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

- 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

- 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_{trend}
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/m²	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
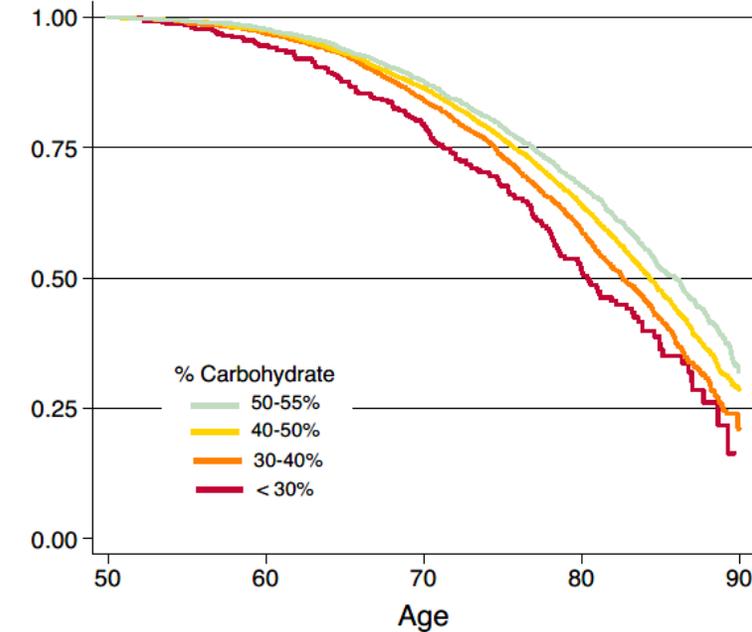
- Highest mortality with lowest CHO intake
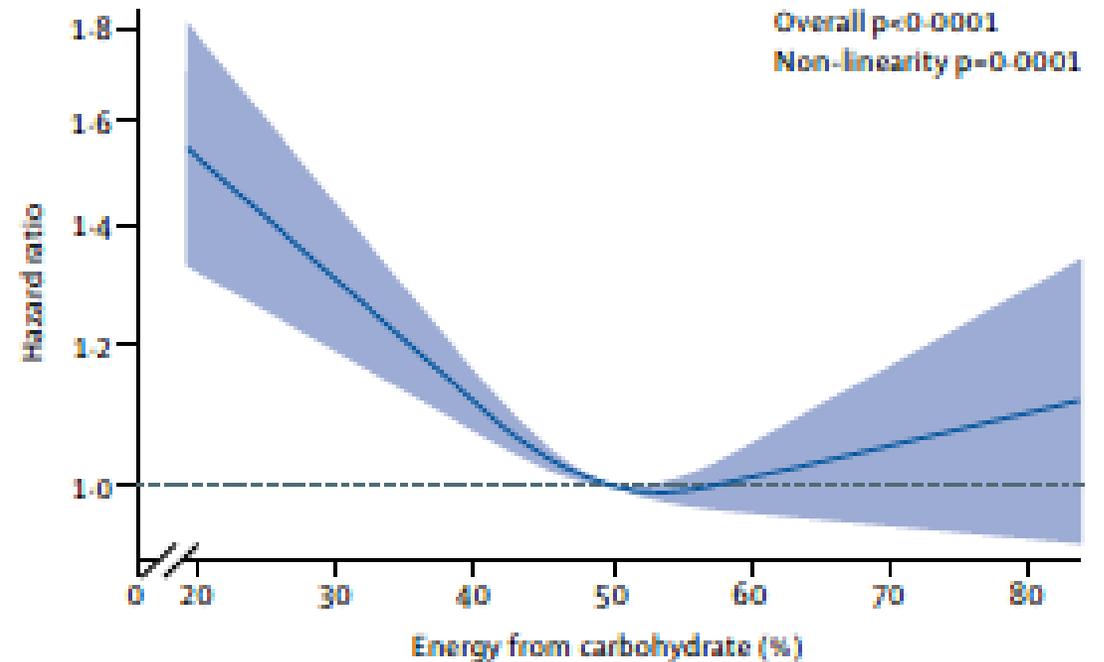
Figure 1: U-shaped association between percentage of energy from carbohydrate and all-cause mortality in the ARIC cohort
The reference level is 50% energy from carbohydrate. Results are adjusted for age, sex, race, ARIC test centre, total energy consumption, diabetes, cigarette smoking, physical activity, 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

Seidelmann et al. Lancet. 2018
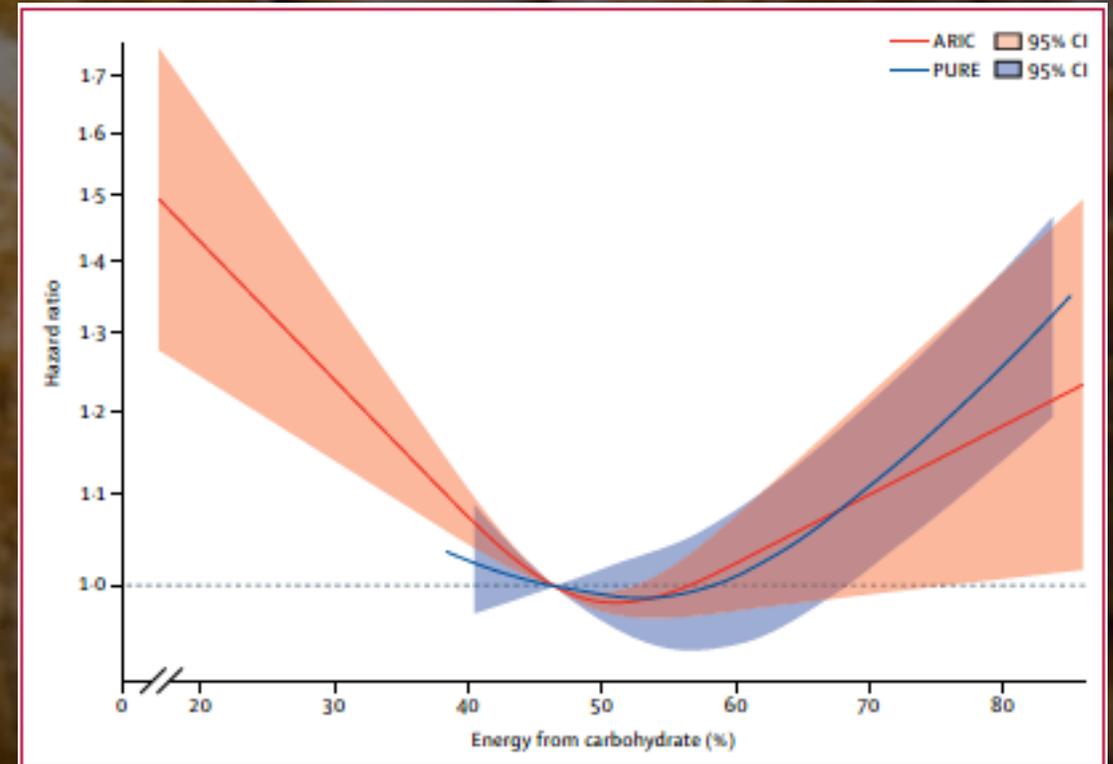
Results: Meta-analysis

