Meeting 5

Youth

Chair: Russ Pate

Members: Chuck Hillman, Kathy Janz, Peter Katzmarzyk, Ken Powell, Melicia Whitt-Glover

Experts and Consultants

- Invited experts: None.
- Consultants: None.

Subcommittee Questions

1. In children younger than age 6 years, is physical activity related to health outcomes?

2. In children and adolescents, is physical activity related to health outcomes?

3. In children and adolescents, is sedentary behavior related to health outcomes?

Question #2

- In children and adolescents, is physical activity related to health outcomes?
  a. What is the relationship between physical activity and cardiorespiratory and muscular fitness?
  b. What is the relationship between physical activity and adiposity/weight status? Does physical activity prevent or reduce the risk of excessive increases in adiposity/weight?
  c. What is the relationship between physical activity and cardiometabolic health?
  d. What is the relationship between physical activity and bone health?
  e. Are there dose-response relationships? If so, what are the shapes of those relationships?
  f. Do the relationships vary by age, sex, race/ethnicity, weight status, or socio-economic status?

- Source of evidence to answer question
  – SR/MA/Existing Report

Analytical Framework

Systematic Review Question

In children and adolescents, is physical activity related to health outcomes?

Target Population

Children, ages 0–18

Comparison

Least active subgroup

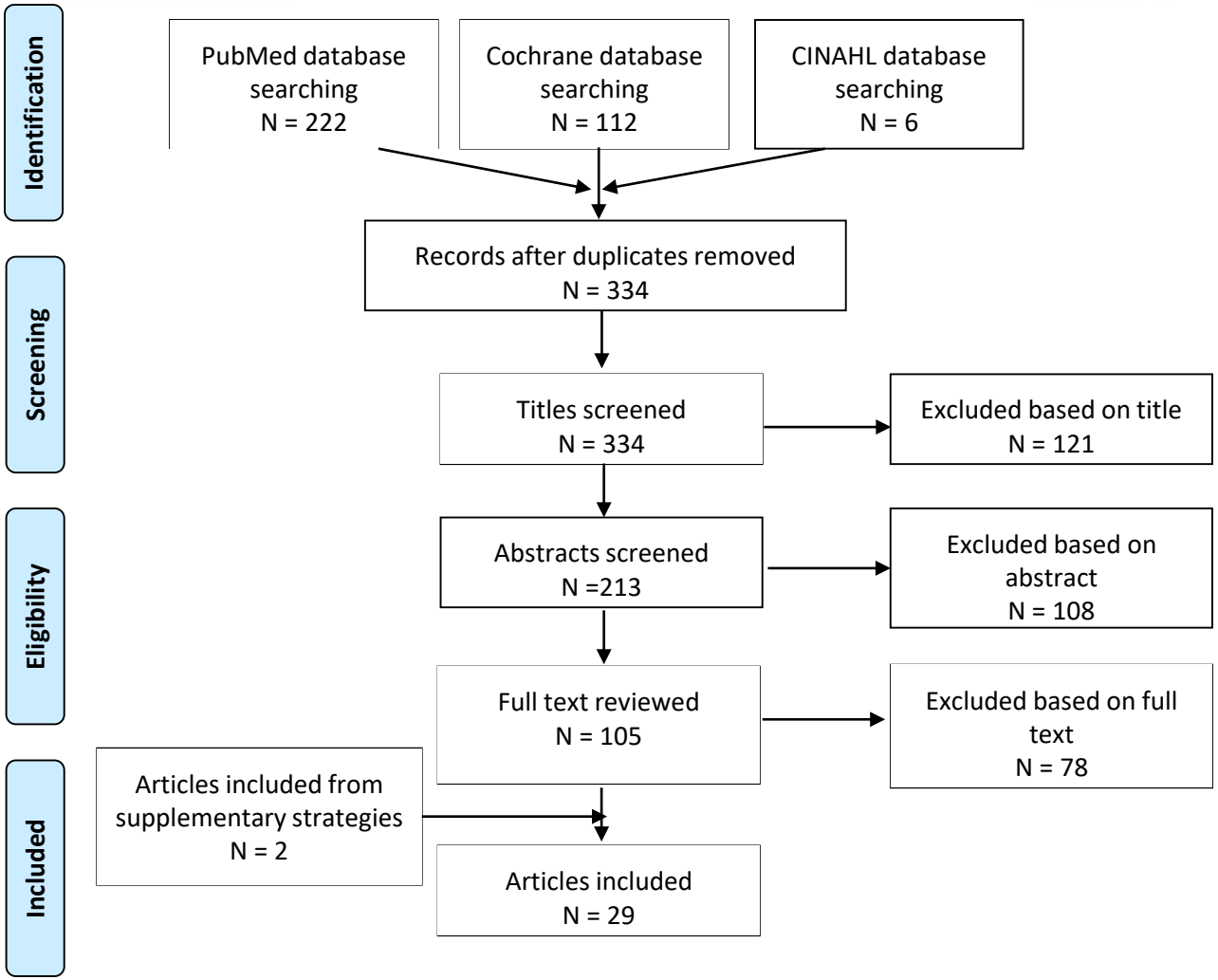
Intervention/Exposure

All types and intensities of physical activity, including any kind of play (structured or free), sports, and other activities

Endpoint Health Outcomes

- Bone density
- Bone strength
- Cardiorespiratory fitness
- Cardiometabolic risk factors
  - Blood pressure
  - Dyslipidemia
  - Glucose
  - Insulin resistance
  - Waist circumference
- Musculoskeletal health
- Obesity
- Overweight
- Weight gain

Search Results: High-Quality Reviews[1] and Reports



[1] Reviews include systematic reviews, meta-analyses, and pooled analyses.

Question #2

In children and adolescents, is physical activity related to health outcomes?

Draft Conclusion Statement

- Conclusion Statement:

  Strong evidence demonstrates that, in children and adolescents, higher amounts of physical activity are associated with more favorable status for multiple health indicators, including cardiorespiratory and muscular fitness, bone health, and weight status/adiposity. Moderate evidence demonstrates that physical activity is positively associated with cardiometabolic health in children and adolescents.

- Grade: Strong

Question #2–Subquestion a

What is the relationship between physical activity and cardiorespiratory and muscular fitness?

Description of the Evidence

- Eight systematic reviews and meta-analyses considered physical activity and cardiorespiratory fitness
