2020 Dietary Guidelines Advisory Committee: Frequency of Eating

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Subcommittee Status

- NESR staff screened articles and prepared evidence portfolios
  - ~ 41,000 articles have been screened
  - Extracted data and assessed risk of bias for 10 included articles
- Subcommittee reviewed evidence and drafted conclusions
  - Frequency of eating and all-cause mortality (Discussed at Meeting 3)
  - Frequency of eating during pregnancy and gestational weight gain
  - Frequency of eating during lactation and post-partum weight loss
  - Frequency of eating and growth, size, body composition, and risk of overweight and obesity
  - Frequency of eating and cardiovascular disease
  - Frequency of eating and type 2 diabetes

Protocols for questions discussed in this presentation are available at DietaryGuidelines.gov

How we got to where we are now…

Original question: What is the relationship between the frequency of eating (such as meals per day, snacking, and fasting) at each stage of life and various outcomes

While **timing of eating occasions** is an important factor within this topic, it was decided by the subcommittee that the **number of daily eating occasions** was the primary intervention/exposure required to evaluate these relationships and a criteria was included that ensured daily eating occasions were reported for each included study.

Studies that met the above criteria and contained data on meal skipping, snacking, and fasting would be included in the body of evidence

Protocols for questions discussed in this presentation are available at DietaryGuidelines.gov

Follow-Up from Meeting 3

- Analytic frameworks and inclusion and exclusion criteria were updated to ensure clarity in the Subcommittee's primary objective:
  - The reviews focus on the **number of eating occasions**.
  - Timing of daily eating occasions (i.e. weekly timing, meal skipping, and fasting) was removed from the description of the intervention/exposure.

- Additional clarifications after meeting 3:
  - The minimum size of study groups and power analysis criteria was required only for intervention studies and not observational studies
  - The eating frequency data collection criteria:
    - Requirement for data collection on 2 separate occasions was removed for observational studies but remained for intervention studies
    - 3, 24 hour periods was retained as an attempt to capture customary frequency of eating

Key Definitions

- **Frequency of Eating**
  - Defined as number of daily **Eating Occasions**
    - Defined as ingestive event:
      - preload, meals, or snacks
      - beverage (energy or non-energy yielding) or food

Inclusion and Exclusion Criteria

Category	Inclusion Criteria	Exclusion Criteria
Intervention/ exposure	Frequency of eating: • **Number of daily eating occasions**	• Studies that only examine frequency of intake of a single food, beverage or category of foods or beverages (i.e. frequency of milk consumption, frequency of seafood consumption) • Studies that do not have eating occasions across the day
Eating frequency data collection for observational studies	• Data collection for eating frequency that **encompasses a minimum of 3, 24-hour periods** ○ (e.g., 3, 24-h dietary recalls reporting each ingestive event) ○ (e.g., 1 eating frequency questionnaire documenting eating frequency for the past month)	• Data collection for eating frequency that encompasses fewer than 3, 24-hour periods

What is the relationship between the frequency of eating and all-cause mortality?

Inclusion and Exclusion Criteria, continued

Category	Inclusion Criteria	Exclusion Criteria

Eating frequency data collection for intervention studies	• Data collection for eating frequency that occurs on at least 2 occasions, including baseline and during or after the intervention.
	  ○ Each occasion encompasses a minimum of 3, 24-hour periods or a questionnaire that covers at least 3 days addressing eating frequency.
	  ▪ (e.g., 3, 24-h dietary recalls reporting ingestive events)
	  ▪ (e.g., 1 eating frequency questionnaire documenting eating frequency for the past month)
		• Data collection for eating frequency that occurs on fewer than 2 occasions, and encompasses fewer than 3, 24-hour periods