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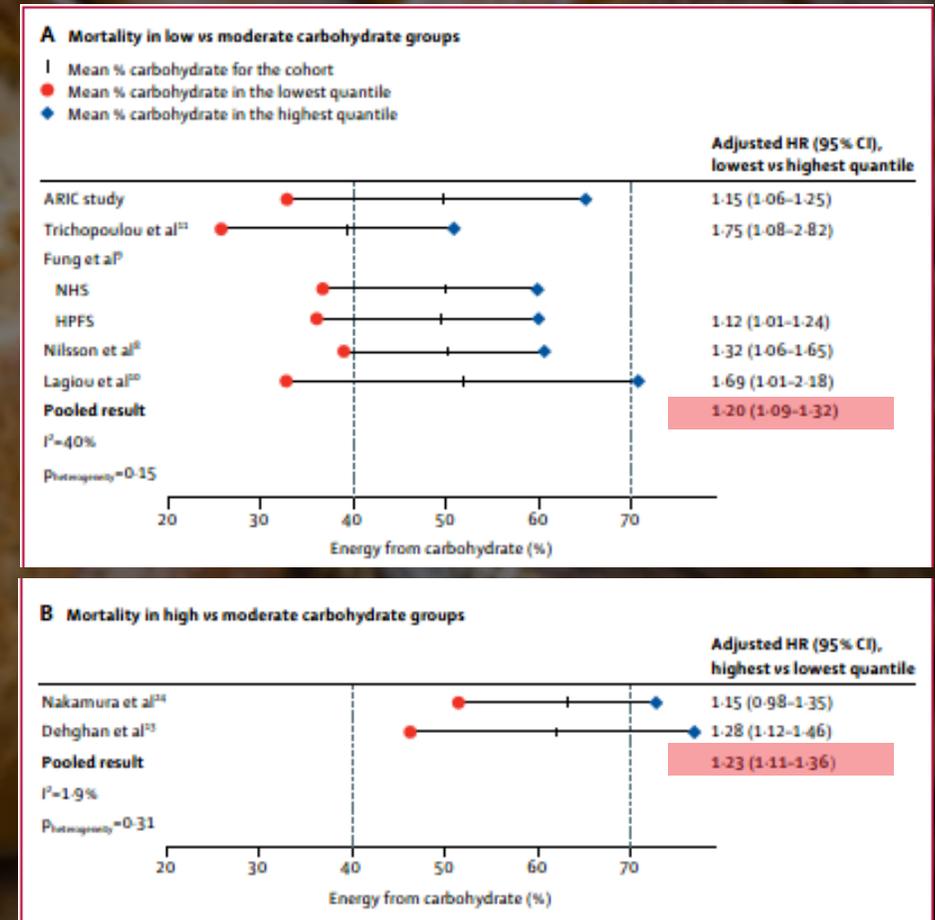
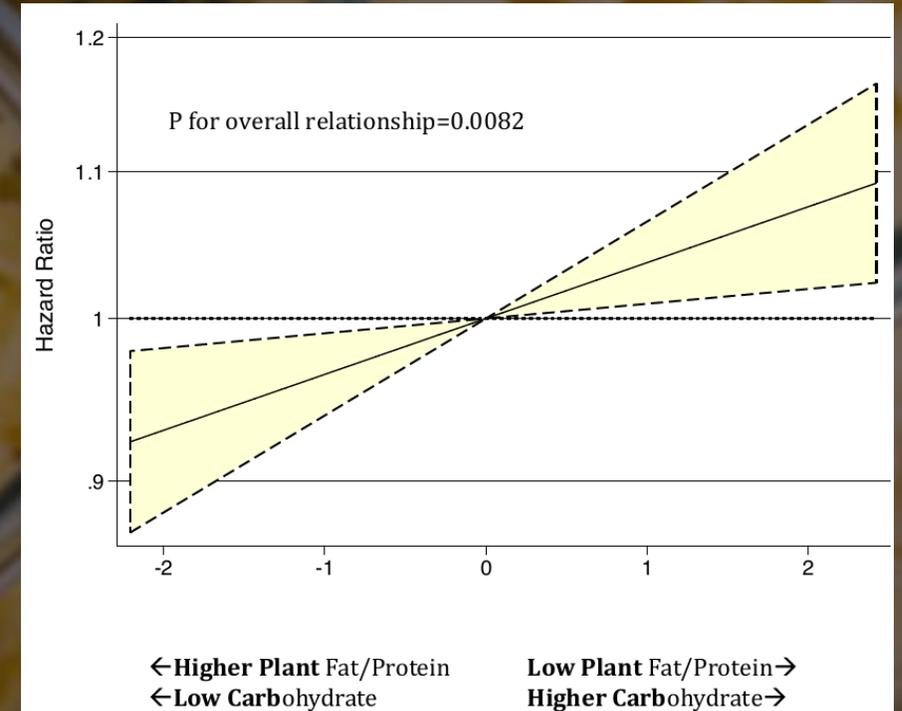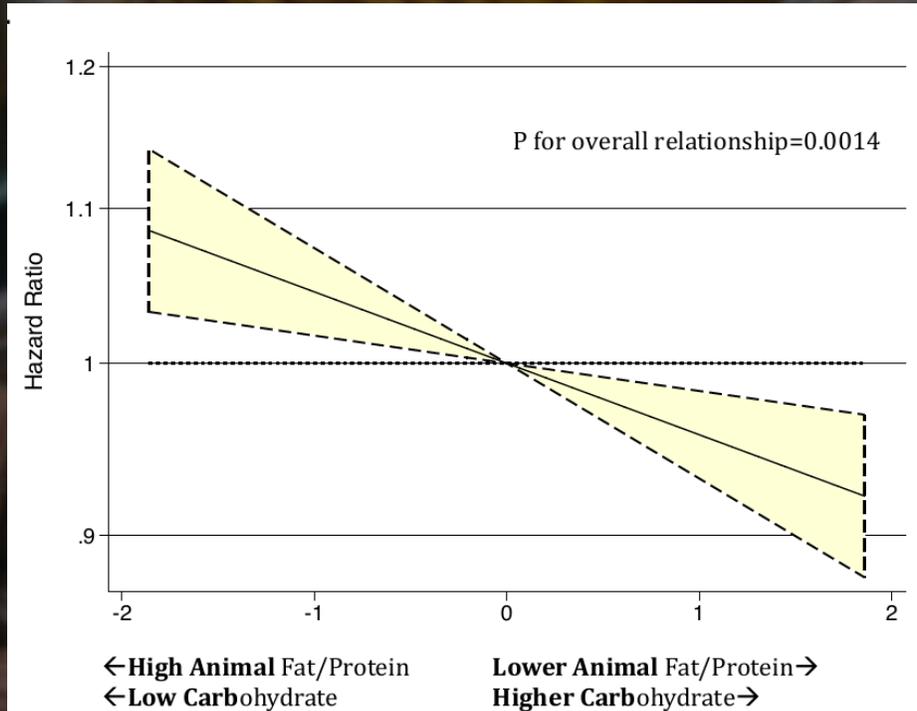