  - Exposures included afterschool programs, school-based interventions, formal exercise training programs, active transport, exergaming, and all settings
- Two systematic reviews considered physical activity and muscular fitness
  - Exposure was formal resistance exercise training

Draft Key Findings

- All reviews concluded that physical activity positively impacted cardiorespiratory fitness; supervised exercise training produced 7-8% increases in VO2max; an effective dose was 3 or more days per week, 30-60 minutes, 50-90% VO2max
- Both relevant reviews concluded that resistance exercise training increased muscular fitness; an effective dose was 2 or more resistance training sessions per week
- The relevant reviews provided little evidence on effect modification by demographic factors

Draft Conclusion Statement

- Conclusion Statement:

  Strong evidence demonstrates that increased moderate-to-vigorous physical activity increases cardiorespiratory fitness and increased resistance exercise increases muscular fitness in children and adolescents.

- Grade: Strong

Question #2–Subquestion b

What is the relationship between physical activity and adiposity/weight status? Does physical activity prevent or reduce the risk of excessive increases in adiposity/weight?

Description of the Evidence

- Ten systematic reviews and/or meta-analyses summarized studies examining the independent association between physical activity and weight status or indicators of adiposity.
- Five of the reviews focused on studies using prospective, observational study designs

Draft Key Findings

- Four of five reviews focusing on studies with prospective, observational study designs concluded that physical activity was inversely related to weight status and/or adiposity.
- None of the reviews provided evidence on dose-response relationships or effect modification by demographic factors.

Draft Conclusion Statement

- Conclusion Statement:

  Strong evidence demonstrates that higher levels of physical activity are associated with smaller increases in weight and adiposity during childhood and adolescence.

- Grade: Strong

Question #2–Subquestion c

What is the relationship between physical activity and cardiometabolic health?

Description of the Evidence

- Nine systematic reviews and meta-analyses examined associations between physical activity and various indicators of cardiometabolic health.
- Three of the reviews were focused on these associations only in overweight or obese children and adolescents.

Draft Key Findings

- Five of five meta-analyses found associations between physical activity and plasma triglycerides.
- Three of four meta-analyses found associations between physical activity and plasma insulin.
- Findings were inconsistent for the associations between physical activity and HDL-cholesterol and blood pressure.
- The relevant reviews provided little evidence on to dose-response relationships and effect modification by demographic factors.

