

# Dietary Carbohydrate intake and mortality: a prospective cohort study and meta-analysis

*Seidelmann et al. Lancet. 2018*

## STUDY 1

# What's the Connection? Carbohydrates & Mortality



# Background

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- Low carb diets are still very popular
- High carb diets are also very popular
- Effect on mortality controversial?
- Meta-analyses from North America and Europe suggest increased mortality from low CHO

Nilsson et al. Eur J Clin Nutr. 2012  
Noto et al. Plos One. 2013

# Methods

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- Atherosclerosis Risk in Communities (ARIC) study
- Prospective, observational study
- 4 US Communities
  - Forsyth County, NC
  - Jackson, MS
  - Minneapolis, MN
  - Washington County, MD
- Age 45-64
- Median follow-up: 25 years



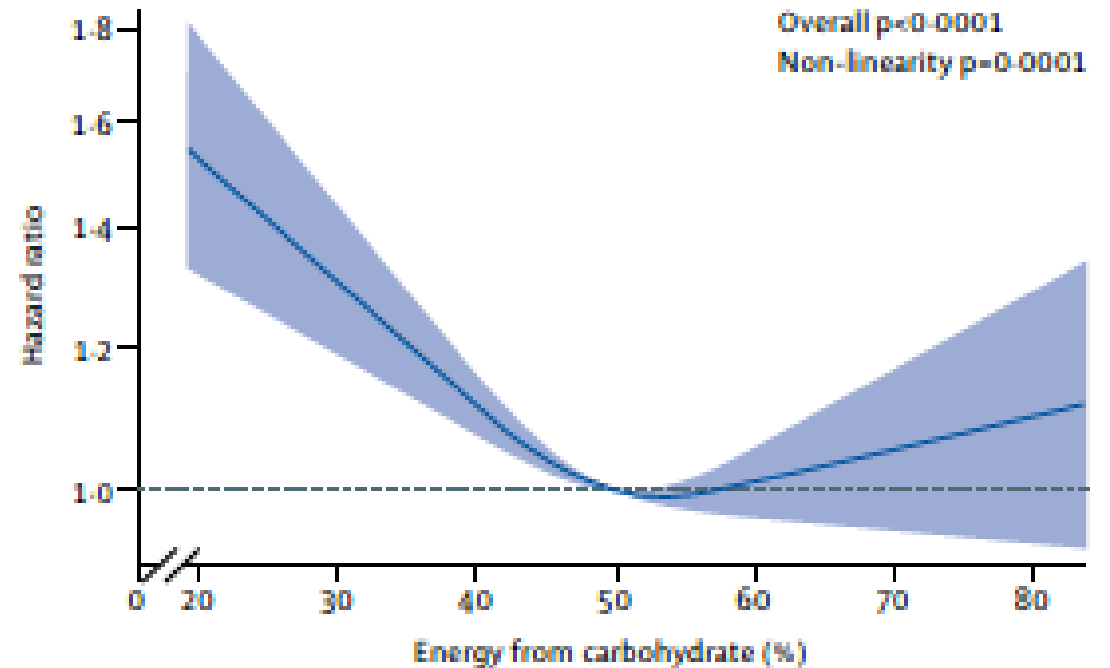
# Population Characteristics

- Mean CHO intake: 48.9%
- Total energy intake: 1558-1607 cal/d
- Mostly Caucasian
- Lo carb group
  - Male
  - College grad
  - High BMI
  - Less exercise
  - More smoking
  - More diabetes

	Q1 (n=3086)	Q2 (n=3086)	Q3 (n=3085)	Q4 (n=3086)	Q5 (n=3085)	P <sub>total</sub>
Median % of energy from carbohydrate	37% (5.7)	44% (2.5)	49% (2.2)	53% (2.8)	61% (6.3)	NA
Mean age, years (SD)	53.7 (5.7)	54.3 (5.7)	54.3 (5.8)	54.3 (5.8)	54.3 (5.8)	<0.0001
Sex						<0.0001
Men	1635 (53%)	1496 (48%)	1379 (45%)	1294 (42%)	1112 (36%)	..
Women	1451 (47%)	1590 (52%)	1706 (55%)	1792 (58%)	1973 (64%)	..
Race						<0.0001
White	2345 (76%)	2320 (75%)	2255 (73%)	2203 (71%)	2133 (69%)	..
Black	731 (24%)	764 (25%)	822 (27%)	875 (28%)	932 (30%)	..
Asian	4 (<1%)	1 (<1%)	6 (<1%)	6 (<1%)	17 (1%)	..
Native American	6 (<1%)	1 (<1%)	2 (<1%)	2 (<1%)	3 (<1%)	..
Mean BMI, kg/m <sup>2</sup>	28.0 (0.1)	27.9 (0.1)	27.6 (0.1)	27.6 (0.1)	27.4 (0.1)	<0.0001
Diabetes	415 (13%)	404 (13%)	345 (11%)	330 (11%)	316 (10%)	<0.0001
Hypertension	1095 (35%)	1028 (33%)	1046 (34%)	1052 (34%)	1148 (37%)	0.4436
Smoking*						<0.0001
Current smoker	1016/3083 (33%)	821/3085 (27%)	787/3083 (26%)	707/3084 (23%)	687/3084 (22%)	..
Former smoker	1079/3083 (35%)	1042/3085 (34%)	995/3083 (32%)	950/3084 (31%)	899/3084 (29%)	..
Never smoker	988/3083 (32%)	1220/3085 (40%)	1301/3083 (42%)	1427/3084 (46%)	1496/3084 (48%)	..
Unknown	0	2/3085 (<1%)	0	0	2/3084 (<1%)	..
Highest exercise activity (quantile 5)	474 (15%)	534 (17%)	575 (19%)	581 (19%)	614 (20%)	<0.0001
College graduates	905 (29%)	860 (28%)	774 (25%)	738 (24%)	674 (22%)	<0.0001
Household income*						<0.0001
<\$5000	154/2909 (5%)	138/2913 (5%)	154/2918 (5%)	154/2905 (5%)	174/2876 (6%)	..
\$5000-\$7999	118/2909 (4%)	107/2913 (4%)	108/2918 (4%)	125/2905 (4%)	164/2876 (6%)	..
\$8000-\$11999	140/2909 (5%)	160/2913 (5%)	187/2918 (6%)	187/2905 (6%)	192/2876 (7%)	..
\$12000-\$15999	185/2909 (6%)	203/2913 (7%)	205/2918 (7%)	229/2905 (8%)	239/2876 (8%)	..
\$16000-\$24999	406/2909 (14%)	385/2913 (13%)	453/2918 (16%)	462/2905 (16%)	480/2876 (17%)	..
\$25000-\$34999	456/2909 (16%)	531/2913 (18%)	524/2918 (18%)	529/2905 (18%)	553/2876 (19%)	..
\$35000-\$49999	582/2909 (20%)	587/2913 (20%)	584/2918 (20%)	558/2905 (19%)	507/2876 (18%)	..
>\$50000	868/2909 (30%)	802/2913 (28%)	703/2918 (24%)	661/2905 (23%)	567/2876 (20%)	..
Mean total energy intake, kcal	1558 (11)	1655 (11)	1660 (11)	1646 (11)	1607 (11)	0.0092
Mean animal protein % of energy	16.9% (0.1)	14.8% (0.1)	13.5% (0.1)	12.3% (0.1)	10.1% (0.1)	<0.0001
Mean plant protein % of energy	3.9% (0.02)	4.3% (0.02)	4.5% (0.02)	4.6% (0.02)	4.8% (0.02)	<0.0001
Mean animal fat % of energy	26.3% (0.1)	22.4% (0.1)	19.9% (0.1)	17.6% (0.1)	13.6% (0.1)	<0.0001
Mean plant fat % of energy	12.5% (0.1)	13.6% (0.1)	13.6% (0.1)	13.2% (0.1)	11.5% (0.1)	<0.0001
Mean dietary fibre, g	13.5 (0.1)	16.5 (0.1)	17.7 (0.1)	18.7 (0.1)	19.8 (0.1)	<0.0001
Glycaemic index	71.8 (0.1)	74.1 (0.1)	74.9 (0.1)	76.0 (0.1)	76.7 (0.1)	<0.0001
Glycaemic load	100.6 (1.1)	134.6 (1.1)	151.1 (1.1)	166.8 (1.1)	191.7 (1.1)	<0.0001
Change in BMI						
3-year change	0.36 (0.03)	0.33 (0.03)	0.31 (0.03)	0.32 (0.03)	0.41 (0.03)	0.3878
6-year change	0.94 (0.04)	0.93 (0.04)	0.86 (0.04)	0.94 (0.04)	0.92 (0.04)	0.8206