Seidelmann et al. Lancet. 2018

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

- 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

- 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

- 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

- ## 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?"*
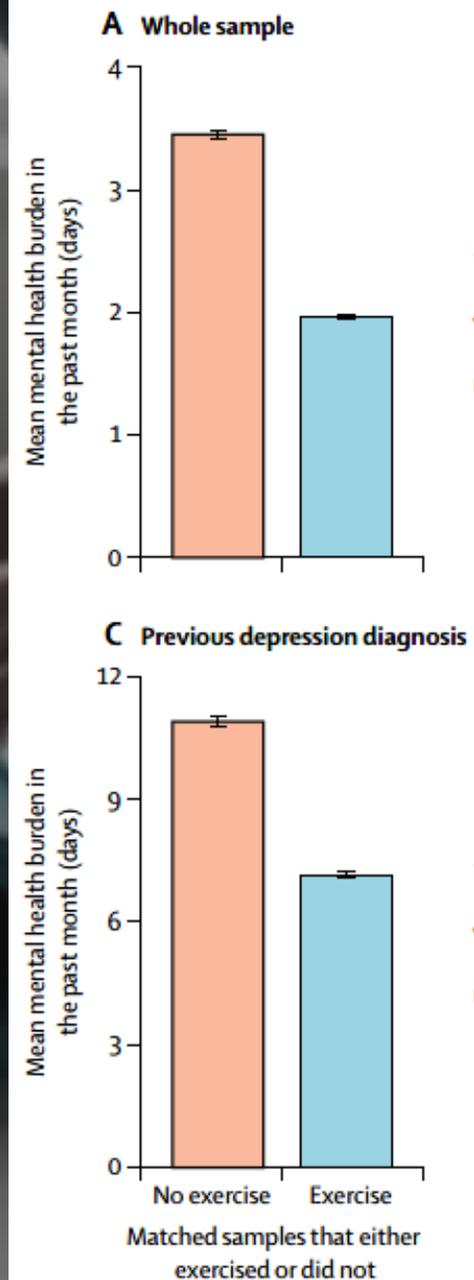
Methods