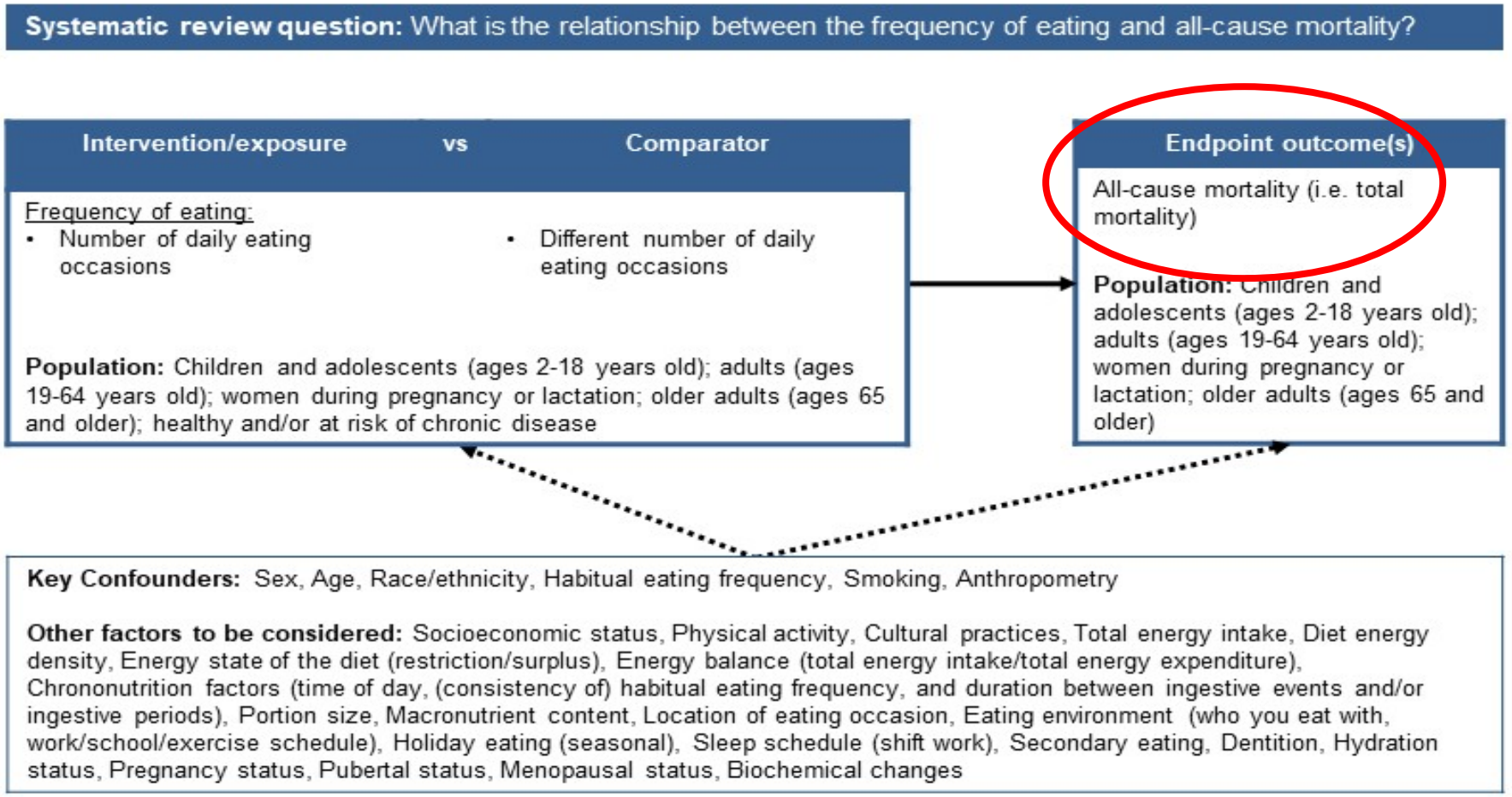
Size of study groups for intervention studies	• 15 participants for studies using within-subject analyses, or • 30 participants for studies using between-subject analysis, or • A power calculation included	• Fewer than 15 participants for studies using within-subject analyses, or • Fewer than 30 participants for studies using between-subject analysis, or • No power calculation reported

Question

What is the relationship between the frequency of eating and all-cause mortality?

Approach to Answer Question: NESR Systematic Review

Analytic Framework



Key definitions

Eating occasion – ingestive event [preload, meals or snacks; food or beverage (energy yielding or non-energy yielding)]
All-cause mortality– the total number of deaths from all causes during a specific time-period
Secondary eating– eating occasions that are not identified as the primary activity (e.g., screen time, eating while driving, reading)

Legend

→ The relationship of interest in the systematic review
⋯→ Factors that may impact the relationship of interest in the systematic review

DRAFT Conclusion Statement and Grade

Conclusion statement

- No evidence is available to determine the relationship between the frequency of eating and all-cause mortality.