# Results

- U-shaped curve with lowest mortality at 50-55% CHO intake
- Highest mortality with lowest CHO intake



**Figure 1: U-shaped association between percentage of energy from carbohydrate and all-cause mortality in the ARIC cohort**

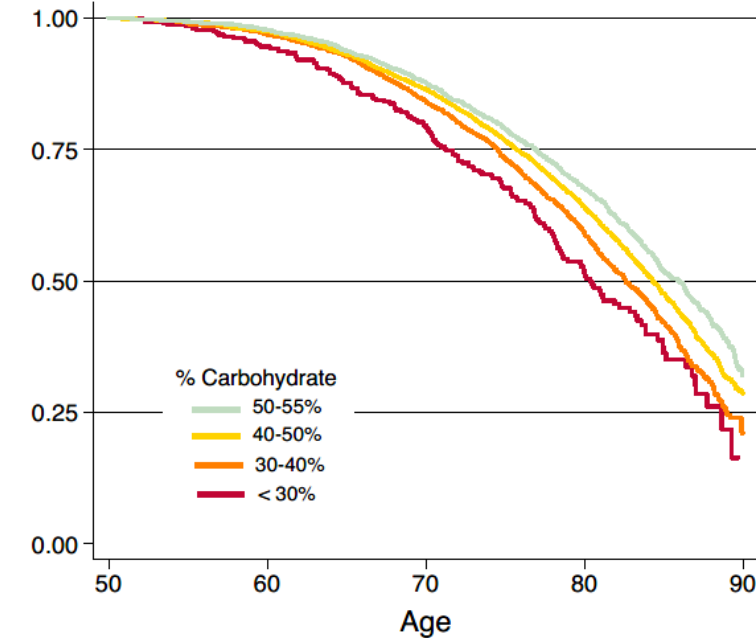
The reference level is 50% energy from carbohydrate. Results are adjusted for age, sex, race, ARIC test centre, total energy consumption, diabetes, cigarette smoking, physical activity, income level, and education. ARIC=Atherosclerosis Risk in Communities.

Seidelmann et al. Lancet. 2018



# Results

- Compared to moderate CHO intake:
  - Highest CHO intake: died 1.1 yrs. sooner
  - Lowest CHO intake: died 4 yrs. sooner



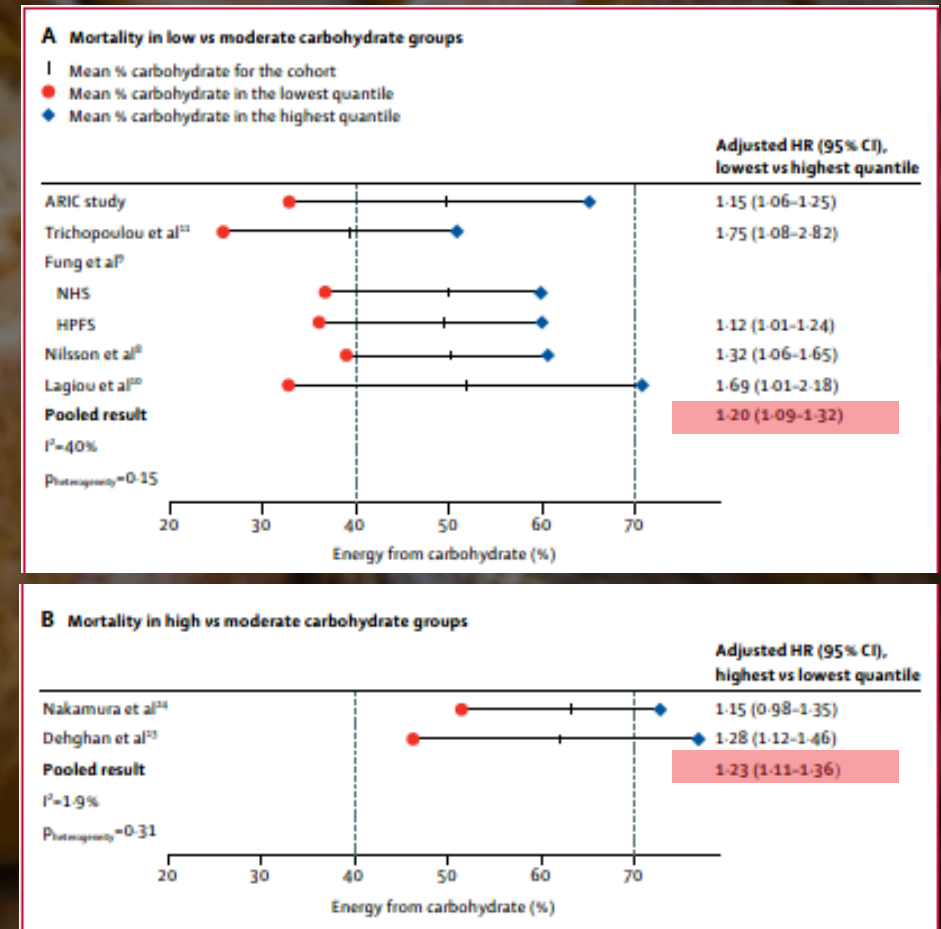
<u>% Carb</u>	<u>Mean Survival in Years from Age 50</u>	<u>Years Difference</u>	<u>P value for difference</u>
>65%		-1.1 (-0.1, -2.0) years	P=0.028
55-65%		0.1 (-0.4, 0.7) years	P=0.7
50 to 55%		Reference=33.1 years	—
40 to 50%		-1.0 (-0.5, -1.5) years	P=1.2 x 10 <sup>-4</sup>
30 to 40%		-2.3 (-1.7, -2.9) years	P=8.4 x 10 <sup>-13</sup>
<30%		-4.0 (-2.6, -5.3) years	P=1.1 x 10 <sup>-8</sup>

**Mean Residual Lifespan in Years**

Seidelmann et al. Lancet. 2018

# Results: Meta-analysis

- Low vs moderate CHO intake
  - **20%** ↑ mortality
- High vs moderate CHO intake
  - **23%** ↑ mortality