- 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
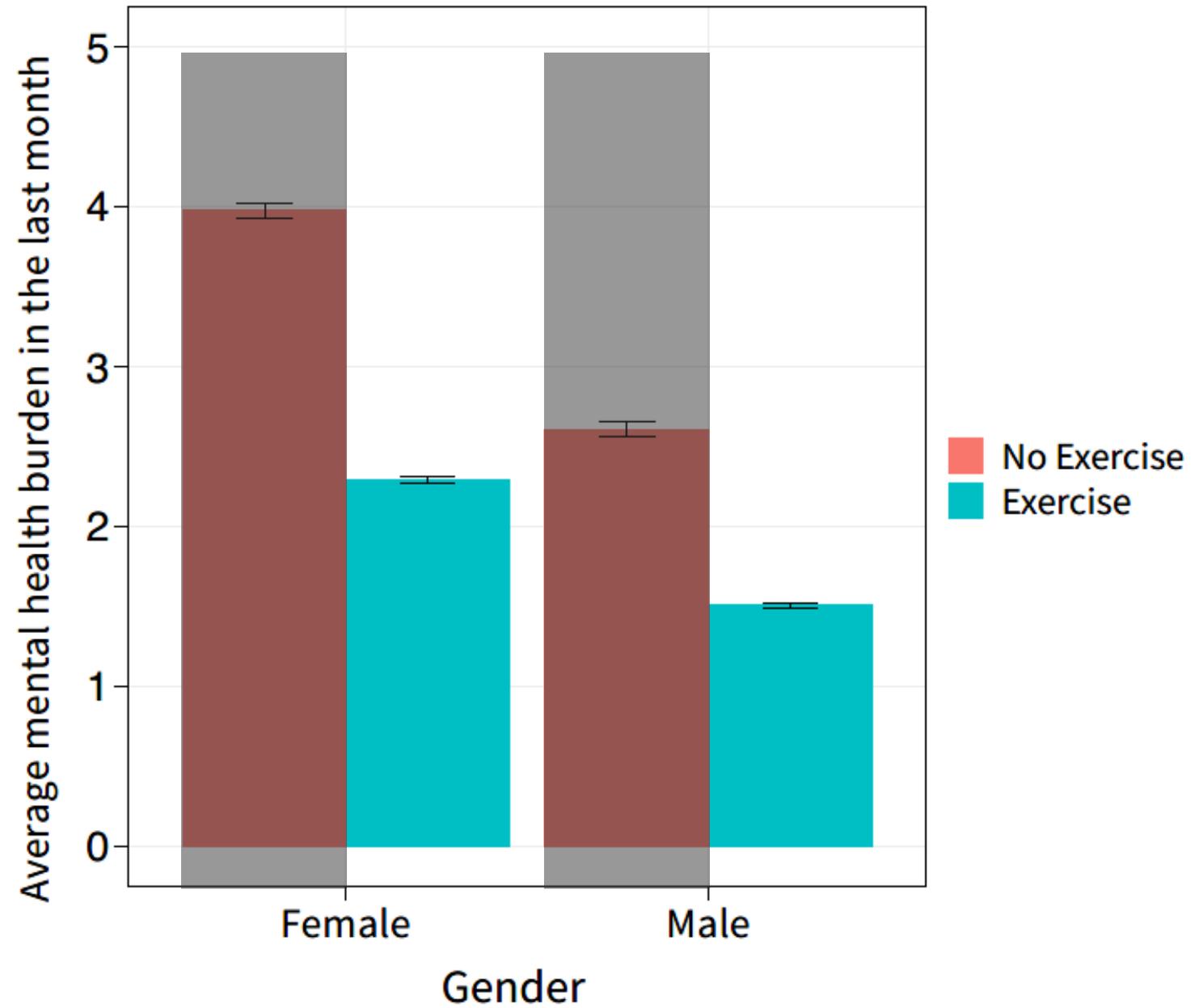 - **34.5%** ↓ self-reported mental health burden

A Whole sample

C Previous depression diagnosis

Mean mental health burden in the past month (days)

