Meeting 5

Cardiometabolic Health and Weight Management

Chair: John Jakicic

Members: Wayne Campbell, Loretta DiPietro, Russ Pate, Linda Pescatello, Ken Powell
Experts and Consultants

• Consultant:
  – Ronald J. Sigal, M.D., M.P.H.
    University of Calgary
1. What is the relationship between physical activity and prevention of weight gain?

2. In people with normal blood pressure or pre-hypertension, what is the relationship between physical activity and blood pressure?

3. In adults without diabetes, what is the relationship between physical activity and incidence of type 2 diabetes?
Question #2

In people with normal blood pressure or pre-hypertension, what is the relationship between physical activity and blood pressure?*

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?

b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, weight status, or resting blood pressure level?

c. Does the relationship vary based on: frequency, duration, intensity, type (mode), or how physical activity is measured?

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

*Subquestions a, b, and c were addressed during the July meeting
There were 8 meta-analyses of randomized clinical control trials that examined the blood pressure response to physical activity among sedentary adults with prehypertension and normal blood pressure [Carlson, 2014; Cornelissen, 2011, 2013b; Corso, 2016; Fagard 2007; MacDonald, 2016; Murtagh, 2015].

- 5 of the meta-analyses included adults with prehypertension [Cornelissen, 2011, 2013b; Corso, 2016; MacDonald, 2016; Murtagh, 2015].
- 7 of the meta-analyses included adults with normal blood pressure [Casonatto, 2016; Carlson, 2014; Cornelissen, 2011, 2013b; Corso, 2016; Fagard 2007; MacDonald, 2016].
Key Findings: Physical Activity and Blood Pressure

- In the 5 meta-analyses involving adults with prehypertension, 5 reported a statistically significant reduction in systolic blood pressure and 4 reported a statistically significant reduction in diastolic blood pressure.

- In the 7 meta-analyses involving adults with normal blood pressure 3 reported a statistically significant reduction and 1 reported a statistically significant rise in systolic blood pressure; and 6 reported a statistically significant reduction in diastolic blood pressure.

- The magnitude of the reductions ranged from 2 to 5 mmHg for systolic blood pressure and 1 to 4 mmHg for diastolic blood pressure.

- The magnitude of these blood pressure reductions may be sufficient to reduce the:
  - Resting blood pressure of some samples with prehypertension into normotensive ranges.
  - Risk of coronary heart disease 4 percent to 5 percent and stroke by 6 percent to 8 percent among adults with prehypertension and normal blood pressure.
In a meta-analysis among 136,846 adults initially free of hypertension at baseline (i.e., those with normal blood pressure) Huai et al. [2013] reported:

- 11.4% adults developed hypertension after an average of 10 years (2 to 45 years) of follow up.
- “High” amounts of leisure-time physical activity (i.e., volume and/or intensity) were associated with a 19% lower risk of hypertension compared to the reference group engaging in “low” leisure-time physical activity (RR 0.81 [95% CI 0.76-0.85]).
- Moderate amounts of recreational physical activity were associated with a 11 percent decreased risk of hypertension compared to lower amounts of recreational physical activity (RR 0.89 [95% CI, 0.85-0.94]).
- No significant associations were found with occupational and commuting physical activity and incident hypertension.
Strong evidence demonstrates that physical activity reduces blood pressure among adults with prehypertension and normal blood pressure. **PAGAC Grade: Strong**
In people with normal blood pressure or pre-hypertension, what is the relationship between physical activity and blood pressure?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?

b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, weight status, or resting blood pressure level?

c. Does the relationship vary based on: frequency, duration, intensity, type (mode), or how physical activity is measured?
In adults without diabetes, what is the relationship between physical activity and the incidence of type 2 diabetes?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?

b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?

c. Does the relationship vary based on: frequency, duration, intensity, type (mode), and how physical activity is measured?

• Source of evidence to answer question:
  – SR/MA/Existing Report
Analytical Framework

Systematic Review Question
In adults without diabetes, what is the relationship between physical activity and the incidence of type 2 diabetes?

Target Population
Adults, ages 18 and older

Comparison
Adults who participate in varying levels of physical activity, including no reported physical activity

Intervention/Exposure
All types and intensities of physical activity including lifestyle activities, leisure activities, and sedentary behavior

Endpoint Health Outcomes
Type 2 diabetes

Key Definitions
Non-diabetic/normal: Having an A1C below 5.7%, fasting blood glucose less than 100 mg/dL, and an OGTT 2 hour blood glucose lower than 140 mg/dL.
Prediabetes: Having an A1C of 5.7%–6.4%, or fasting blood glucose of 100–125 mg/dl, or and/or an OGTT 2 hour blood glucose of 140 mg/dL–199 mg/dL with fasting blood glucose <126 mg/dL.
Diabetes: Having an A1C of 6.5% or higher, fasting blood glucose of 126 mg/dL or higher, and/or an OGTT 2 hour blood glucose of 200 mg/dL or higher.
Search Results: High-Quality Reviews

Reviews include systematic reviews, meta-analyses, and pooled analyses.