Grade: Grade Not Assignable

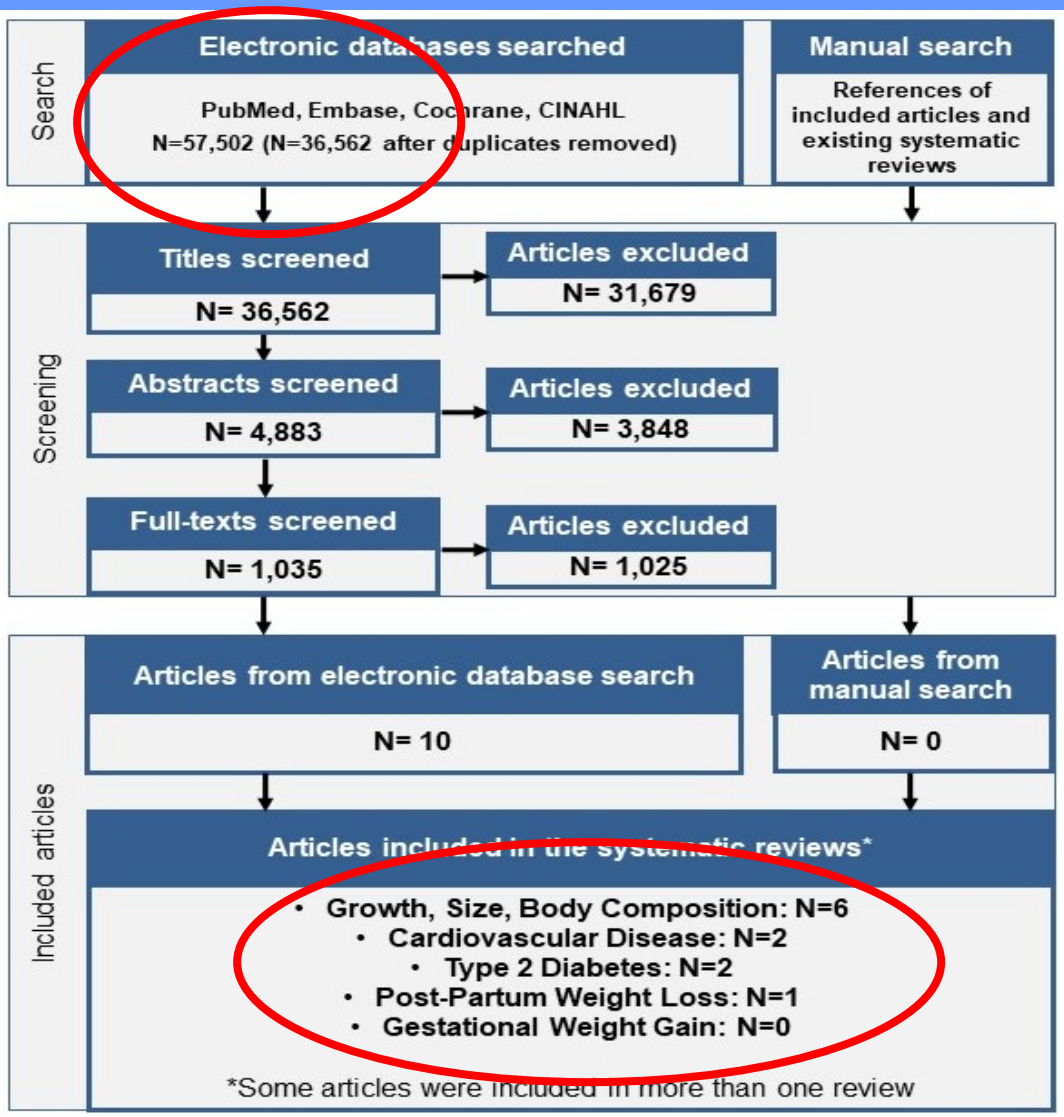
Remaining Systematic Review Questions

What is the relationship between the frequency of eating:

- during pregnancy and gestational weight gain
- during lactation and post-partum weight loss
- and growth, size, body composition, and risk of overweight and obesity
- and cardiovascular disease
- and type 2 diabetes

Approach to Answer Question: NESR Systematic Review

Literature Search and Screening Results



Question
(frequency of eating & gestational weight gain)

What is the relationship between the frequency of eating during pregnancy and gestational weight gain?

Approach to Answer Question: NESR Systematic Review

Analytic Framework
(frequency of eating & gestational weight gain)

Systematic review question: What is the relationship between the frequency of eating during pregnancy and gestational weight gain?

Intervention/exposure	vs	Comparator
Frequency of eating: • Number of daily eating occasions		• Different number of daily eating occasions
Population: Women during pregnancy; healthy and/or at risk for chronic disease		

Endpoint outcome(s)

Gestational weight gain:
- Change in maternal body weight from baseline (before or during pregnancy) to a later time point during pregnancy and/or right before delivery
- Weight gain in relationship to weight gain recommendations, based on pre-pregnancy BMI

Population: Women during pregnancy; healthy and/or at risk for chronic disease

Key Confounders: Age, Race/ethnicity, Pre-pregnancy anthropometry, Physical activity, Smoking, Parity

Other factors to be considered: Socioeconomic status, Cultural practices, Total energy intake, Diet energy density, Energy state of the diet (restriction/surplus), Energy balance (total energy intake/total energy expenditure), Chrononutrition factors (time of day, (consistency of) habitual eating frequency, and duration between ingestive events and/or ingestive periods), Portion size, Macronutrient content, Location of eating occasion, Specialized diet including all-liquids diet, Eating environment (who you eat with, work/school/exercise schedule), Holiday eating (seasonal), Sleep schedule (shift work), Secondary eating, Dentition, Hydration status, Medication and substance use, History of gestational diabetes mellitus, History of gestational hypertension, Biochemical changes

Key definitions

Eating occasion – ingestive event [preload, meals or snacks; food or beverage (energy yielding or non-energy yielding)]
Secondary eating– eating occasions that are not identified as the primary activity (e.g., screen time, eating while driving, reading)
Gestational weight gain - weight a woman gains during pregnancy (CDC)

Legend

→ The relationship of interest in the systematic review
⇢ Factors that may impact the relationship of interest in the systematic review

Description and Summary of the Evidence
(frequency of eating & gestational weight gain)

- No studies published between January 2000 and September 2019 met the inclusion criteria for this systematic review.