Draft Conclusion Statement

- Conclusion Statement:

  Moderate evidence indicates that physical activity is positively associated with cardiometabolic health in children and adolescents in general; the evidence is strong for plasma triglycerides and insulin.

- Grade: Moderate

Question #2–Subquestion d

What is the relationship between physical activity and bone health?

Description of the Evidence

- Six systematic reviews and one meta-analysis examined associations between physical activity and various indicators of bone health.
- Interventions reviewed included high-impact, dynamic, short duration exercise, such as hopping, jumping and tumbling.
- Two reviews considered prospective, observational studies.

Draft Key Findings

- All reviews concluded that physical activity is positively associated with bone mass accrual and/or bone structure.
- Positive associations were reported in reviews focusing on both experimental trials and prospective, observational studies.
- Reviews did not examine dose-response relationships or effect modification by demographic factors.

Draft Conclusion Statement

- Conclusion Statement:

  Strong evidence demonstrates that children and youth who are more physically active than their peers have higher bone mass, improved bone structure, and greater bone strength.

- Grade: Strong

Question #2–Subquestion e

Are there dose-response relationships? If so, what are the shapes of those relationships?

Description of the Evidence

- In general, systematic reviews and meta-analyses did not consider dose-response relationships.

Draft Conclusion Statement

- Conclusion Statement:

  Available evidence is insufficient to determine the dose-response relationship between physical activity and health effects during childhood and adolescence.

- Grade: Grade not assignable

Question #2–Subquestion f

Do the relationships vary by age, sex, race/ethnicity, weight status, or socio-economic status?

Description of the Evidence

- In general, systematic reviews and meta-analyses did not consider effect modification by demographic characteristics.

Draft Conclusion Statement

- Conclusion Statement:

  Available evidence is insufficient to determine whether the relationship between physical activity and health effects in youth is moderated by age, sex, race/ethnicity, weight status, or socio-economic status.

- Grade: Grade not assignable

Draft Research Recommendations

- Randomized clinical trials to elucidate the dose-response relationships for physical activity and physical fitness, adiposity, indicators of bone health, and cardiometabolic risk factors.
- Prospective, observational studies to examine the associations between physical activity and health outcomes in youth stratified by level of physical activity.
- Studies to determine whether the health effects of physical activity differ across groups based on sex, age, maturational status, race/ethnicity, and socio-economic status.

Draft Research Recommendations

- Research examining the effects of physical activity during childhood and adolescence on health outcomes later in life.
- Experimental and prospective, observational studies on physical activity and health outcomes in youth with elevated risk status.
- Studies with prospective designs examining the independent effects of television watching and overall sedentary behavior on health outcomes.

Draft Research Recommendations

- Research determining the prevalence of participation in specific forms of community- and school-based physical activity in youth.
- Studies determining the effects of novel forms of physical activity, including high intensity interval training, exergaming and competitive sport, on health outcomes in youth.

Draft Research Recommendations

- Research examining the impact of genetic profiles on behavioral and physiological responses to physical activity.
- Studies to elucidate the dimensions, doses, and timing of physical activity needed to produce specific bone health outcomes.

Committee Discussion

2. In children and adolescents, is physical activity related to health outcomes?
    a. What is the relationship between physical activity and cardiorespiratory and muscular fitness?
    b. What is the relationship between physical activity and adiposity/weight status? Does physical activity prevent or reduce the risk of excessive increases in adiposity/weight?
    c. What is the relationship between physical activity and cardiometabolic health?
    d. What is the relationship between physical activity and bone health?
    e. Are there dose-response relationships? If so, what are the shapes of those relationships?
    f. Do the relationships vary by age, sex, race/ethnicity, weight status, or socio-economic status?

Question #3

- In children and adolescents, is sedentary behavior related to health outcomes?
  a. What is the relationship between sedentary behavior and cardiometabolic health?
  b. What is the relationship between sedentary behavior and adiposity/weight status?
  c. What is the relationship between sedentary behavior and bone health?
  d. Are there dose-response relationships? If so, what are the shapes of the relationship?
  e. Do the relationships vary by age, sex, race/ethnicity, weight status, or socio-economic status?
- Source of evidence to answer question
  - SR/MA/Existing Report
  - De novo systematic review of original articles

Analytical Framework

Systematic Review Question

In youth, what is the relationship between sedentary behavior and health outcomes?