1 PubMed database searching N = 972
2 Cochrane database searching N = 123
3 CINAHL database searching N = 29
4 Records after duplicates removed N = 1020
5 Titles screened N = 1020
6 Excluded based on title N = 747
7 Abstracts screened N = 273
8 Excluded based on abstract N = 222
9 Full text reviewed N = 53
10 Excluded based on full text N = 41
11 Articles included N = 12

1 Reviews include systematic reviews, meta-analyses, and pooled analyses.
Description of the Evidence

- 12 reviews
  - Type of review
    - 7 Meta-analyses
    - 4 Systematic reviews
    - 1 pooled analysis
  - Study designs included in the reviews
    - 10 reviews with only cohort studies
    - 1 review with cohort and experimental studies
    - 1 review with cohort, experimental, and case-control studies
Description of the Evidence

• Studies per review:
  – Range of 2 - 81, median 8.5

• Total # subjects per review (8 reviews):
  – Range of 4500 - ~300,000, median 140,000 subjects

• Age of subjects:
  – Average age (3 studies): 50, 50, and 52 years of age
Description of the Evidence

• Physical activity
  – Mostly leisure-time MVPA
  – 4/12 included other domains: transportation, occupational, household

• Dose-response
  – 5 meta-analyses provided point estimates for 3+ volumes of physical activity
• All 12 reviews reported an inverse relationship between volume of physical activity and risk of incident type 2 diabetes.
• High versus low risk estimates, 4 reviews and 1 systematic review:

- 0.45 (0.31, 0.77)
- 0.53 (0.40, 0.70)
- 0.58 (no 95% CI)
- 0.65 (0.59, 0.71)
- 0.83 (0.76, 0.90)
Draft Key Findings

Dose-response curves from 5 meta-analyses

Relative risk of incidence of T2D

0 MET-hr/wk  5 MET-hr/wk  10 MET-hr/wk  15 MET-hr/wk  20 MET-hr/wk  25 MET-hr/wk  30 MET-hr/wk

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• One systematic review and one meta-analysis presented information regarding the effect of weight status on the relationship between physical activity and type 2 diabetes.

• No evidence of effect modification
• Strong evidence demonstrates an inverse relationship between volume of moderate to vigorous physical activity and incidence of type 2 diabetes.

PAGAC Grade: Strong
• Strong evidence demonstrates the existence of an inverse, curvilinear dose-response relationship between volume of physical activity and incidence of type 2 diabetes, with a decreasing slope at higher levels of physical activity.

PAGAC Grade: Strong
• Moderate evidence indicates that the inverse relationship between volume of physical activity and risk of type 2 diabetes does not vary by weight status.

PAGAC Grade: Moderate
Conclusion Statement

• Limited evidence suggests that the relationship between higher volume of physical activity and lower incidence of type 2 diabetes is not influenced by age, sex, or race ethnicity. **PAGAC Grade: Limited**

• Insufficient evidence is available to determine if the relationship between physical activity and the incidence of type 2 diabetes varies by socioeconomic status. **PAGAC Grade: Grade not assignable**

• Insufficient evidence exists to determine whether the relationship between physical activity and the incidence of type 2 diabetes varies by the frequency, intensity, duration, or type of physical activity, or how physical activity is measured. **PAGAC Grade: Grade not assignable**
• Determine the value of different types (e.g., strength, alternative) and intensities (e.g., light, vigorous) of physical activity on the incidence of type 2 diabetes.

• Determine whether the relationship between physical activity and risk of type 2 diabetes varies by age, sex, race/ethnicity, and socio-economic status.
In adults without diabetes, what is the relationship between physical activity and the incidence of type 2 diabetes?

a. Is there a dose-response relationship? If yes, what is the shape of the relationship?

b. Does the relationship vary by age, sex, race/ethnicity, socio-economic status, or weight status?

c. Does the relationship vary based on: frequency, duration, intensity, type (mode), and how physical activity is measured?
Next Steps

- Final edits to Q1 document (including tables)
- Final edits to Q2 document (including tables)
- Final edits to Q3 document (including tables)
  - Initial review by Anne Rodgers
- Integration of full document for final report