What is the relationship between the frequency of eating during pregnancy and gestational weight gain?
2020 Dietary Guidelines Advisory Committee: *Meeting 4*

DRAFT Conclusion Statement and Grade (frequency of eating & gestational weight gain)

Conclusion statement

No evidence is available to draw a conclusion about the relationship between the frequency of eating during pregnancy and gestational weight gain.

Grade: Grade Not Assignable

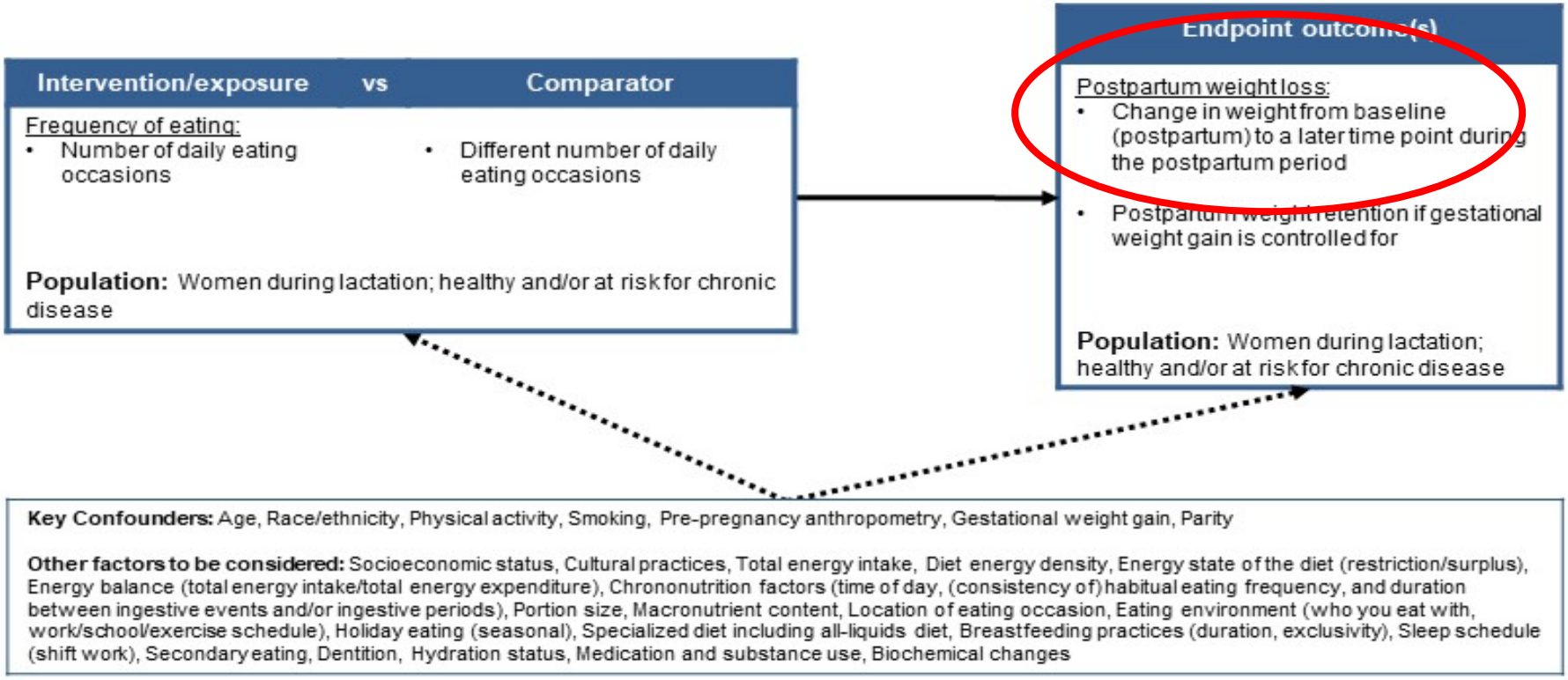
Question
(frequency of eating & post-partum weight loss)

What is the relationship between frequency of eating during lactation and post-partum weight loss?

Approach to Answer Question: NESR Systematic Review

Analytic Framework
(frequency of eating & post-partum weight loss)

Systematic review question: What is the relationship between the frequency of eating during lactation and post-partum weight loss?