No exercise | Exercise

Matched samples that either exercised or did not

Results

Exercise and mental health across lifespan
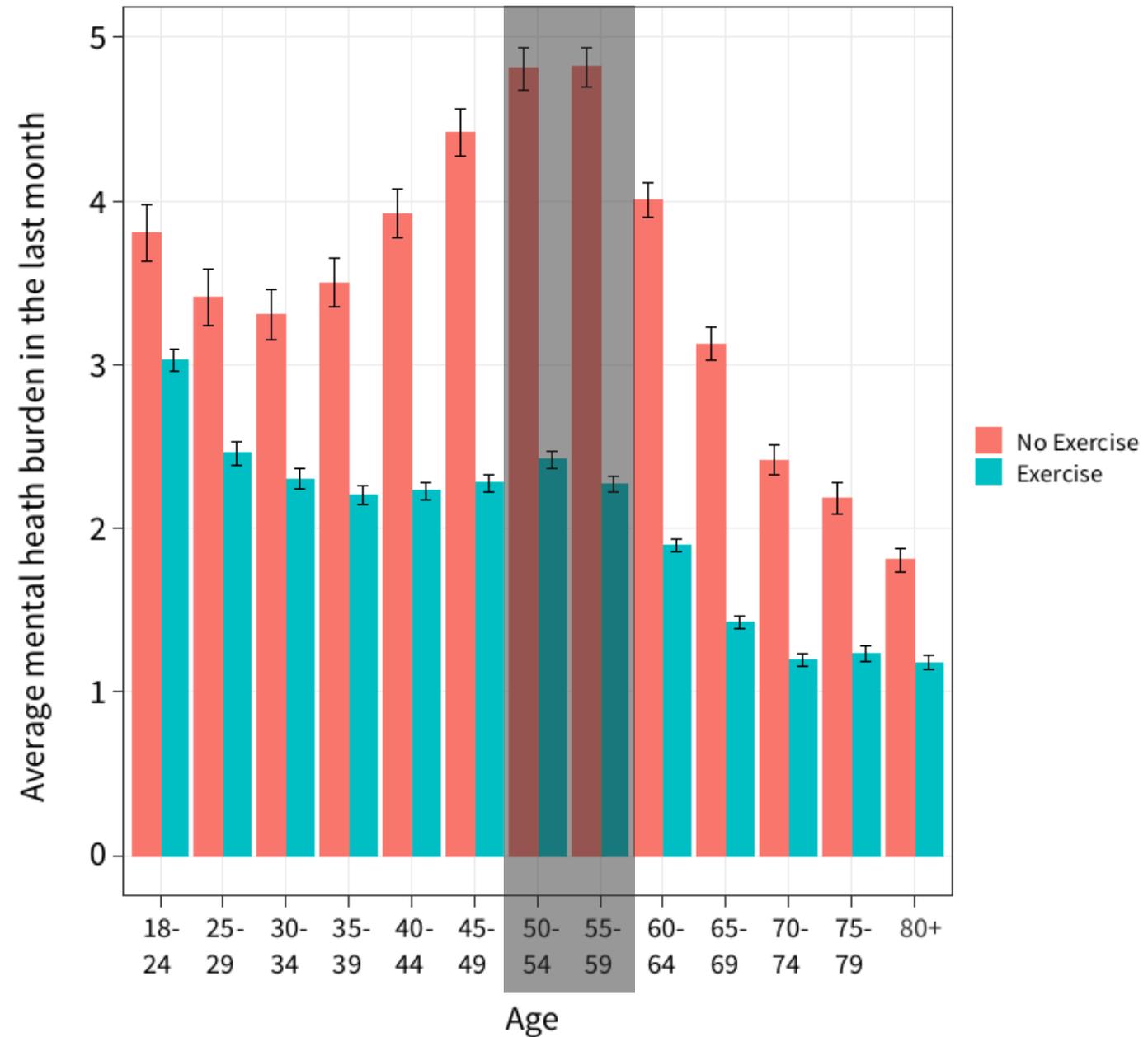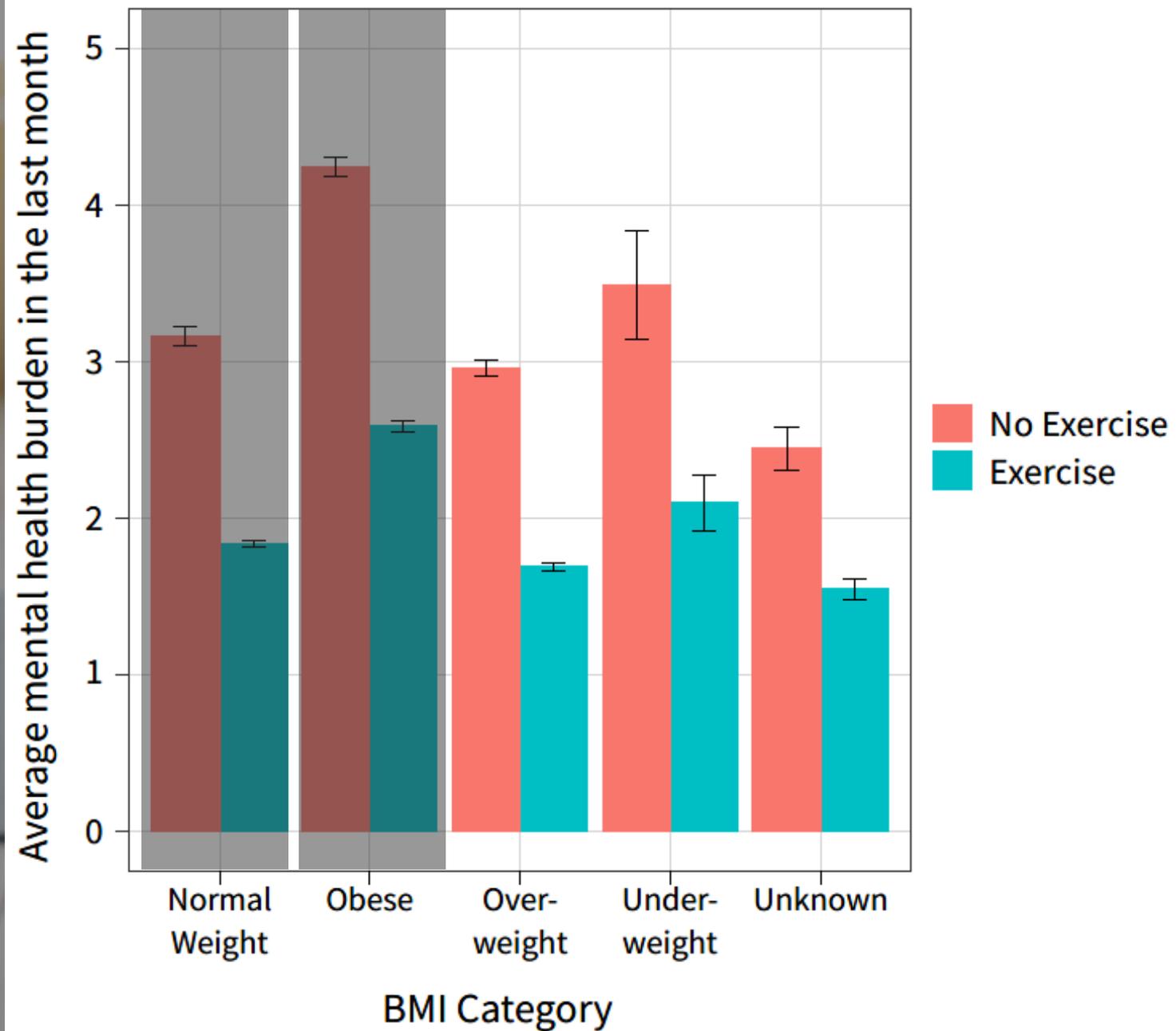
Results