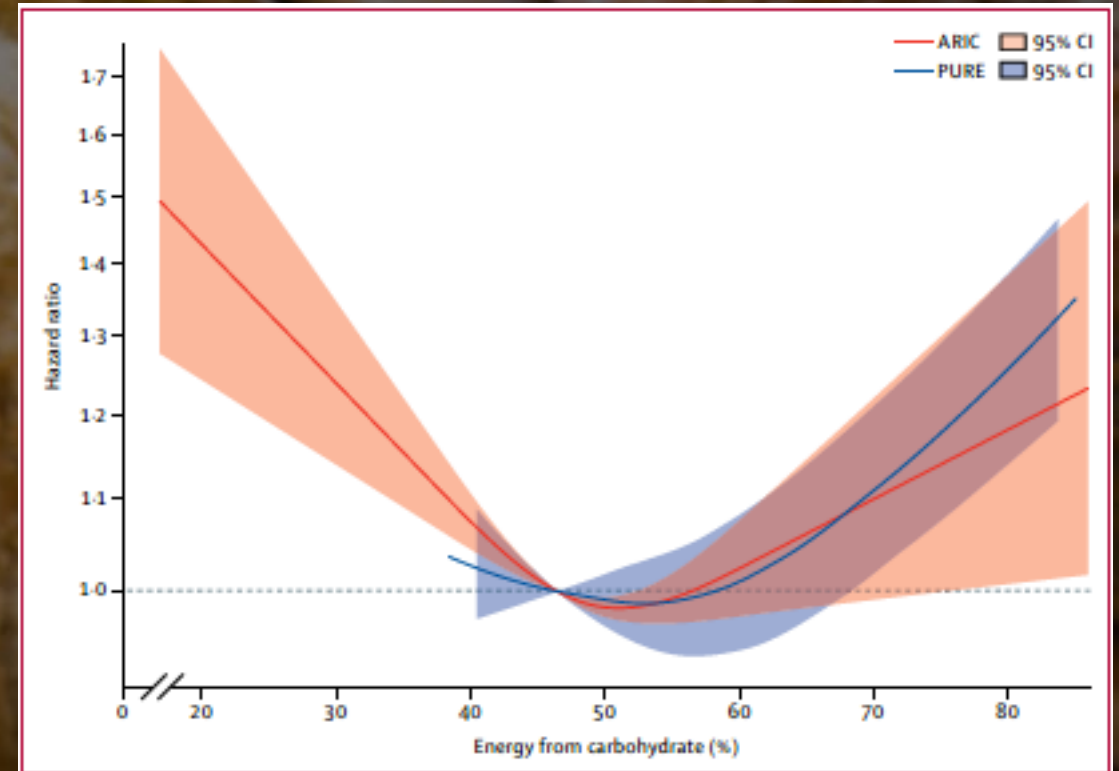


Seidelmann et al. Lancet. 2018



# Results: ARIC vs PURE

- Similar **increase** in mortality w/ higher CHO intake in ARIC and PURE

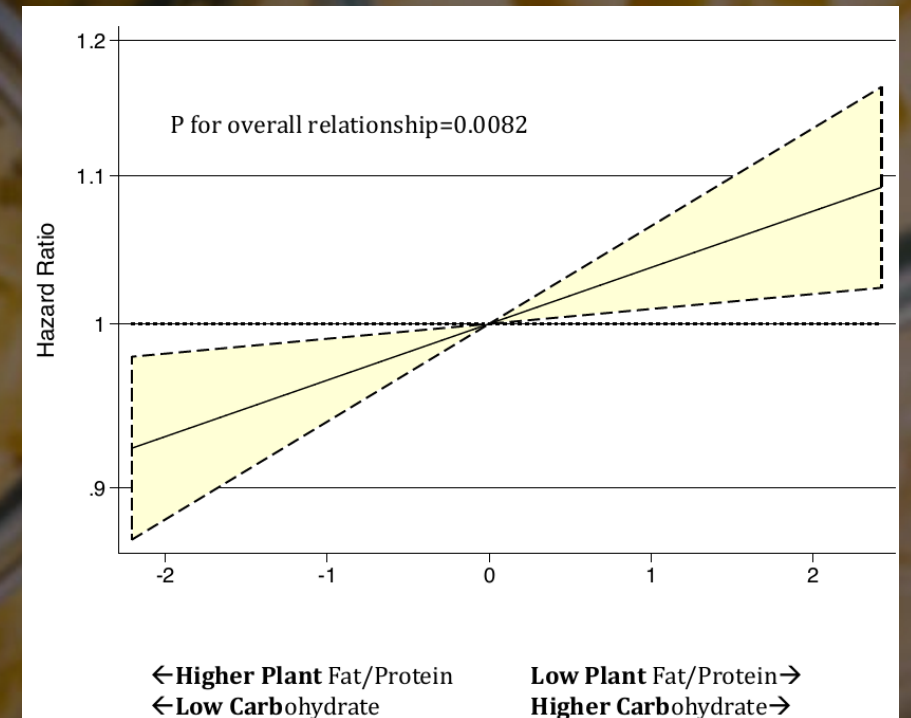
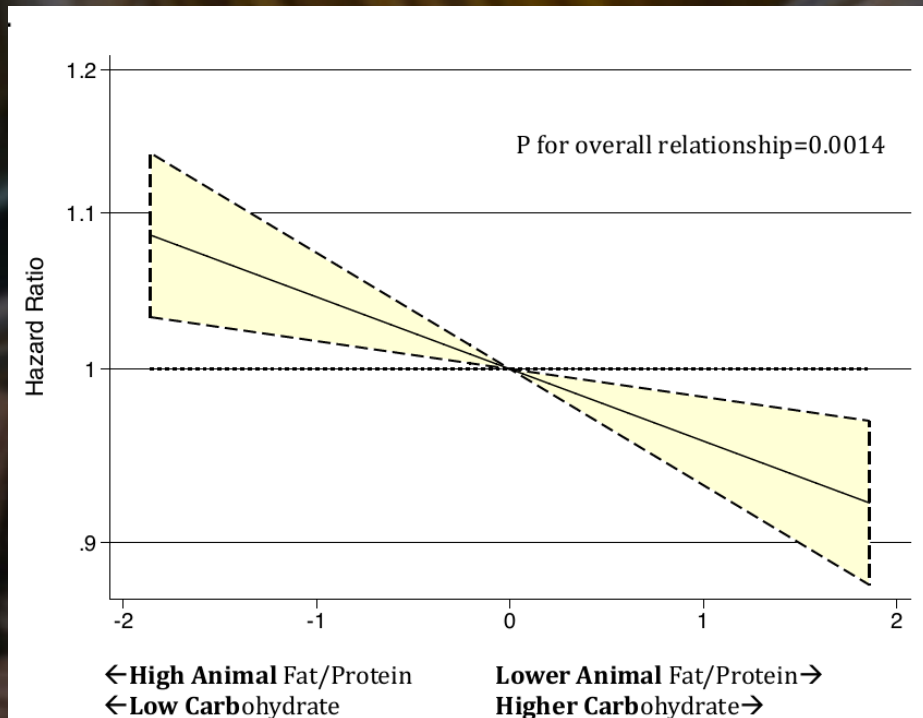


Seidelmann et al. Lancet. 2018



# Results: Low Carb Animal vs Plant

- Low CHO, high ANIMAL fat/protein: **higher mortality**
- Low CHO, high PLANT fat/protein: **lower mortality**



# Limitations

- Didn't define if CHO **refined vs complex** (same with PURE trial)
- Animal protein: beef, pork, lamb, chicken.
  - No data on fish
- Authors disclosures: receive funding from California Walnut Commission and Dairy Management (not used for this project); grants from NIH, Novartis, Zogenix
- Cohort study, only correlation and not causation
- Total calorie intake **1560-1660 kcal/day**: not representative of population
- FFQ reliability of recall; diet assessed at **2 intervals** (over 6 years) out of the 25 year duration of study
- Residual confounders



## Bottom Line:

- Both a high Carbohydrate and low carbohydrate are linked with **higher mortality**
- Low carbohydrate diets with plant fats and protein have **lower** mortality risk than those with animal fats and protein
- Quality of carbohydrates matter

### STUDY 1

# What's the Connection? Carbohydrates & Mortality

# Association between physical exercise and mental health in 1.2 million individuals in the USA between 2011 and 2015: a cross-sectional study

*Chekroud et al. Lancet. 2018*

## STUDY 2

# What's the Connection? Physical Activity & Mental Health



# Background

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- Exercise linked w/ ↓ risk of
  - All-cause mortality
  - CV mortality
  - Stroke
  - Diabetes
- Depression is now leading cause of global disability burden
- Question on exercise and mental health is less clear