Key definitions

Eating occasion – ingestive event [preload, meals or snacks; food or beverage (energy yielding or non-energy yielding)]
Secondary eating– eating occasions that are not identified as the primary activity (e.g., screen time, eating while driving, reading)
Postpartum weight retention: amount of weight that remains during the postpartum period minus the woman's pre-pregnancy weight (IOM, 2009)

Legend

→ The relationship of interest in the systematic review
⇢ Factors that may impact the relationship of interest in the systematic review

Description of the Evidence
(frequency of eating & post-partum weight loss)

- 1 prospective cohort study, using data from an RCT, was identified that met the inclusion criteria
  - Took place in Sweden
  - 4 day weighed food records were used at baseline and follow-up to measure eating occasions per day
  - A change in eating frequency (per a decrease in 1 eating occasion) between baseline and follow-up was assessed
  - Study outcome reported: change in post-partum weight
  - 100% of women included in the study were overweight or obese
  - 95% were exclusively breastfeeding, 5% were partially breastfeeding, and parity was 1

What is the relationship between frequency of eating during lactation and post-partum weight loss?

2020 Dietary Guidelines Advisory Committee: *Meeting 4*

Summary of the Evidence Synthesis (frequency of eating & post-partum weight loss)

- 1 prospective cohort study did not report a significant association between eating frequency and a change in postpartum weight loss after a 12 week follow-up.

DRAFT Conclusion Statement and Grade (frequency of eating & post-partum weight loss)

Conclusion statement

Insufficient evidence is available to determine the relationship between the frequency of eating during lactation and post-partum weight loss.

Grade: Grade Not Assignable

Question
(frequency of eating & growth, size, body composition)

What is the relationship between the frequency of eating and growth, size, body composition, and risk of overweight and obesity?

Approach to Answer Question: NESR Systematic Review

Analytic Framework
(frequency of eating & growth, size, body composition)

Systematic review question: What is the relationship between the frequency of eating and growth, size, body composition, and risk of overweight and obesity?

Intervention/exposure	vs	Comparator
Frequency of eating: • Number of daily eating occasions		• Different number of daily eating occasions

Population: Children and adolescents (ages 2-18 years old); adults (ages 19-64 years old); older adults (ages 65 and older); healthy and/or at risk of chronic disease.

Endpoint outcome(s)

- Weight, weight-for-age
- Height, length/stature-for-age
- BMI, BMI z-score, weight-for-length
- Body circumferences: head, arm, waist, thigh, neck
- Body composition and distribution (e.g., % fat mass, fat-free mass, lean mass)
- Incidence and prevalence of:
  - -Underweight, failure to thrive, stunting, wasting
  - -Healthy weight
  - -Overweight
  - -Obesity

Population: Children and adolescents (ages 2-18 years old); adults (ages 19-64 years old); older adults (ages 65 and older).

Key Confounders: Sex, Age, Race/ethnicity, Habitual eating frequency, Physical activity, Smoking, Anthropometry at baseline

Other factors to be considered: Socioeconomic status, Cultural practices, Total energy intake, Diet energy density, Energy state of the diet (restriction/surplus), Energy balance (total energy intake/total energy expenditure), Chrononutrition factors (time of day, (consistency of) habitual eating frequency, and duration between ingestive events and/or ingestive periods), Portion size, Macronutrient content, Location of eating occasion, Specialized diet including all-liquids diet, Eating environment (who you eat with, work/school/exercise schedule), Holiday eating (seasonal), Sleep schedule (shift work), Secondary eating, Dentition, Hydration status, Pregnancy status, Pubertal status, Menopausal status, Medication and substance use, Biochemical changes

Key definitions

Eating occasion – ingestive event [preload, meals or snacks; food or beverage (energy yielding or non-energy yielding)]

Secondary eating– eating occasions that are not identified as the primary activity (e.g., screen time, eating while driving, reading)

Legend

→ The relationship of interest in the systematic review

⇢ Factors that may impact the relationship of interest in the systematic review

Description of the Evidence
(frequency of eating & growth, size, body composition)

- 6 studies were identified that met inclusion criteria
  - 1 randomized controlled trial
  - 5 prospective cohort studies
- 5 studies took place in the US and 1 in Greece
- Number of eating occasions in the comparison groups differed
- 3 studies used a 3 day food record and 3 studies used an FFQ and added a question to assess number of daily eating occasions
- Study outcomes reported:
  - BMI
  - change in BMI
  - body fat
  - fat free mass
  - waist circumference
  - change in waist circumference
  - 5 kg weight gain
  - weight change
  - subcutaneous fat
  - preperitoneal fat
  - abdominal fat index

What is the relationship between the frequency of eating and growth, size, body composition, and risk of overweight and obesity?

