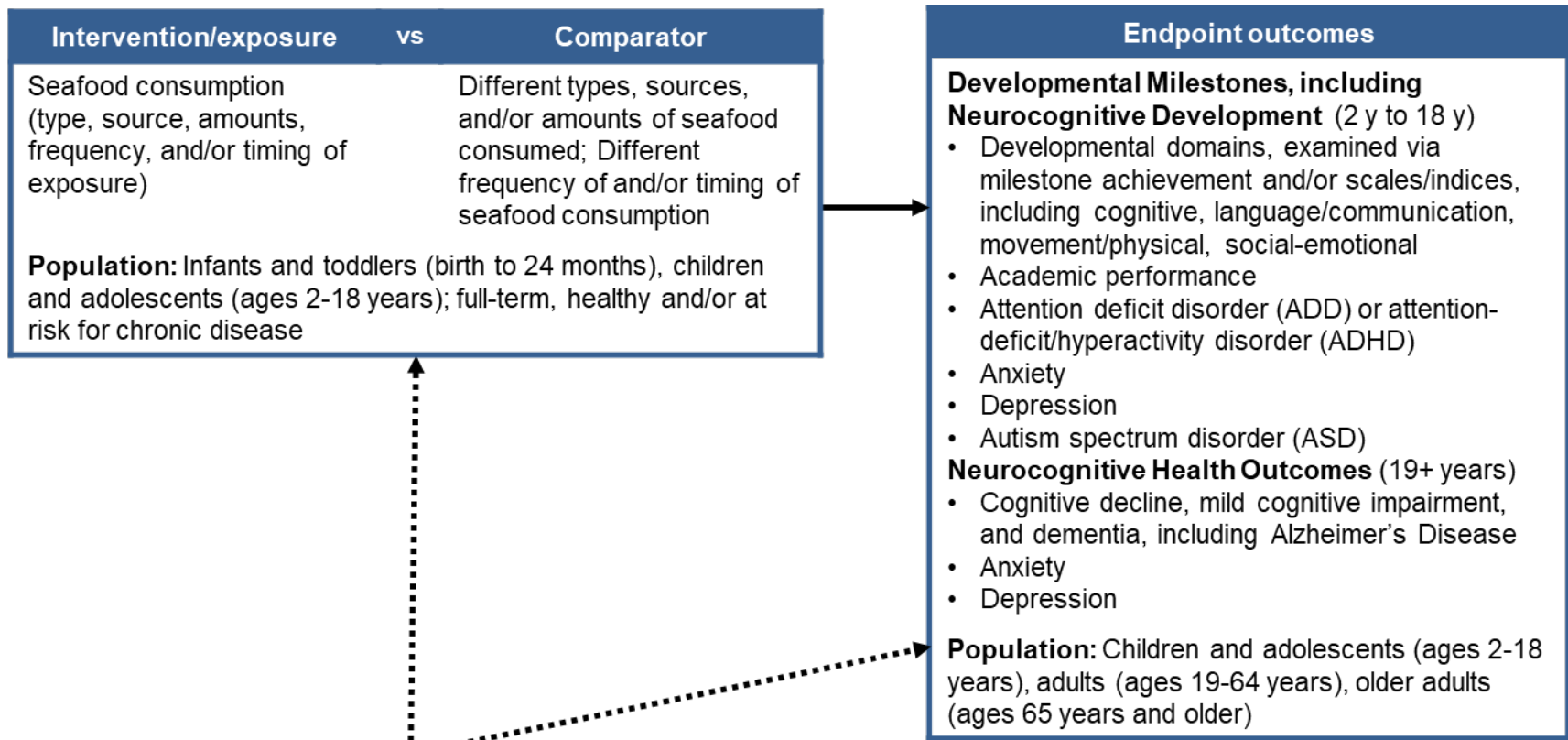
What is the relationship between **seafood consumption** during childhood and adolescence and **neurocognitive development**?