# Methods

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- Cross-sectional study
- Data from Behavioral Risk Factor Surveillance System survey from CDC
- Age 18+, all 50 states
- Data collected on 2011, 2013 and 2015
- N = 1,237,194



# Methods

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- Participants self-reported **depression** history
  - *“Has a doctor, nurse, or other health professional EVER told you that you have a depressive disorder, including depression, major depression, dysthymia, or minor depression?”*
- Participants self-reported outcome measure of **mental health days**
  - *“Now thinking about your mental health, which includes **stress**, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?”*

# Methods

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- **Physical Activity**

- *“During the past month, other than your regular job, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?”*
- *“What type of physical activity or exercise did you spend the most time doing during the past month?”*



# Methods

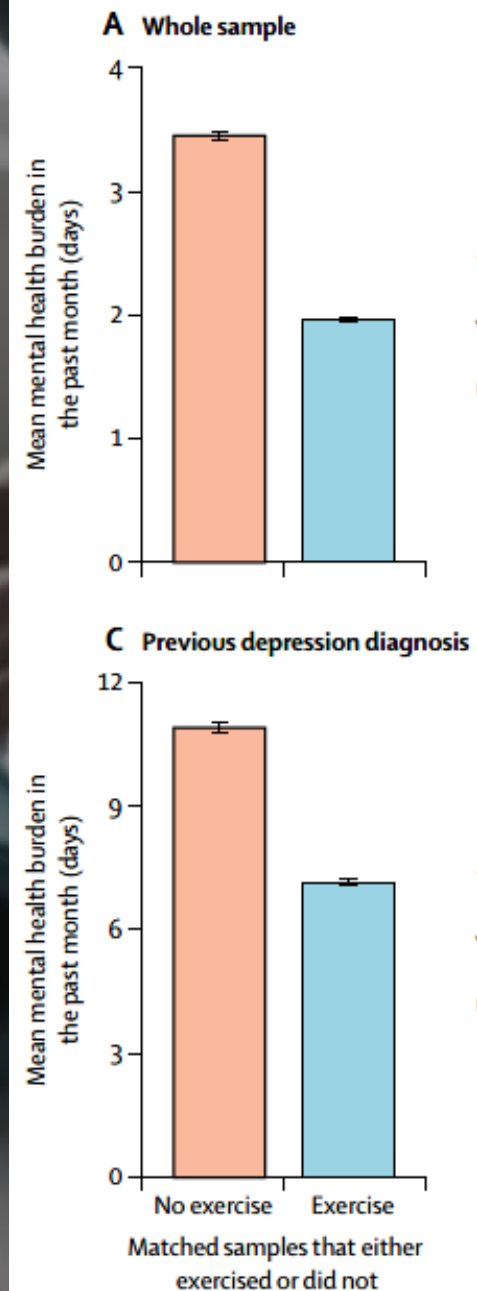
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- Results adjusted for:
  - Age, race, gender, marital status, income, employment status, education level, BMI, self reported physical health, and previous depression diagnosis

# Results

## Mental health days w/ exercise

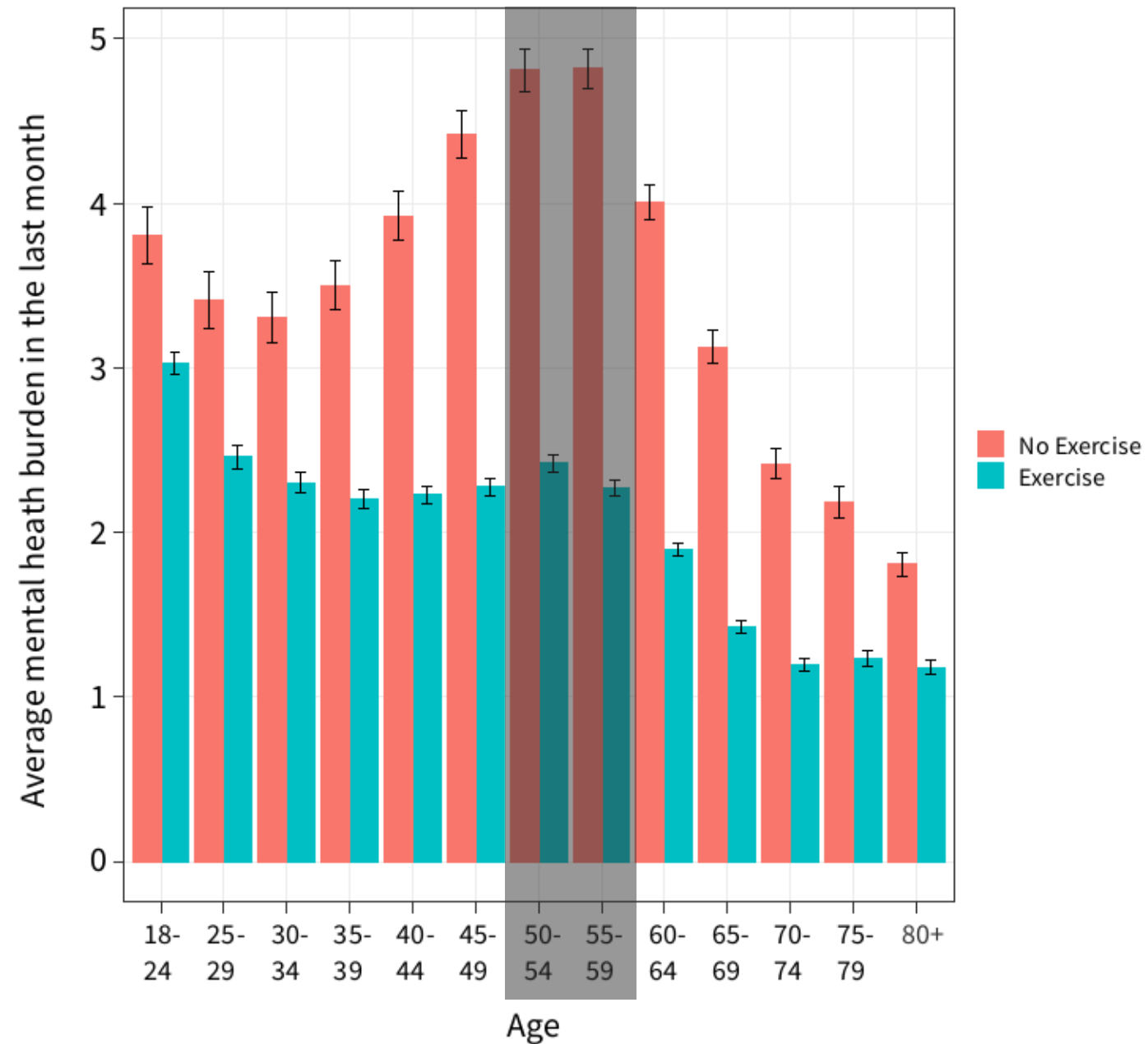
- Whole Sample
  - **43.2%** ↓ self-reported mental health burden
- Previous Depression Diagnosis
  - **34.5%** ↓ self-reported mental health burden