Exercise and mental health across gender

Results
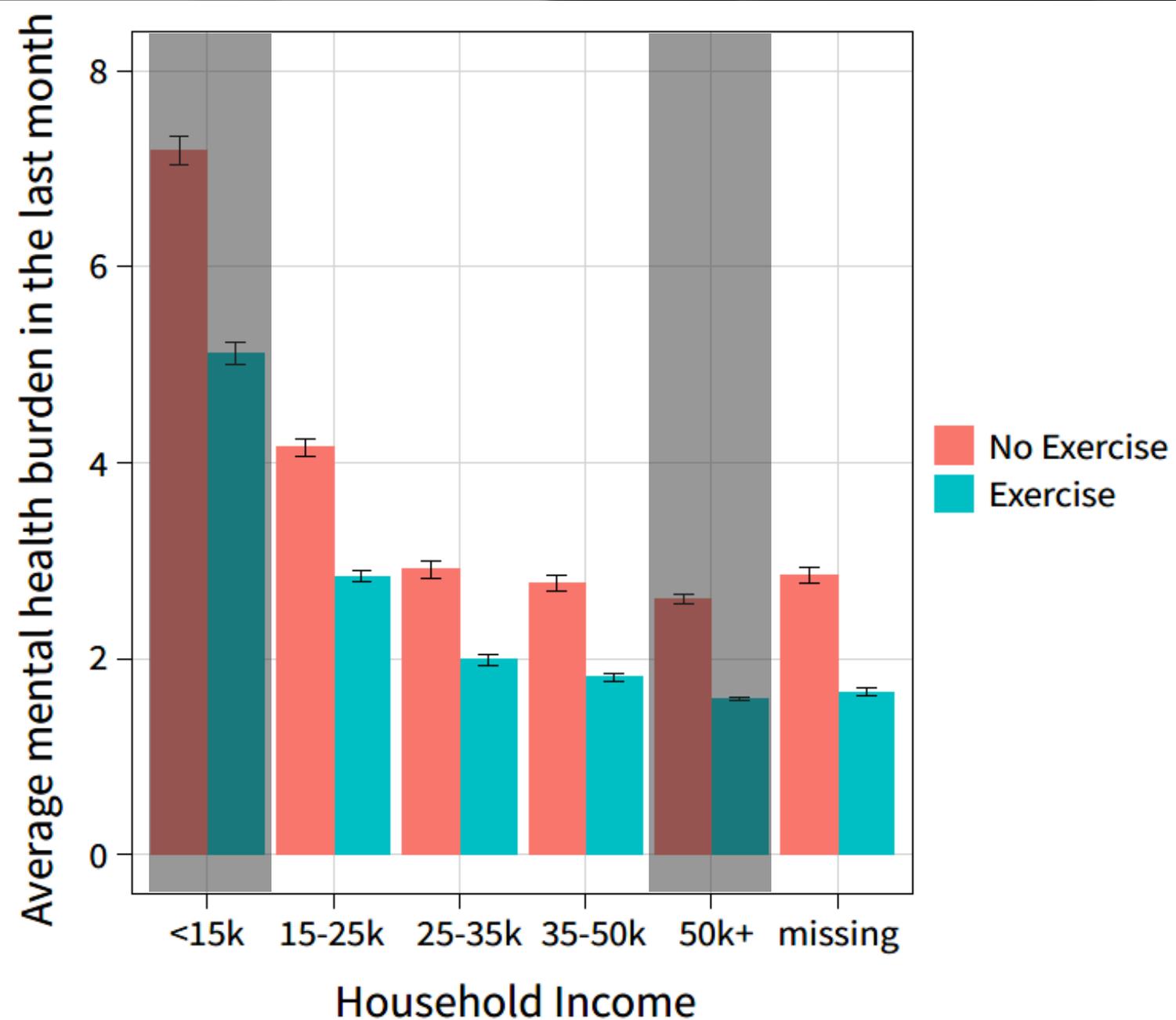
Exercise and mental health across and race
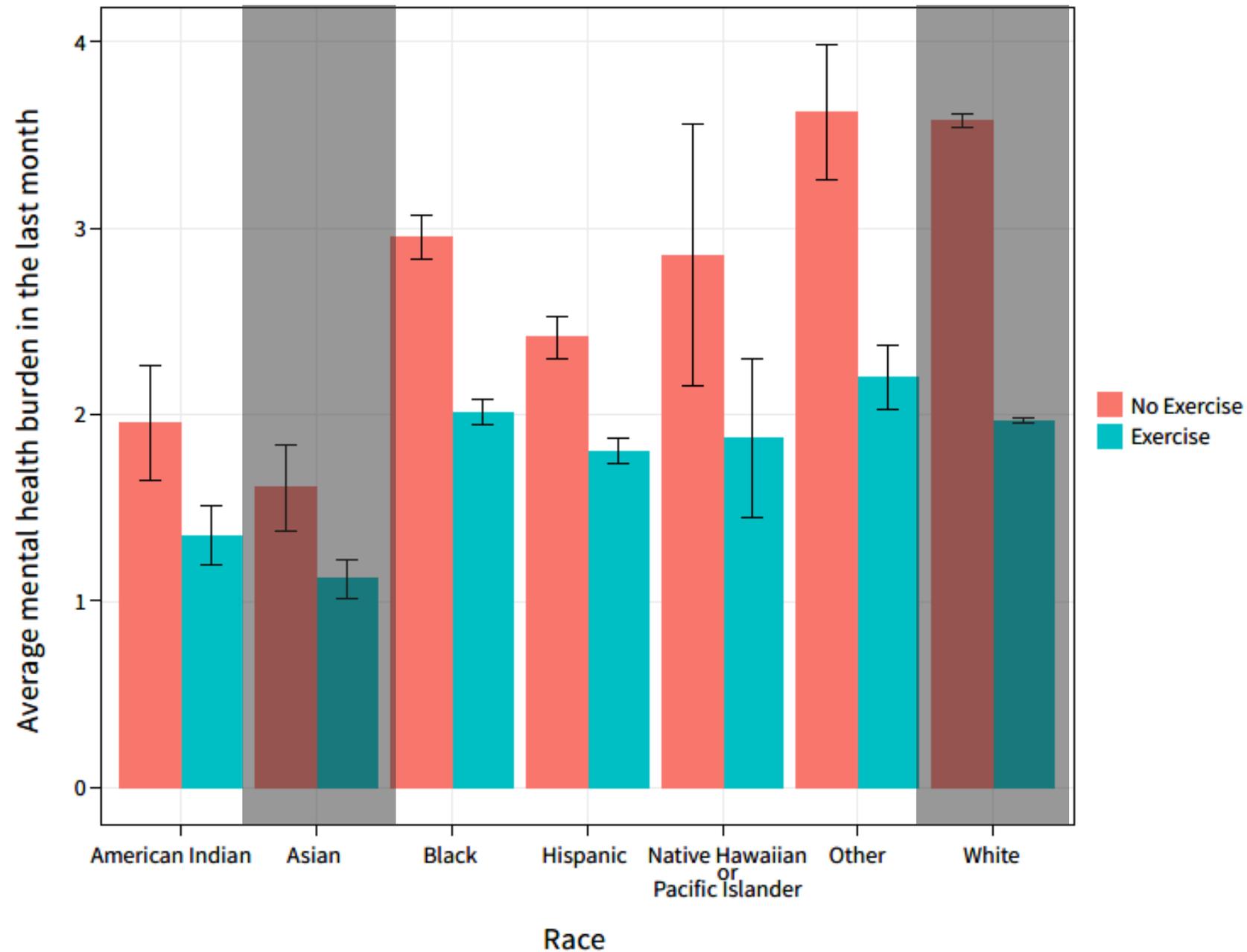
Results