Approach to Answer Question: NESR Systematic Review

Analytic Framework

Seafood intake during childhood/adolescence

Systematic review question: What is the relationship between seafood consumption during childhood and adolescence and neurocognitive development?



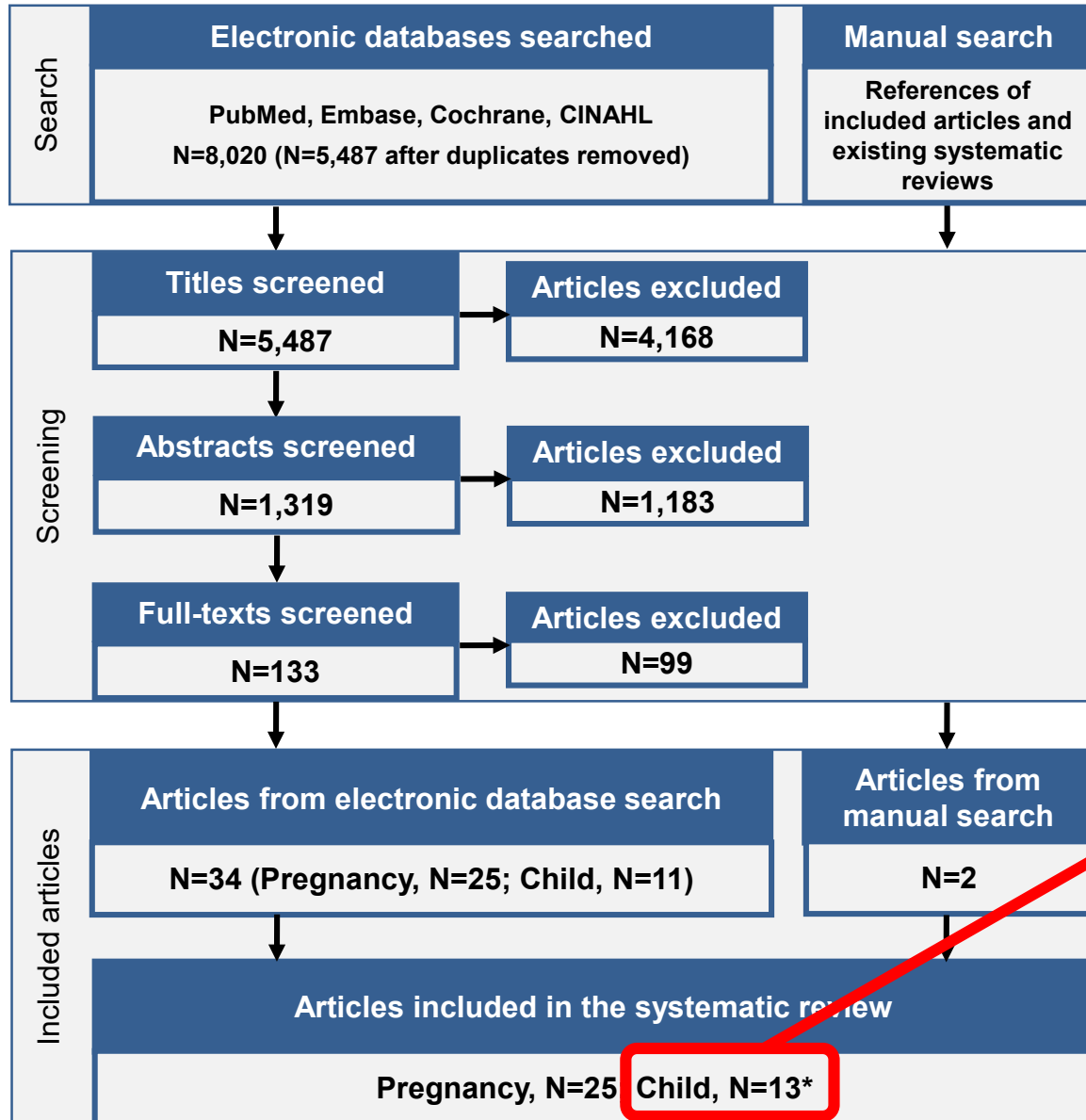
Key Confounders: Child sex, Child age, Race/ethnicity, Socioeconomic status, Infant feeding mode, Non-fish dietary exposure to n-3 PUFAs, Smoking, Parental education