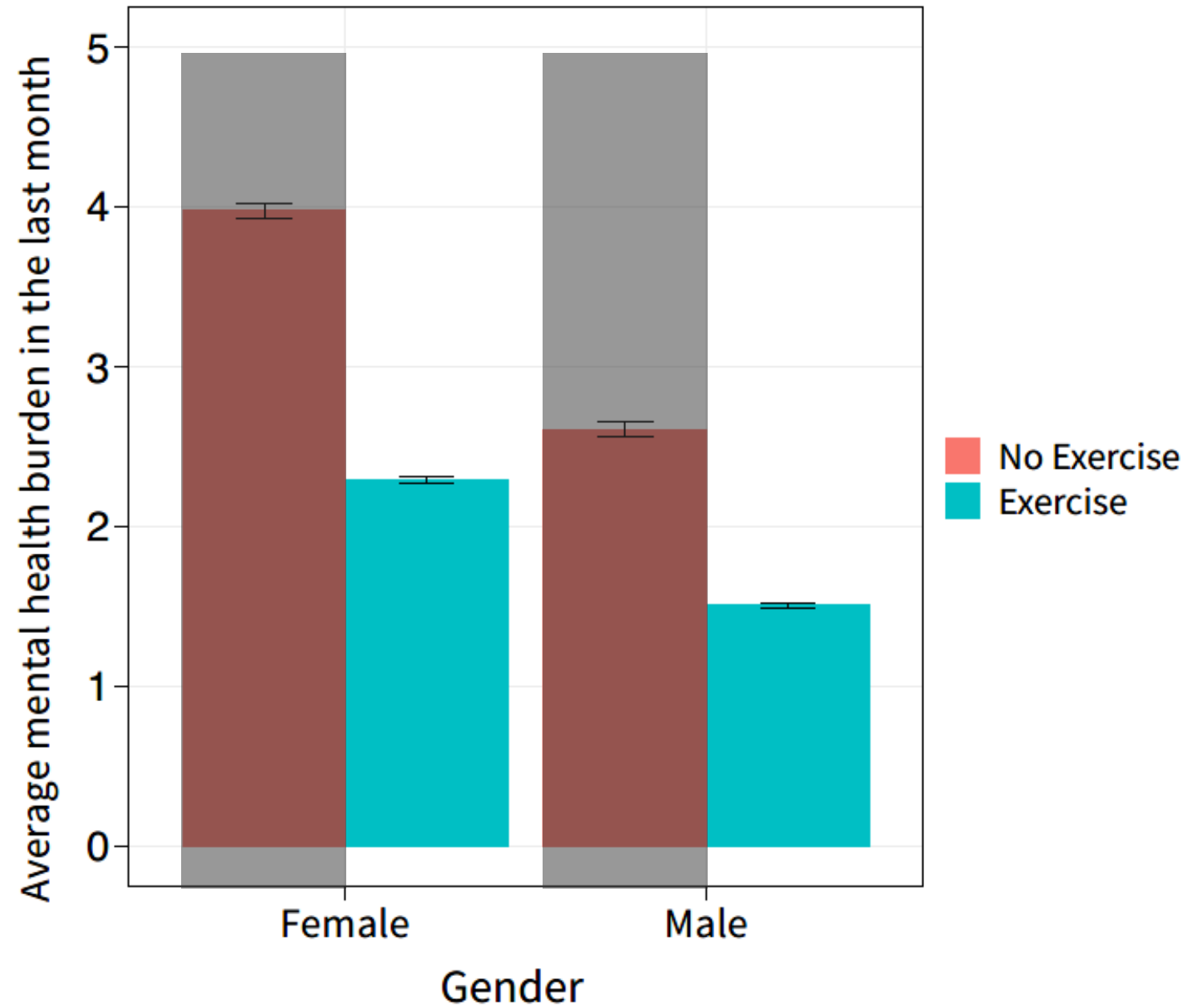
# Results

## Exercise and mental health across lifespan



# Results

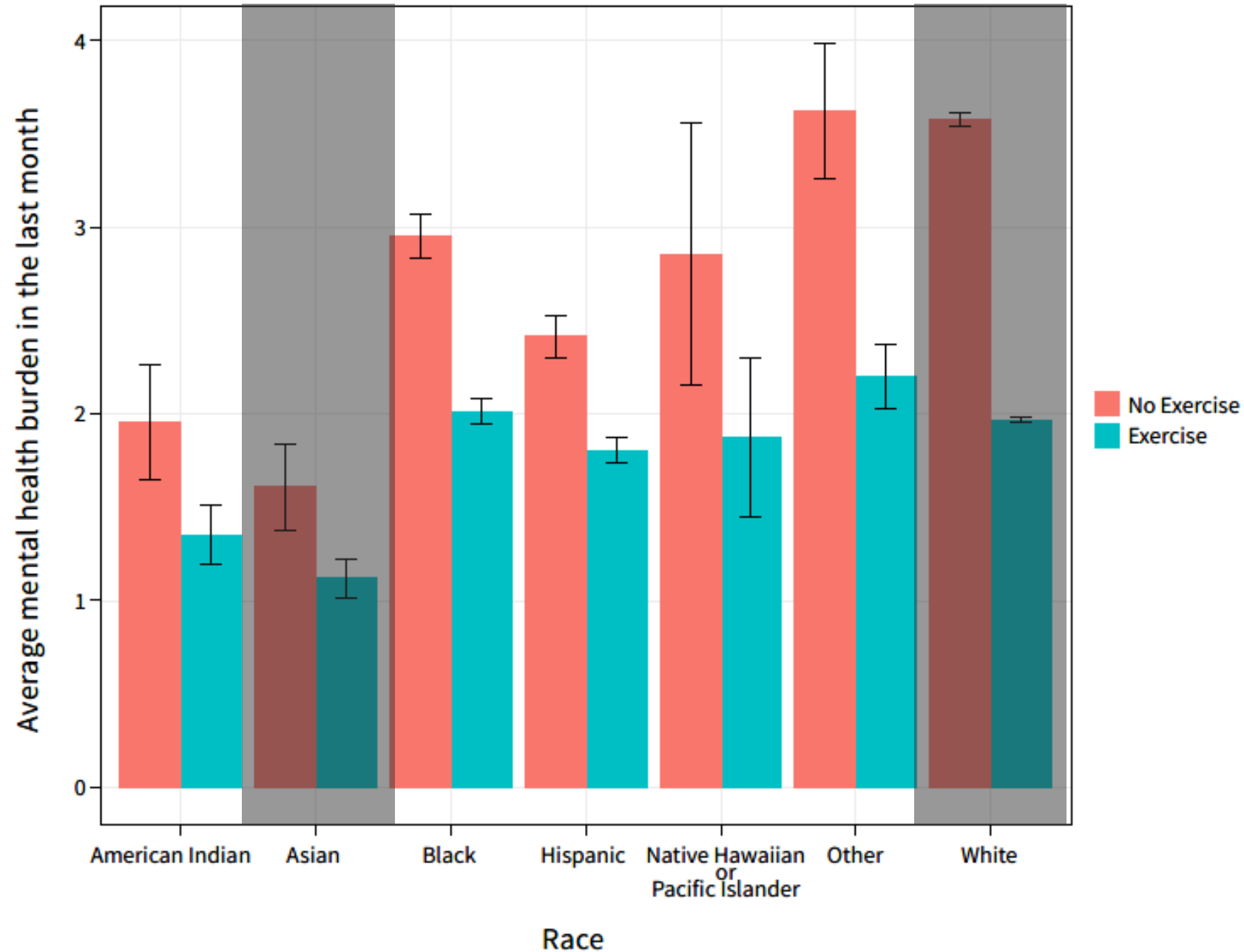
## Exercise and mental health across gender