Target Population

Children, ages 0–18

Comparison

Youth who participate in varying levels and types of sedentary behavior

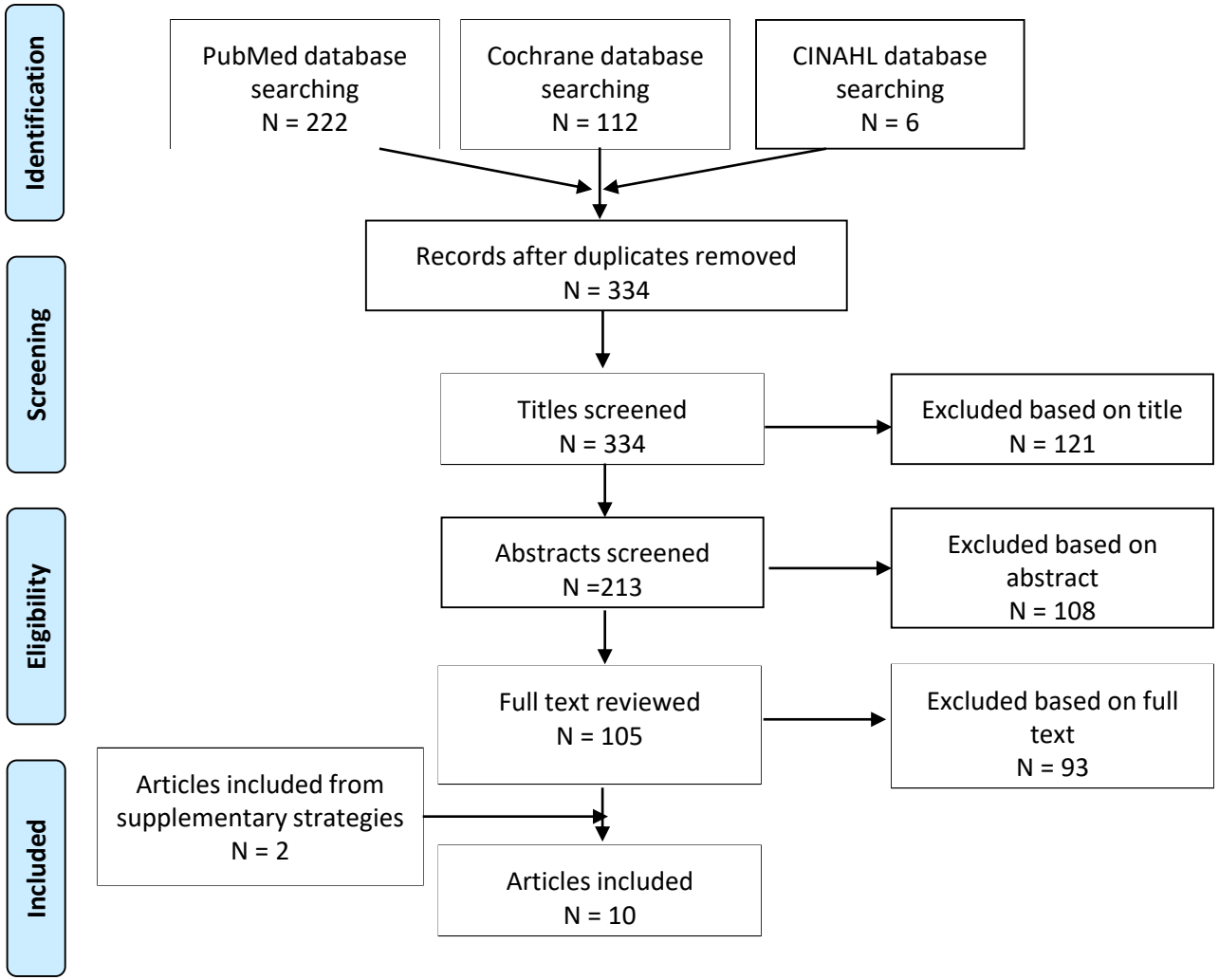
Intervention/Exposure

All types of sedentary behavior, including total sitting time, screen time, leisure-time sitting, and objective measures of sedentary time (e.g., accelerometers, heart rate monitors)