Outcome Specific Key Confounders: ADD, ADHD, Anxiety, ASD, Depression, Alzheimer's (all ages): Family history of neurocognitive disorder.

Other factors to be considered: Key nutrients in seafood (e.g., n-3 PUFAs, iron, iodine, selenium, fish protein, vitamin D); Environmental chemicals (e.g., mercury, persistent organic pollutants, and polychlorinated biphenyls); Blood biomarkers of seafood intake (e.g., n-3 PUFAs, and environmental pollutants)

Literature Search and Screening Results

Seafood intake during childhood/adolescence



This search addressed two systematic review questions related to **seafood consumption** and **neurocognitive outcomes**.

Child studies

- Developmental domain: 10
- ADD/ADHD: 2
- ASD: 0
- Anxiety and depression: 2
- Academic performance: 1

Seafood during childhood/adolescence and neurocognitive development
2020 Dietary Guidelines Advisory Committee: Meeting 4

*2 articles included in both reviews

Seafood intake during childhood/adolescence

Description of the Evidence – All outcomes

13 total articles

- RCTs and PCS

3 RCTs (6 articles)

- RCT (Germany) & FINS-KIDS (Norway) both in children 4 to 6 years
 - Consumed fatty fish meals compared to meat meals 3x/week for 16 weeks
- FINS-TEENS (Norway) in adolescents 14 to 15 years
 - Consumed fish meals compared to meat meals 3x/week for 12 weeks
- Outcomes
 - Assessed before and after the trial
 - Assessment tools varied

Seafood intake during childhood/adolescence

Description of the Evidence – All outcomes, continued

13 total articles

- RCTs and PCS

6 prospective cohorts (7 articles)

- Countries: UK, Sweden, China, Canada
- Exposures
 - Seafood intake during childhood: i.e., oily fish, fish intake
 - Majority of studies assessed seafood intake via food frequency questionnaire (FFQ)
- Outcomes
 - Variety of tools used within each outcome domain
 - Assessed in children 3 to 18 years of age
- No PCS accounted for all key confounders

Seafood intake during childhood/adolescence

Developmental outcomes

Study characteristics

- Cognitive: 7 articles (4 RCT, 3 PCS)
- Language and communication: 5 articles (3 RCT, 2 PCS)
- Movement and physical: 2 articles (2 RCT)
- Social-emotional and behavioral: 3 articles (2 RCT, 1 PCS)

Majority of studies were conducted in northern Europe, particularly in Scandinavian countries.

Seafood intake during childhood/adolescence

Cognitive development

- 4 articles from 3 RCTs (Germany and Norway)
 - Predominantly null or beneficial effects of seafood compared to meat meals in children 4-6 years and 14-15 years of age
- 3 articles from 3 PCS (China, Sweden, UK)
 - Beneficial associations were found between child seafood intake (9 to 15 years) and cognitive development in children 12 to 18 years of age
 - No association was found between child seafood intake and cognitive development at 3.5 years

Seafood intake during childhood/adolescence

Cognitive development, continued

Draft Conclusion Statements

Insufficient evidence is available to determine whether seafood intake during childhood and adolescence is associated with improvements in cognitive development in children and adolescents.

Grade: Grade not assignable (improvements)

Moderate evidence suggests that seafood intake during childhood and adolescence does not have detrimental impacts on cognitive development in children and adolescents.