Overall results were inconsistent (frequency of eating & growth, size, body composition)

- 5 studies in adults:
  - 3 studies reported a positive association between frequency of eating and growth, size, and body composition outcomes
  - 2 studies did not report a significant association between frequency of eating and growth, size, and body composition outcomes
- 1 study in children reported an inverse association between frequency of eating and growth, size, and body composition outcomes after a 10 year follow-up

What is the relationship between the frequency of eating and growth, size, body composition, and risk of overweight and obesity?
2020 Dietary Guidelines Advisory Committee: *Meeting 4*

Summary of the Evidence Synthesis
(frequency of eating & growth, size, body composition)

- Studies were inconsistent in how they defined and examined frequency of eating, the outcomes they examined, and in their reported results.
- Studies had several additional critical limitations,
  - Cohort studies were weak study designs to explore this question
    - High risk of bias
    - High or unknown attrition

DRAFT Conclusion Statement and Grade
(frequency of eating & growth, size, body composition)

Conclusion statement

Insufficient evidence is available to determine the relationship between the frequency of eating and growth, size, body composition, and the risk of overweight and obesity.

Grade: Grade Not Assignable

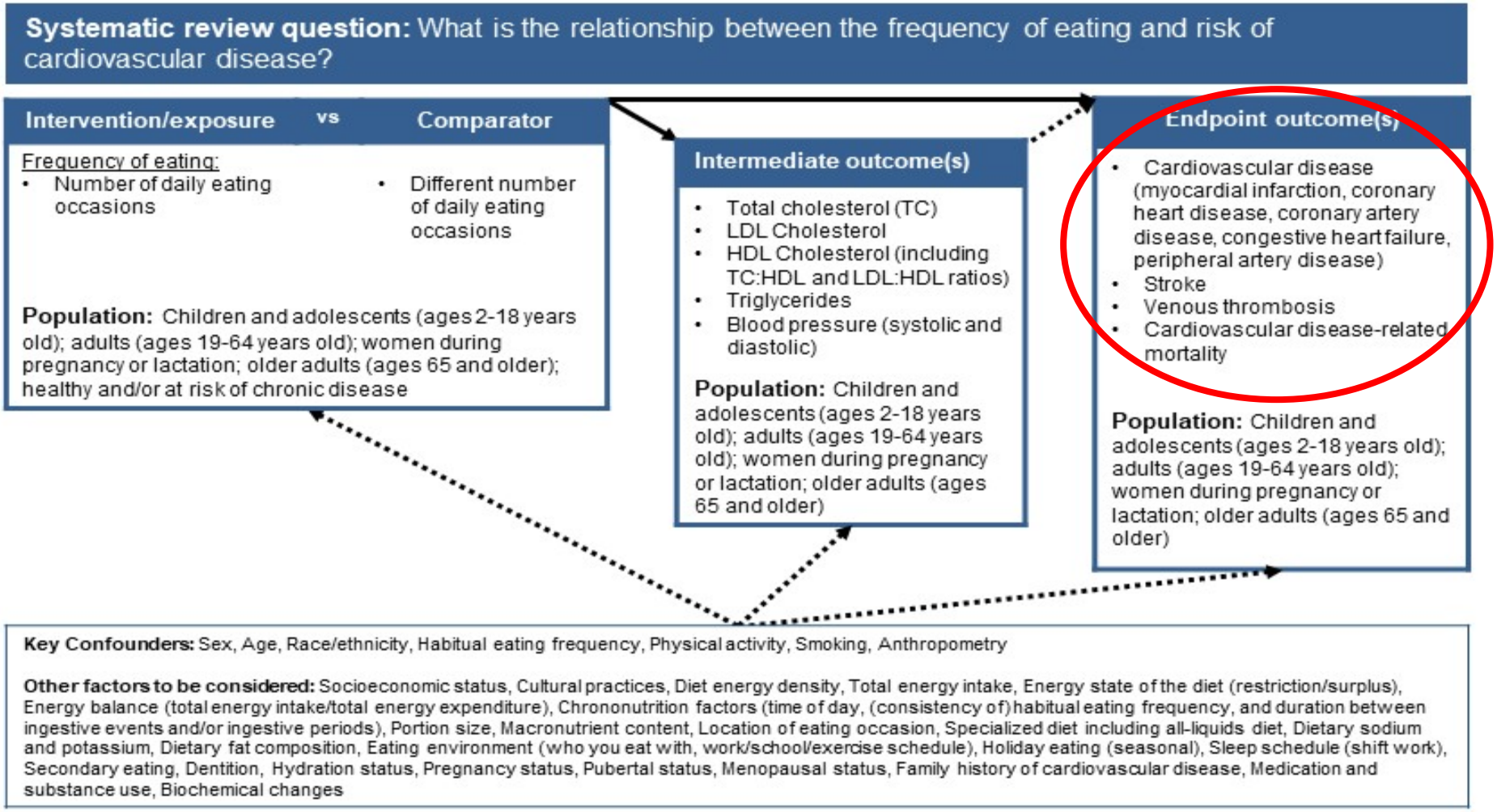
What is the relationship between the frequency of eating and growth, size, body composition, and risk of overweight and obesity?
2020 Dietary Guidelines Advisory Committee: *Meeting 4*

Question
(frequency of eating & cardiovascular disease)

What is the relationship between the frequency of eating and cardiovascular disease?