Exercise and mental health across BMI
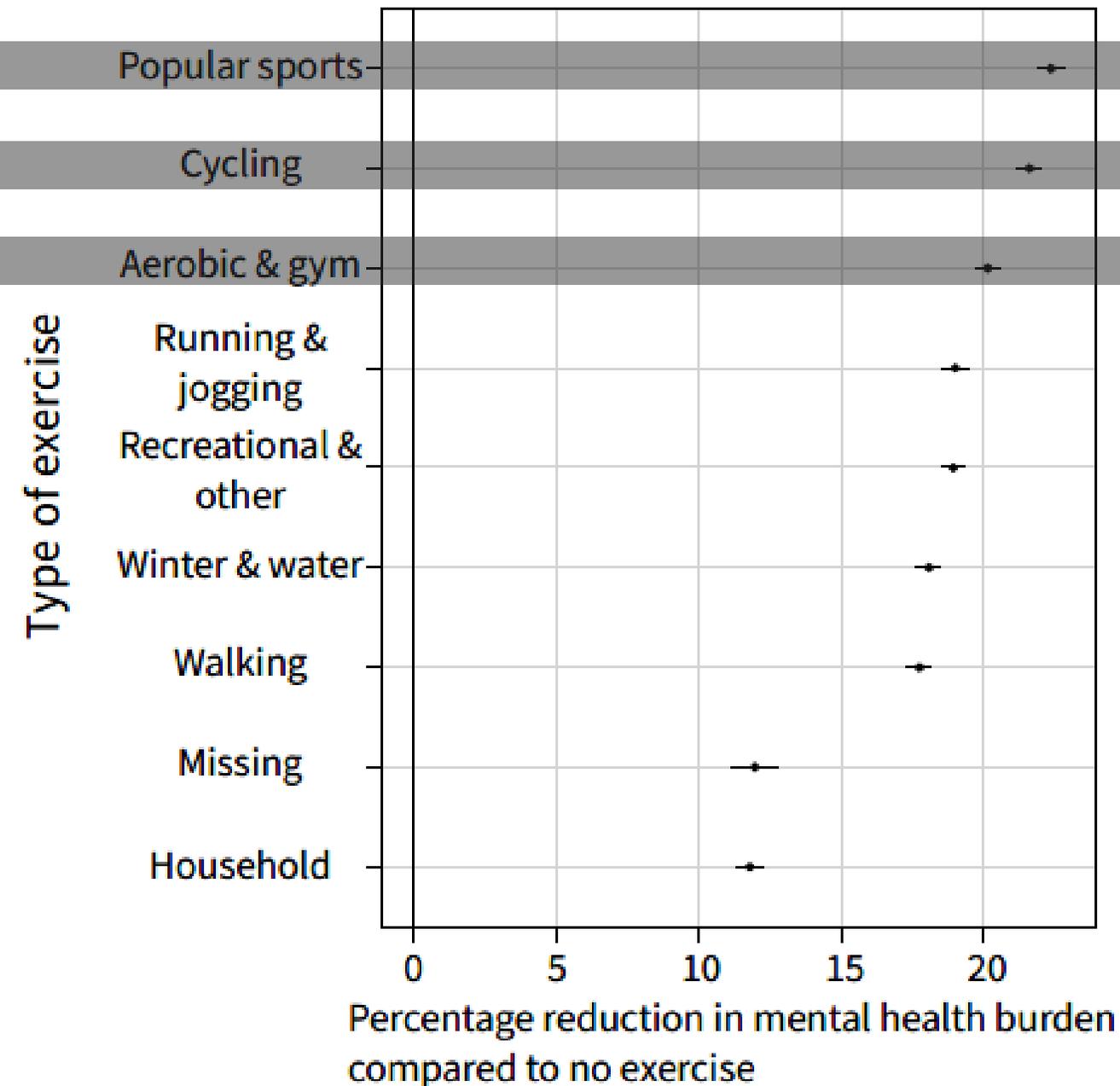
Results

Household income and mental health burden

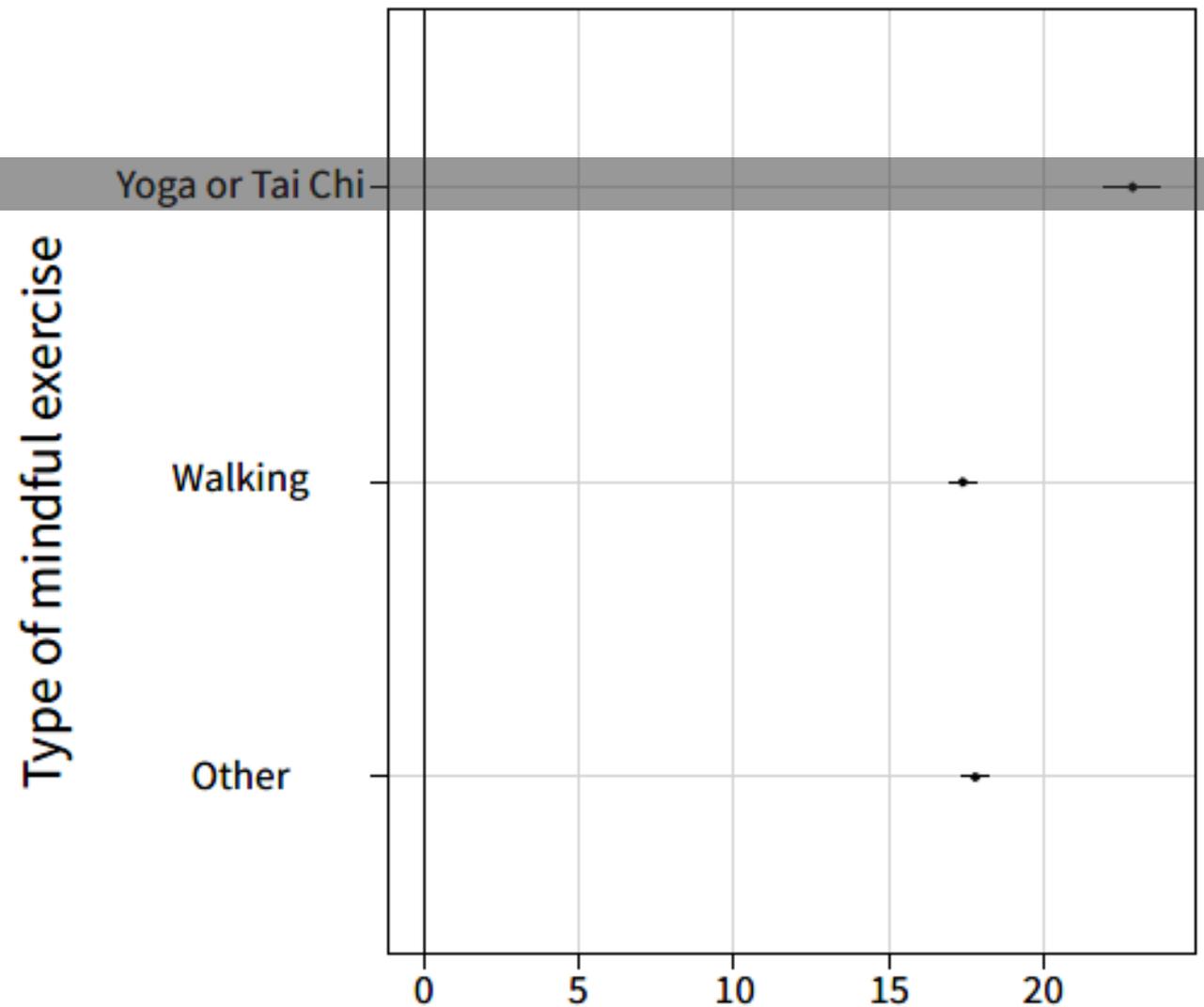- $50k+ vs < $15k
  - **17%** ↓ mental health burden