Grade: Moderate (no detrimental impact)

Seafood intake during childhood/adolescence

Language and communication development

- 3 articles from 2 RCTs (Germany and Norway)
 - No effect of fish compared to meat meals on language and communication development at 4-6 years
- 2 articles from 2 PCS (China and Sweden)
 - Positive associations were found
 - Language/communication in children 9 to 15 years of age
 - Verbal IQ in children 12-18 years of age
- Heterogeneity in:
 - Child seafood intake (timing, type, amount, and duration)
 - Ages of children at assessment
 - Outcome assessment tools

Seafood intake during childhood/adolescence

Language and communication development, continued

Draft Conclusion Statements

Insufficient evidence is available to determine whether seafood intake during childhood and adolescence is associated with improvements in language and communication development in children and adolescents.

Grade: Grade not assignable (improvements)

Moderate evidence suggests that seafood intake during childhood and adolescence does not have detrimental impacts on language and communication development in children and adolescents.

Grade: Moderate (no detrimental impact)

Seafood intake during childhood/adolescence

Movement and physical development

2 articles from 2 RCTs

- Countries: Germany and Norway
 - Age: 4-6 years
 - Intervention: Fatty fish versus meat meals
 - Assessment tool: nine hole peg test
- Found predominantly null effects on manual dexterity and fine motor coordination
 - One RCT found beneficial effect on fine manual dexterity and fine motor coordination only in the non-dominant hand

Seafood intake during childhood/adolescence

Movement and physical development, continued

Draft Conclusion Statement

Insufficient evidence is available to determine the relationship between seafood intake during childhood and movement/physical development in children.

Grade: Grade not assignable

Seafood intake during childhood/adolescence

Social-emotional & behavioral development

- 2 articles from 2 RCTs (Norway)
 - No effect of fish meal, compared to meat meals, on social-emotional and behavioral development in children at 4-6 years and 14 to 15 years of age
- 1 article from 1 PCS (UK)
 - A null association was found between seafood intake (3 years) and social-emotional and behavioral development in children at 4-13 years of age
- All studies used the Strengths and Difficulties Questionnaire
- Heterogeneity in:
 - Ages of children at intervention/exposure and outcome assessment
 - Child seafood intake (timing, type, amount, and duration)

Seafood intake during childhood/adolescence

Social-emotional & behavioral development, continued

Draft Conclusion Statement

Insufficient evidence is available to determine the relationship between seafood intake during childhood and adolescence and social-emotional and behavioral development in children and adolescents.

Grade: Grade not assignable

Seafood intake during childhood/adolescence ADD/ADHD-like behavior

Summary of Evidence

- 2 articles from 2 RCTs (Norway)
 - No effect of fish meal, compared to meat meals, on ADD/ADHD-like behavior at 4 to 6-year olds and 14 to 15 years
- Difficult to determine a relationship due to:
 - Inadequate number of studies
 - Outcome assessment relied on parental-report

Seafood intake during childhood/adolescence ADD/ADHD-like behavior, continued

Draft Conclusion Statement

Insufficient evidence is available to determine the relationship between seafood consumption during childhood and adolescence and attention deficit disorder (ADD) or attention-deficit/hyperactivity disorder (ADHD)-like traits or behaviors.

Grade: Grade not assignable

Seafood intake during childhood/adolescence Autism Spectrum Disorder (ASD)

Draft Conclusion Statement

No evidence is available to determine the relationship between seafood intake during childhood and adolescence and autism spectrum disorder (ASD)-like traits or behaviors or ASD diagnosis.

Grade: Grade not assignable

Seafood intake during childhood/adolescence

Academic Performance

1 article from 1 PCS (Sweden)

- Found a significant positive association between frequency of consumption of meals containing fish at 15 years and higher total school grade at 16 years
- Difficult to determine a conclusion due to inadequate number of studies and concern for risk of bias due to measurement of exposure and outcome

Seafood intake during childhood/adolescence

Academic Performance, continued

Draft Conclusion Statement

Insufficient evidence is available to determine the relationship between seafood consumption during adolescence and academic performance in adolescents.