Endpoint Health Outcomes

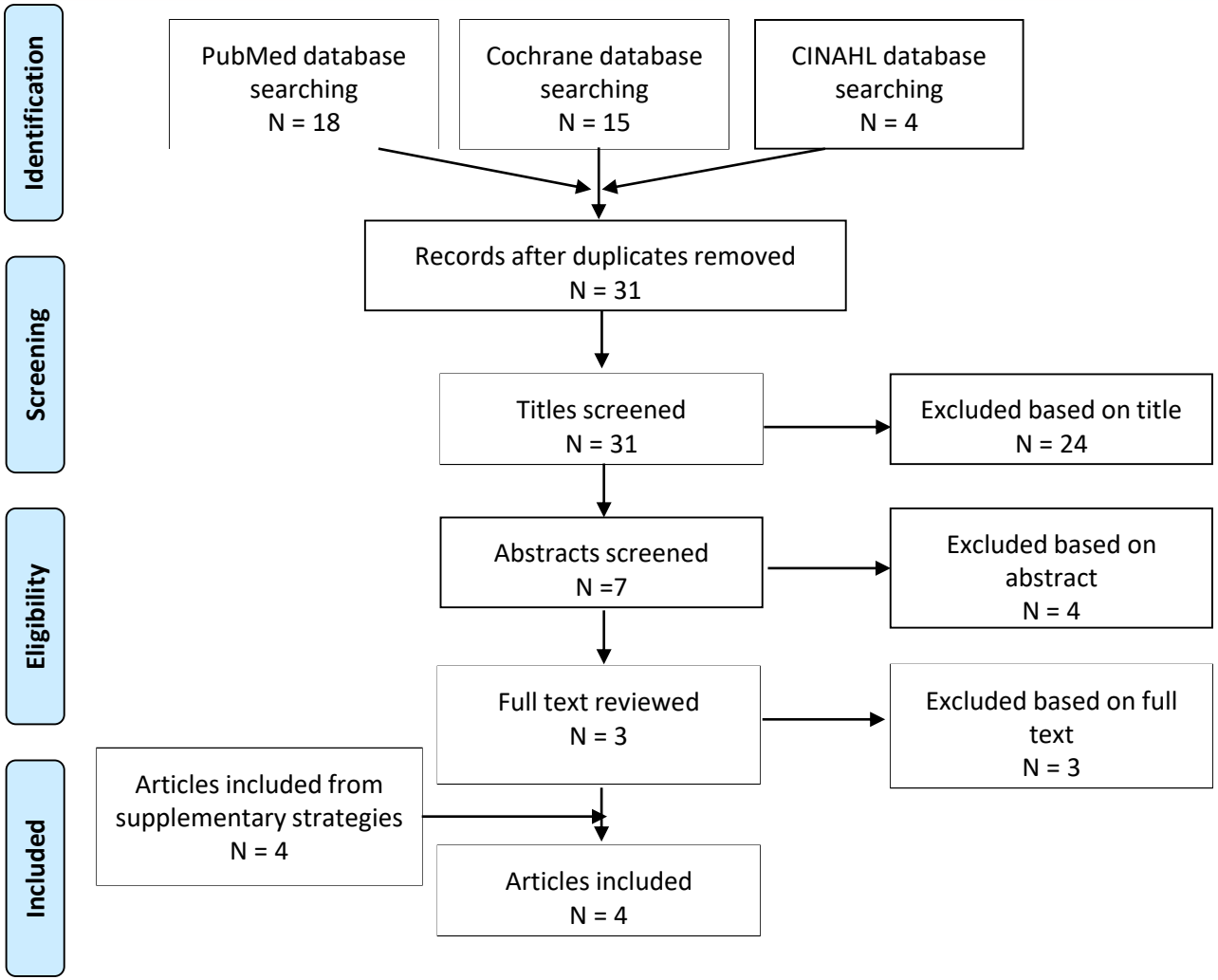
- Bone density
- Bone strength
- Cardiorespiratory fitness
- Cardiometabolic risk factors
  - Blood pressure
  - Dyslipidemia
  - Glucose
  - Insulin resistance
  - Waist circumference
- Musculoskeletal health
- Obesity
- Overweight
- Weight gain

Search Results: High-Quality Reviews[1] and Reports (weight status & cardiometabolic health)



[1] Reviews include systematic reviews, meta-analyses, and pooled analyses.