Approach to Answer Question: NESR Systematic Review

Analytic Framework
(frequency of eating & cardiovascular disease)



Key definitions

Eating occasion – ingestive event [preload, meals or snacks; food or beverage (energy yielding or non-energy yielding)]

Secondary eating– eating occasions that are not identified as the primary activity (e.g., screen time, eating while driving, reading)

Legend

→ The relationship of interest in the systematic review

⇢ Factors that may impact the relationship of interest in the systematic review

Description of the Evidence
(frequency of eating & cardiovascular disease)

- 2 studies in adults were identified that met inclusion criteria
  - Both studies were prospective cohort studies
- 1 study took place in the US and 1 in Greece
- Number of eating occasions in the comparison groups differed
- 1 study used a 3 d food record and 1 study used an FFQ and added a question to assess number of daily eating occasions at baseline
- Study outcomes reported: coronary heart disease, hypertension, systolic blood pressure, and diastolic blood pressure

Overall results were inconsistent (frequency of eating & cardiovascular disease)

- 1 study reported an inverse association in adults between eating frequency at baseline and systolic and diastolic blood pressure and risk of hypertension after a 5 year follow-up.
- 1 study reported no association in adults between eating frequency at baseline and coronary heart disease after a 16 year follow-up.

Summary of the Evidence Synthesis (frequency of eating & cardiovascular disease)

- The studies were inconsistent in how they defined and examined frequency of eating, the outcomes they examined, and in their reported results.
- Studies had several additional critical limitations:
  - Weak study design to explore this question
    - High risk of bias
    - Attrition unknown

DRAFT Conclusion Statement and Grade (frequency of eating & cardiovascular disease)

Conclusion statement

Insufficient evidence is available to determine the relationship between the frequency of eating and cardiovascular disease.