Grade: Grade not assignable

Seafood intake during childhood/adolescence

Anxiety and Depression

2 PCS (Canada & UK)

- Diagnosis: significant, positive association between greater fish intake (10-11 years) and lower odds of diagnosis of internalizing disorder, including anxiety or depression, in children 10 to 14 years
- Symptoms: null association between fish intake (14.5 years) and depressive symptoms at 17.5 years
- Difficult to determine a relationship due to:
 - Inadequate number of studies
 - Inconsistent results
 - Little information describing the exposure

Seafood intake during childhood/adolescence Anxiety and Depression, continued

Draft Conclusion Statement

Insufficient evidence is available to determine the relationship between seafood consumption during childhood and adolescence and anxiety and depression in children and adolescents.

Grade: Grade not assignable

Seafood intake during childhood/adolescence

Neurocognitive health in adulthood

Draft Conclusion Statement

No evidence is available to determine the relationship between seafood intake during childhood and adolescence and neurocognitive health (e.g., cognitive decline, anxiety, depression) in adulthood.

Grade: Grade not assignable

Seafood Question #3

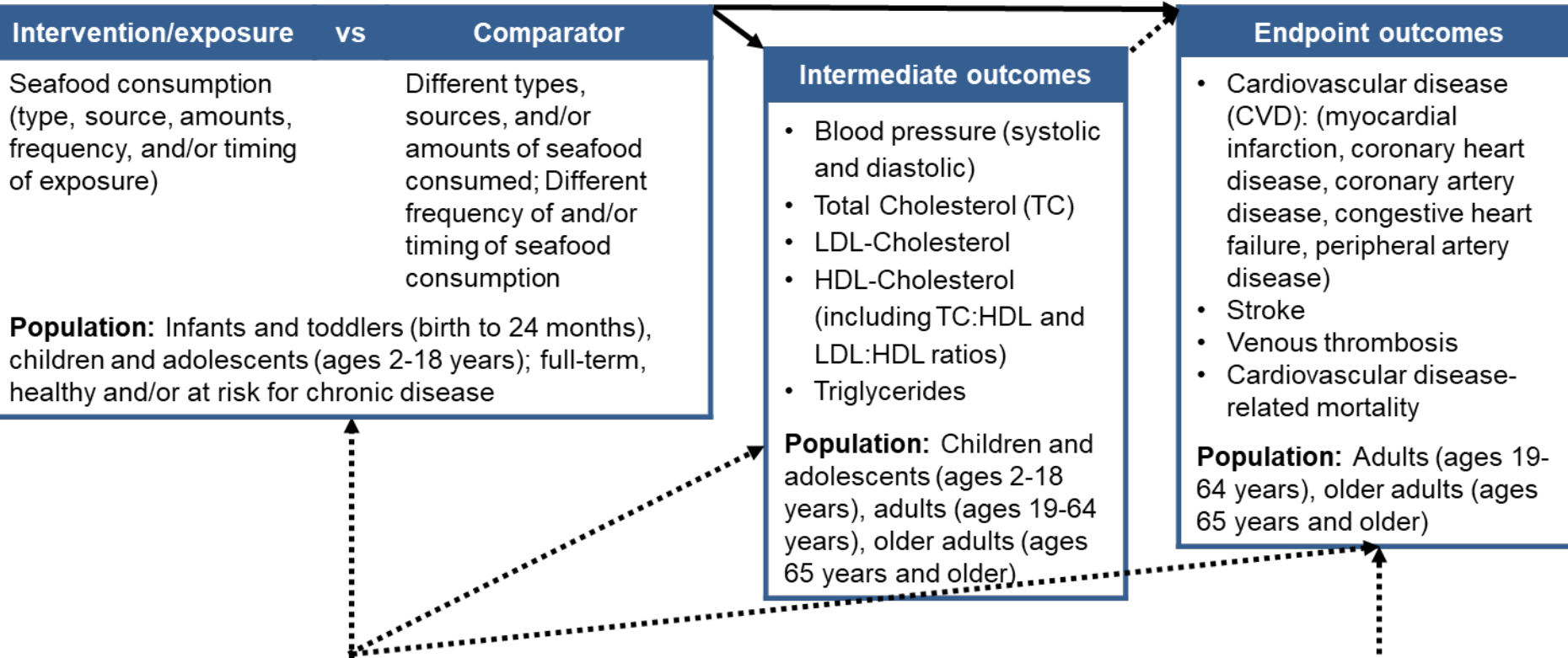
What is the relationship between **seafood consumption** during childhood and adolescence and risk of **cardiovascular disease**?