Search Results: Original Research (Bone health)



Draft Conclusion Statement

- Conclusion Statement:

  Limited evidence suggests that time spent in sedentary behavior is related to health outcomes in children and adolescents.

- Grade: Limited

Question #3–Subquestion a

What is the relationship between sedentary behavior and cardiometabolic health?

Description of the Evidence

- 15 systematic reviews and meta-analyses
- 4 reviews were most directly applicable to the question
- Reviews included consideration of relatively few longitudinal studies
- Much of the relevant evidence is based on assessment of TV watching or screen time as the exposure

Draft Key Findings

- Limited evidence of longitudinal associations between objectively measured sedentary time and indicators of cardiometabolic health.
- Evidence is somewhat stronger for associations between TV watching.

Draft Conclusion Statement

- Conclusion Statement:

  Limited evidence suggests that overall time spent in sedentary behavior is related to cardiometabolic health; the evidence is somewhat stronger for television viewing/screen time.

- Grade: Limited

Question #3–Subquestion b

What is the relationship between sedentary behavior and adiposity/weight status?

Description of the Evidence

- 15 systematic reviews and meta-analyses
- 10 of the reviews were most directly applicable to the question
- Relatively few studies included in reviews were based on objective measurement of sedentary time
- Most of the evidence based on TV watching and/or screen time
- Few studies included in reviews considered interventions to reduce sedentary time

Draft Key Findings

- Limited evidence of a longitudinal association between objectively measured sedentary time and weight status/adiposity
- Significant evidence supporting a longitudinal association between TV watching time and/or screen time and weight status/adiposity

Draft Conclusion Statement

- Conclusion Statement:

  Limited evidence suggests that time spent in sedentary behavior is related to weight status/adiposity in children and adolescents; the evidence is somewhat stronger for television viewing/screen time.

- Grade: Limited

Question #3–Subquestion c

What is the relationship between sedentary behavior and bone health?

Description of the Evidence

- Primary research literature – 4 studies using prospective, observational study designs
- All 4 studies used objective measurement of physical activity via accelerometry
- Methods for assessment of bone health outcomes varied across studies

Draft Key Findings

- Methods for assessment of physical activity, indicators of bone health, and data analysis highly variable across studies
- Evidence of an association between sedentary behavior and bone health is limited

Draft Conclusion Statement

- Conclusion Statement:

  Limited evidence suggests that sedentary behavior is related to bone health.

- Grade: Limited

Question #3–Subquestion d

Are there dose-response relationships? If so, what are the shapes of those relationships?

Description of the Evidence

- Neither systematic reviews/meta-analyses nor primary research studies considered dose-response relationships.

Draft Conclusion Statement

- Conclusion Statement:

  Insufficient evidence is available to determine whether there is a dose-response relationship between time spent in sedentary behavior and health outcomes in children and adolescents.

- Grade: Grade not assignable

Question #3–Subquestion e

Do the relationships vary by age, sex, race/ethnicity, weight status, or socio-economic status?

Description of the Evidence

- Neither systematic reviews/meta-analyses nor primary research studies considered effect modification by demographic characteristics.

Draft Conclusion Statement

- Conclusion Statement:

  Insufficient evidence is available to determine whether the relationship between sedentary behavior and health outcomes in youth is moderated by age, sex, race/ethnicity, weight status, or socio-economic status.

- Grade: Grade not assignable

Draft Research Recommendations

- Research, using longitudinal research designs, examining the relationship between specific forms of sedentary behavior (e.g., sitting time, screen time) and health outcomes in children and adolescents using both self-report and objective assessment of sedentary behavior.
- Intervention studies to test the effects of reducing sedentary behavior on health outcomes in children and adolescents
- Studies examining the interactive effects of sedentary behavior and physical activity of varying intensities on health outcomes in children and adolescents.
- Research examining the independent effects of sedentary time during TV watching and screen time on health outcomes in children and adolescents.

Committee Discussion

In youth, what is the relationship between sedentary behavior and health outcomes?

a. What is the relationship between sedentary behavior and cardiometabolic risk factors?
b. Does sedentary behavior contribute to excessive weight gain that results in overweight or obesity?
c. What is the relationship between sedentary behavior and bone health?
d. Is there a dose-response relationship? If yes, what is the shape of the relationship?
e. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?

Next Steps

- Continue editorial work on Q3 summary
- Draft chapter