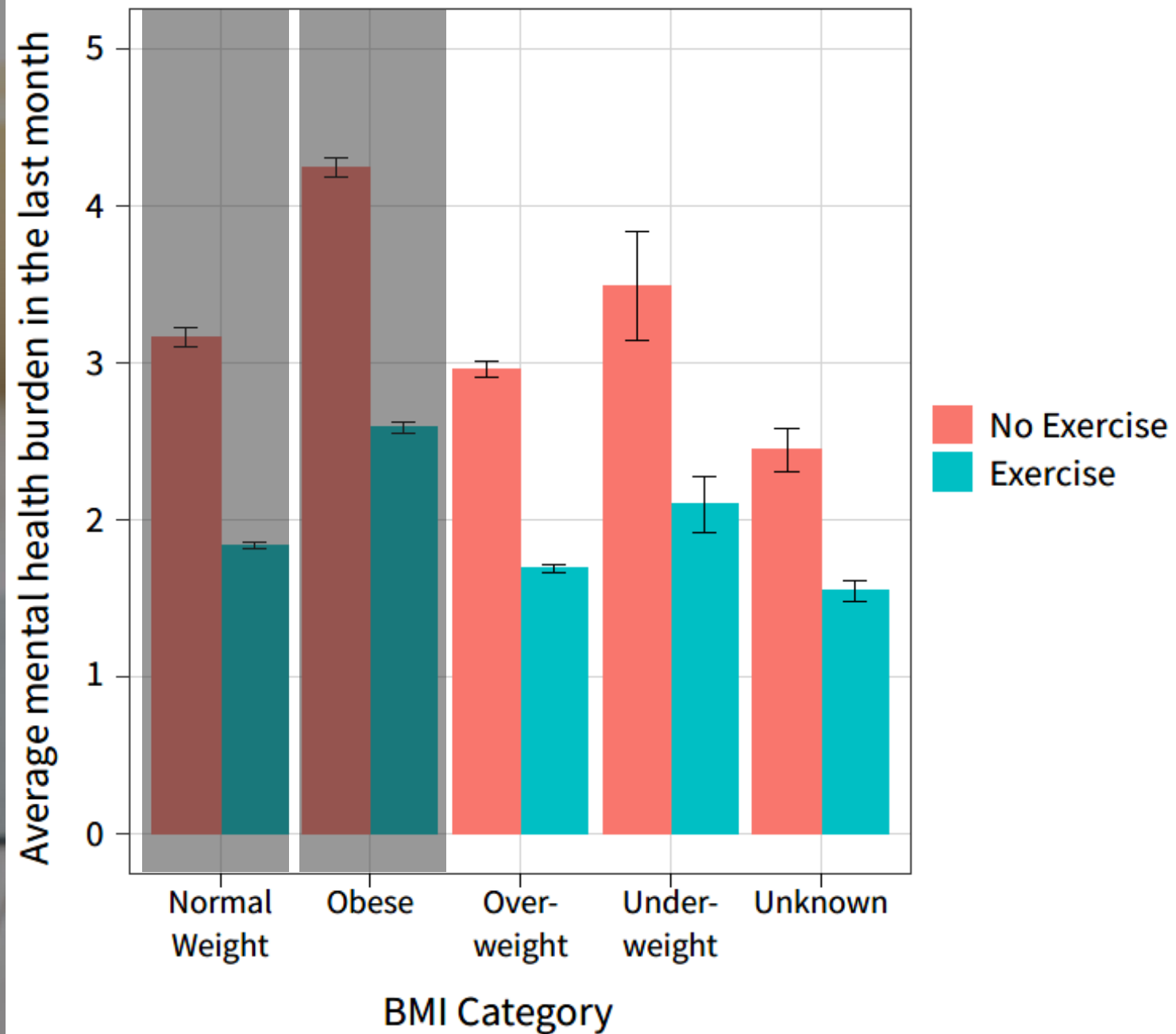
# Results

## Exercise and mental health across and race



# Results

## Exercise and mental health across BMI

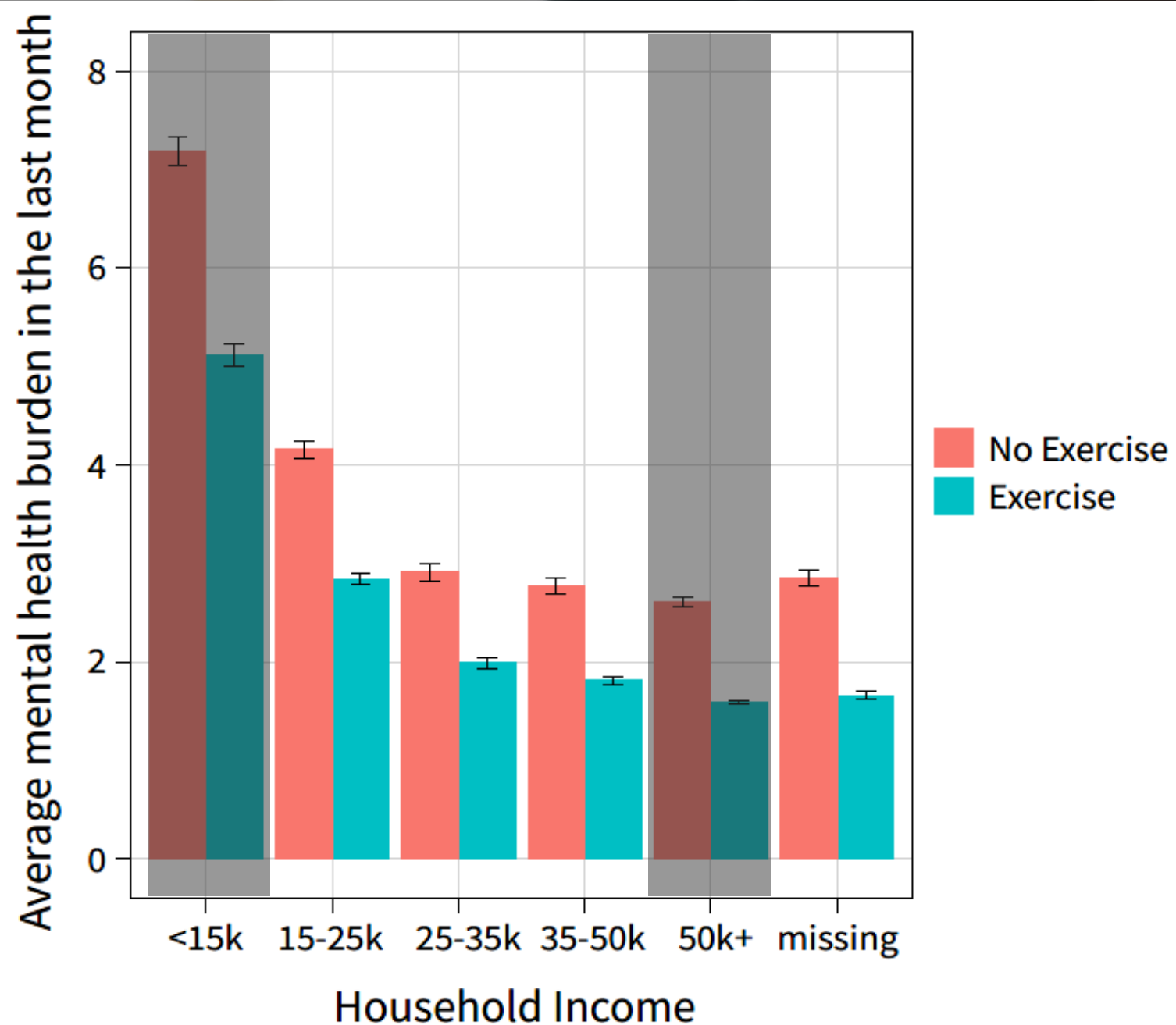




# Results

## Household income and mental health burden

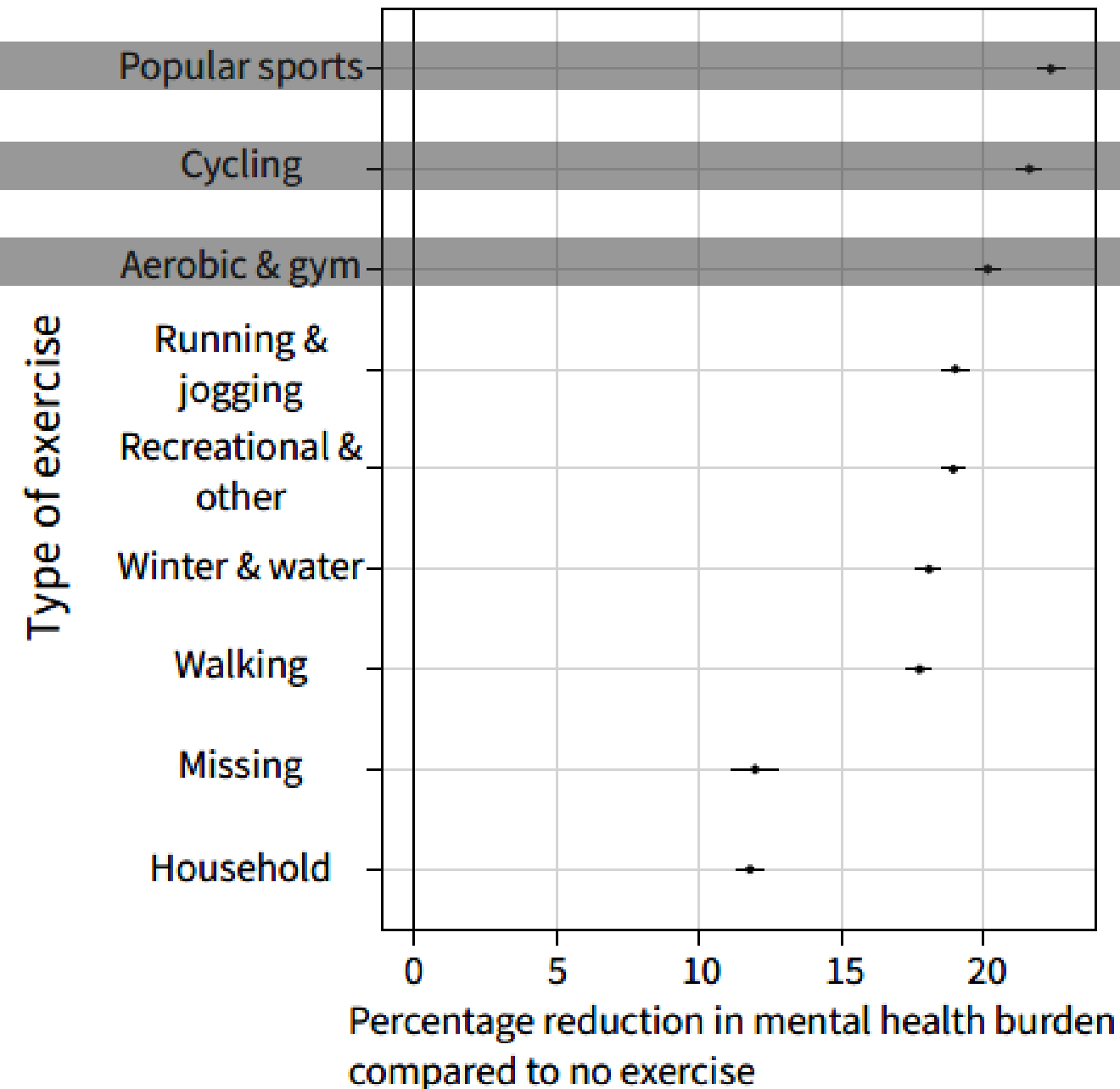