Approach to Answer Question: NESR Systematic Review

Analytic Framework

Seafood & Risk of CVD

Systematic review question: What is the relationship between seafood consumption during childhood and adolescence (up to 18 years of age) and risk of cardiovascular disease?

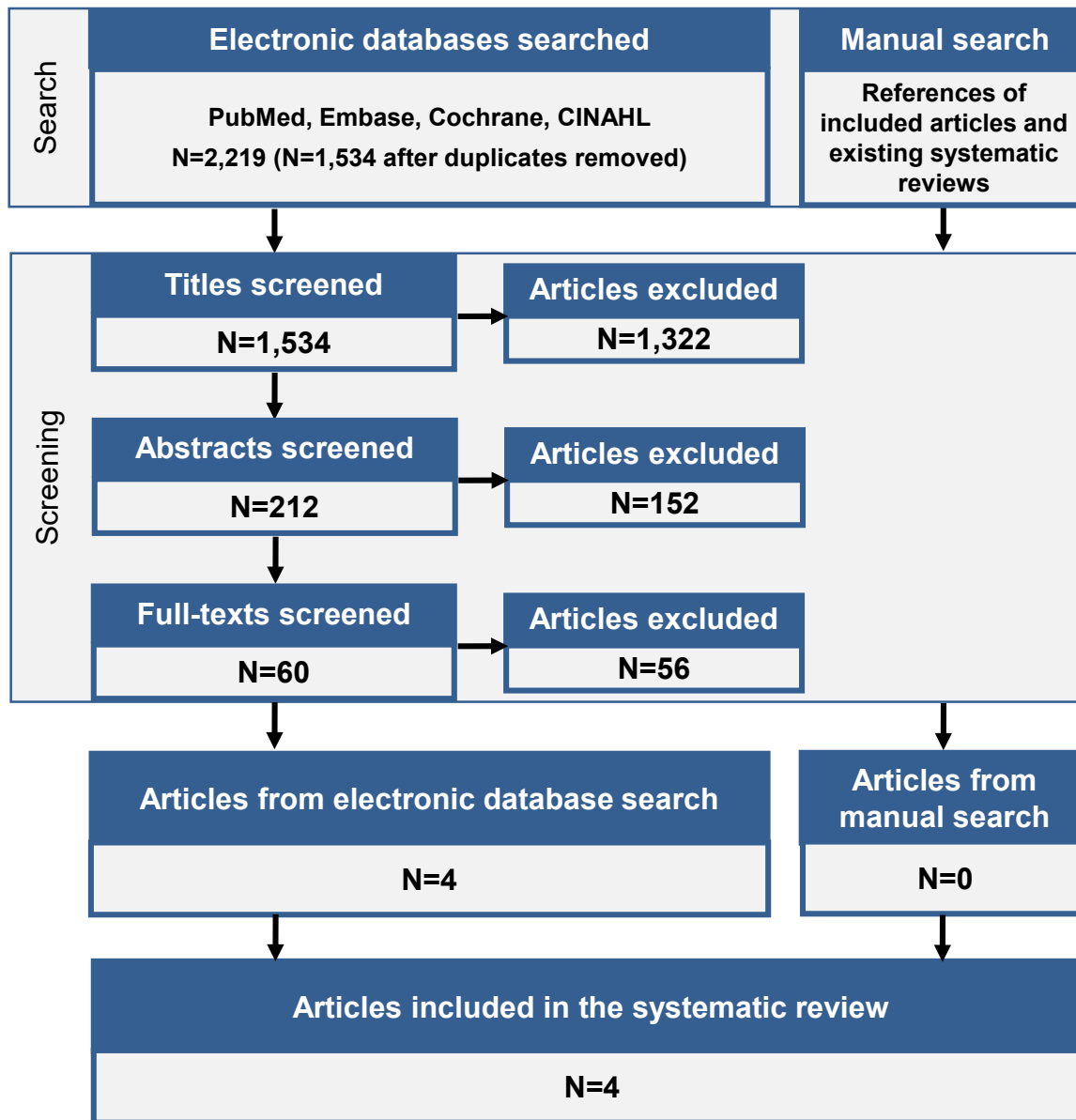


Key Confounders: Child sex, Child age, Race/ethnicity, Socioeconomic status, Non-fish dietary exposure to n-3 PUFAs, Smoking, Anthropometry, Family history of CVD

Other factors considered: Key nutrients in seafood (e.g., n-3 PUFAs, iron, iodine, selenium, fish protein, vitamin D); Environmental chemicals, e.g., mercury, persistent organic pollutants, and polychlorinated biphenyls; Blood and human milk biomarkers of seafood intake (e.g., n-3 PUFAs, and environmental pollutants)

Literature Search and Screening Results

Seafood & Risk of CVD



Seafood during
childhood/adolescence and
risk of CVD
2020 Dietary Guidelines Advisory
Committee: Meeting 4

Seafood intake during childhood/adolescence & Risk of CVD

4 total articles

- RCTs and PCS

2 articles from 2 RCTs (Oman & Mexico)

- Ages: 10 – 12 years
- Interventions:
 - 100 grams of oily fish versus cheese/salad sandwich 5 times per week for 12 weeks
 - 6, 7, or 8 grams of tuna (intervention frequency, duration and control condition not reported)
- Intermediate outcomes only
 - Blood pressure and blood lipids

Seafood intake during childhood/adolescence & Risk of CVD, continued

2 articles from 2 PCS

- Intermediate outcomes

- 1 articles from 1 PCS (Denmark)