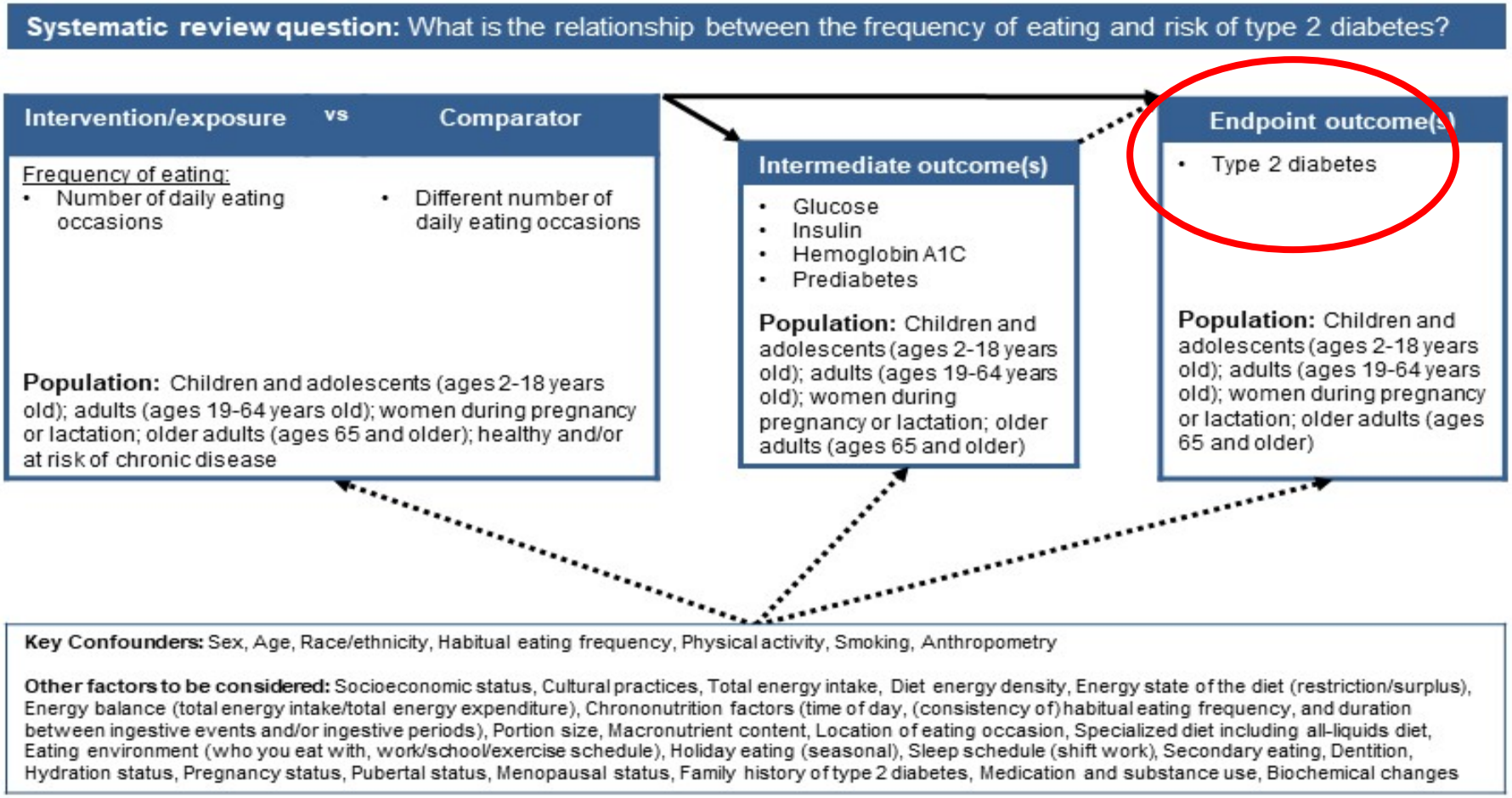
Grade: Grade Not Assignable

Question
(frequency of eating & type 2 diabetes)

What is the relationship between the frequency of eating and type 2 diabetes?

Approach to Answer Question: NESR Systematic Review

Analytic Framework
(frequency of eating & type 2 diabetes)



Key definitions

Eating occasion – ingestive event [preload, meals or snacks; food or beverage (energy yielding or non-energy yielding)]

Secondary eating– eating occasions that are not identified as the primary activity (e.g., screen time, eating while driving, reading)

Legend

→ The relationship of interest in the systematic review

⇢ Factors that may impact the relationship of interest in the systematic review

Description of the Evidence
(frequency of eating & type 2 diabetes)

- 2 studies were identified that met inclusion criteria
  - Both studies were prospective cohort studies
- Both studies took place in the US
- Both studies used an FFQ with an added question to assess number of daily eating occasions at baseline
- Study outcomes reported: risk of type 2 diabetes

Overall results were inconsistent (frequency of eating & type 2 diabetes)

- 1 study reported an association between men who reported 1-2 eating occasions per day had a higher risk of type 2 diabetes compared to men who reported 3 eating occasions per day.
- In the same study there was also a significant dose response with increased eating occasions and risk of type 2 diabetes.
- 1 study did not report an association between eating frequency and risk of type 2 diabetes

Summary of the Evidence Synthesis
(frequency of eating & type 2 diabetes)

- The studies were inconsistent in how they defined and examined frequency of eating and in their reported results.
- Studies had several additional critical limitations:
  - High risk of bias
  - Weak study design to explore this question
  - Attrition unknown

DRAFT Conclusion Statement and Grade (frequency of eating & type 2 diabetes)

Conclusion statement

Insufficient evidence is available to determine the relationship between frequency of eating during lactation and type 2 diabetes.

Grade: Grade Not Assignable

Summary of study limitations across the included evidence

- Inconsistent and insufficient findings to draw conclusions about the relationship between frequency of eating and the health outcomes.
- Water consumption was not explicitly mentioned
- Prospective cohort studies:
  - Inconsistent measures of frequency of eating assessments
  - Eating frequency only assessed at baseline
  - Comparisons were not consistent across studies
  - Both energy yielding and non-energy yielding beverages were inconsistently accounted for
  - High or unknown attrition rates
- Reported outcomes varied across studies
- The study populations do not fully represent the race/ethnic or socioeconomic diversity of the US population.

Protocols for questions discussed in this presentation are available at DietaryGuidelines.gov

Draft Research Recommendations

- Need more controlled trials
- Develop a consistent definition of an ingestive event that includes eating and drinking and methods to quantify it
- Document frequency of water consumption
- Collection of ingestive frequency data:
  - Report number of ingestive events across 24 hours
  - Collect a minimum of 3 days of ingestive event data and on at least 2 discrete occasions to allow assessment of estimate reliability
- Report information on food insecurity to allow isolation of voluntary versus involuntary ingestive event effects
- Report key confounders and other factors to be considered

Protocols for questions discussed in this presentation are available at DietaryGuidelines.gov

Next Steps

- Systematic Reviews will be peer-reviewed
- Collaboration with data analysis and food pattern modeling working group for the data analysis question answering:
  - What is the relationship between the frequency of eating and achieving nutrient and food group recommendations?
- Use the findings of the completed systematic reviews and data analyses to draft the scientific report of this Dietary Guidelines Advisory Committee

Frequency of Eating: Members and Staff

Members:	
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Ron Kleinman	
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