- \$50k+ vs < \$15k
  - **17%** ↓ mental health burden



# Results

## Exercise type and mental health burden

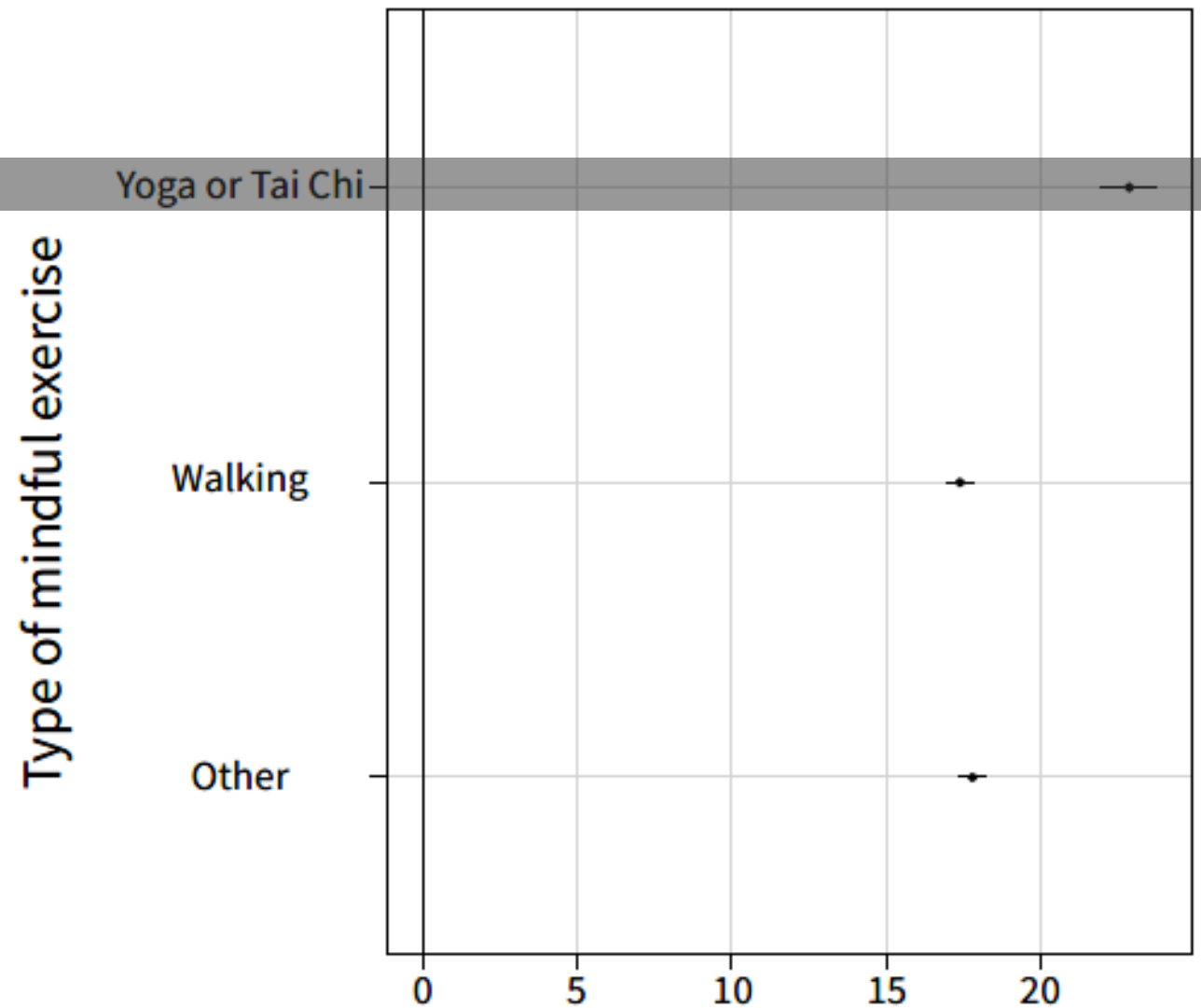
- **Popular sports (team-based): 22.3% ↓**
- **Cycling: 21.6% ↓**
- **Aerobic and Gym exercises: 21.1% ↓**