- Exposure: Fish intake at 10 years (assessed using a food record)
- Outcomes: Blood pressure and blood lipids

- End-point outcomes

- 1 article from 1 PCS (UK)
- Exposure: Assessed fish and oily fish intake at 7.5 years (7-day household inventory collected between 1937-1939)
- Outcomes: Stroke mortality, CHD mortality measured during 60 years of follow-up

Seafood intake during childhood/adolescence and Risk of CVD, continued

- Results from the few available studies were not consistent
- Difficult to determine a relationship due to:
 - Inadequate number of studies
 - Serious methodological limitations of some studies

Seafood intake during childhood/adolescence

Risk of CVD, continued

Draft Conclusion Statement

Insufficient evidence is currently available to accurately determine the relationship between seafood consumption during childhood and adolescence and risk of developing cardiovascular disease.

Grade: Grade not assignable

Next Steps

1. Peer-Review and Draft Report

- **Seafood** during pregnancy and neurocognitive development
- **Seafood** during childhood/adolescence and neurocognitive development
- **Seafood** during childhood/adolescence and cardiovascular disease

2. Implement protocols

- **Dietary fats** and cardiovascular disease
- **Dietary fats** and neurocognitive development/health
- **Dietary fats** and all-cause mortality
- **Dietary fats** and cancer

2020 Dietary Guidelines Advisory Committee: Dietary Fats and Seafood

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