# Results

Mindful exercise and mental health burden vs no exercise in whole sample

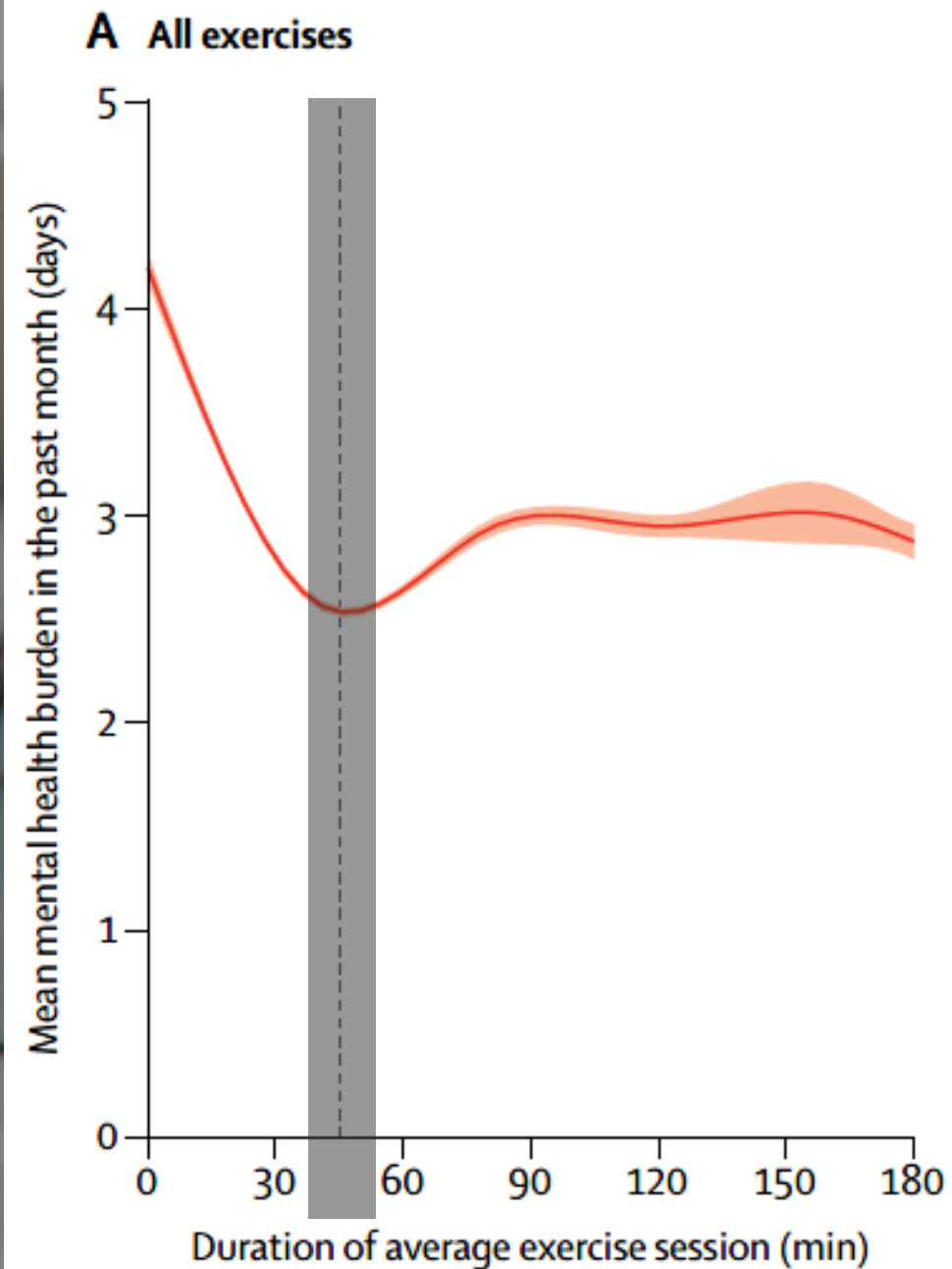


Percentage reduction in mental health burden compared to no exercise

# Results

## Exercise duration and mental health burden

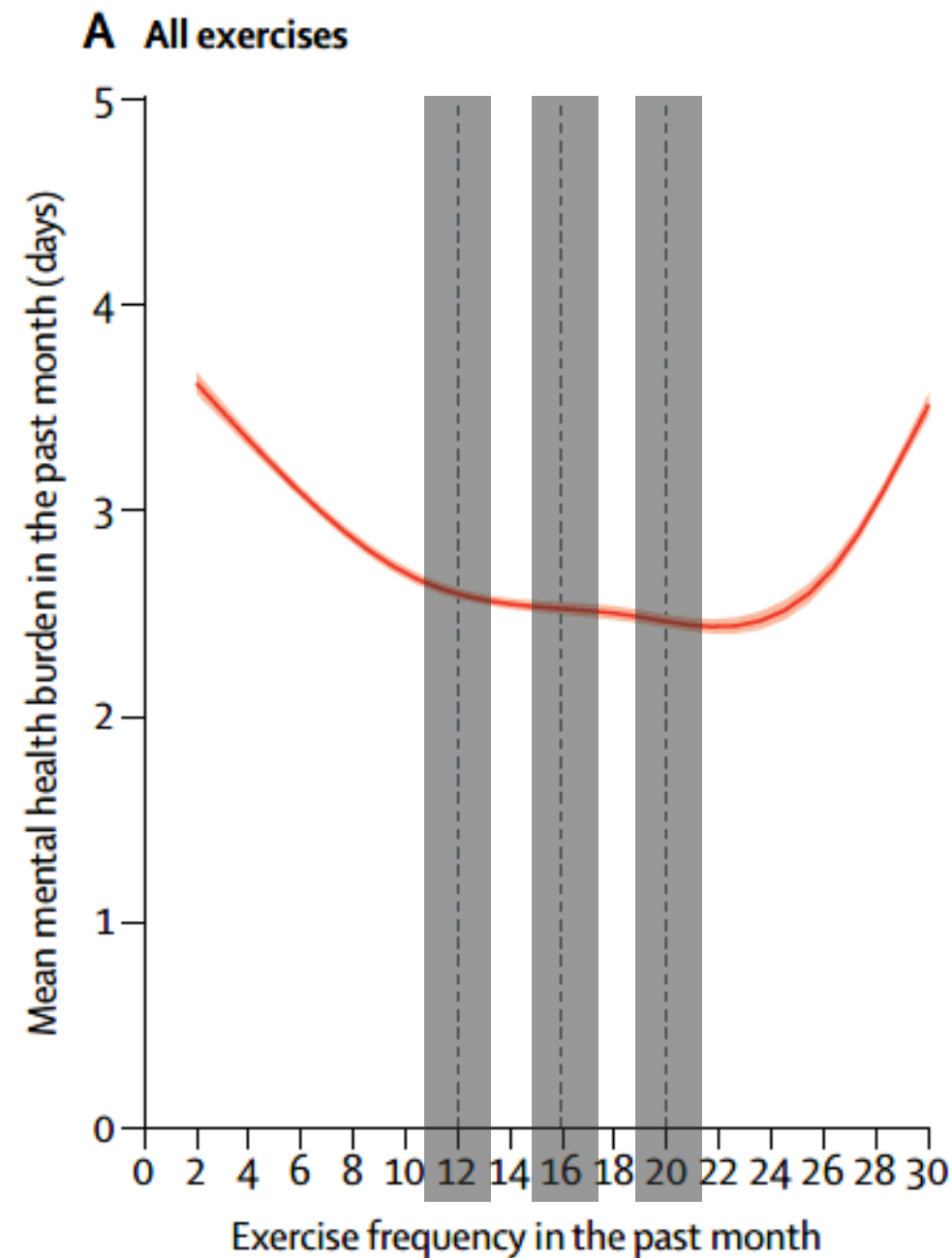
- **Optimal duration: 45 minutes**



# Results

## Exercise frequency and mental health burden

- **Optimal frequency: 3-5 days/wk**





# Limitations

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- Cross-sectional study; correlation and not causation
- Reverse causation ?
- Residual confounding factors
- Self-reported mental health burden; no validated questionnaire to assess mental state
- Definition of mental burden very broad
- Underestimate of exercise in those doing multiple activities (e.g. walking and gym)
- No follow-up

## Bottom Line

- Exercise is linked to lower mental health burden
- Optimal amount seems to be 45 min, 3-5 times per week
- Best exercises are popular team sports, cycling, aerobic and gym activities

### STUDY 2

# What's the Connection? Physical Activity & Mental Health

# Thank You

for joining today's session



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