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

Type of mindful exercise: Yoga or Tai Chi, Walking, Other
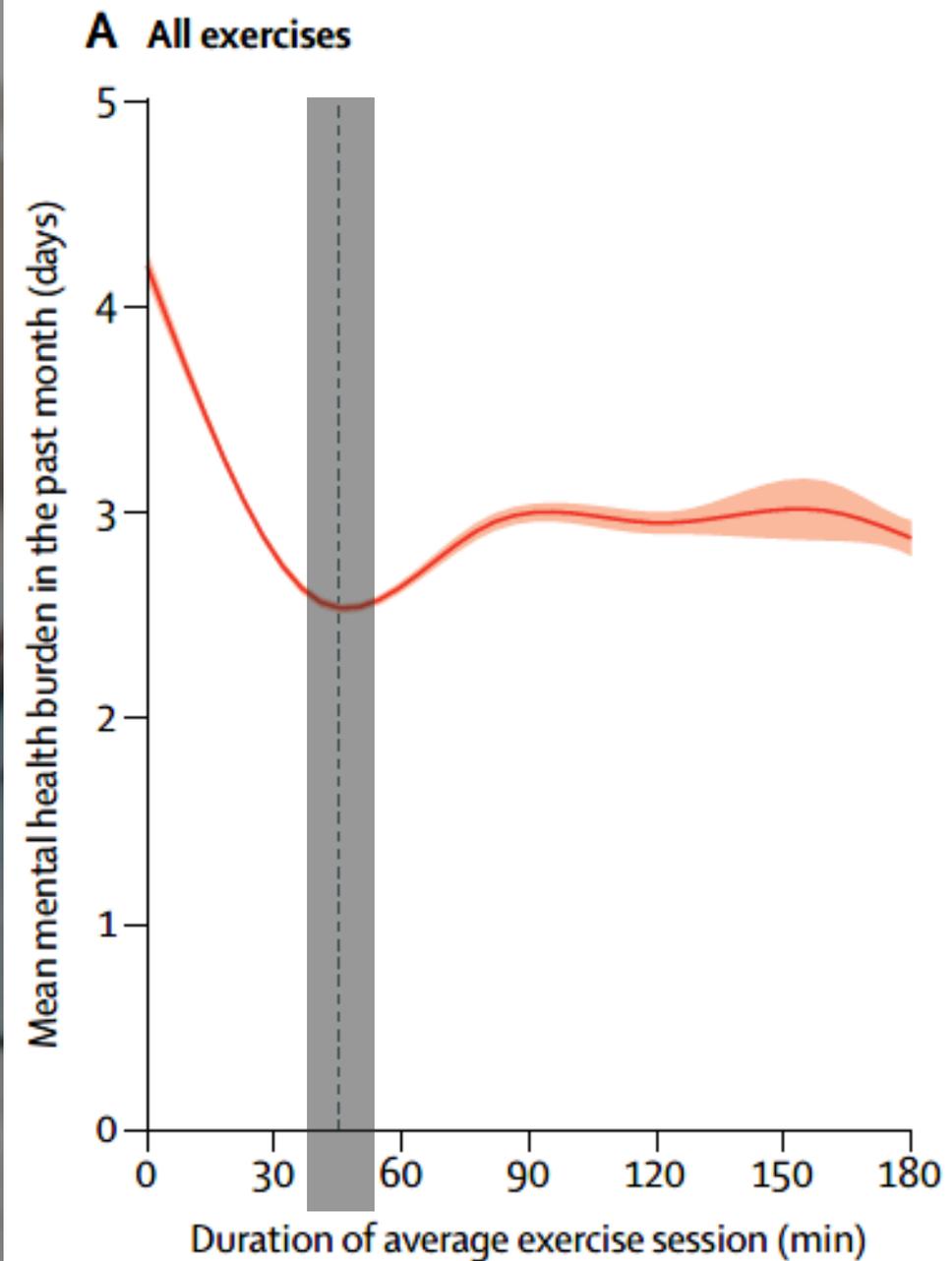
Percentage reduction in mental health burden compared to no exercise

Results

Exercise duration and mental health burden

- **Optimal duration: 45 minutes**

A All exercises

Mean mental health burden in the past month (days) vs. Duration of average exercise session (min)

Results

Exercise frequency and mental health burden

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

A All exercises

Mean mental health burden in the past month (days) vs. Exercise frequency in the past month
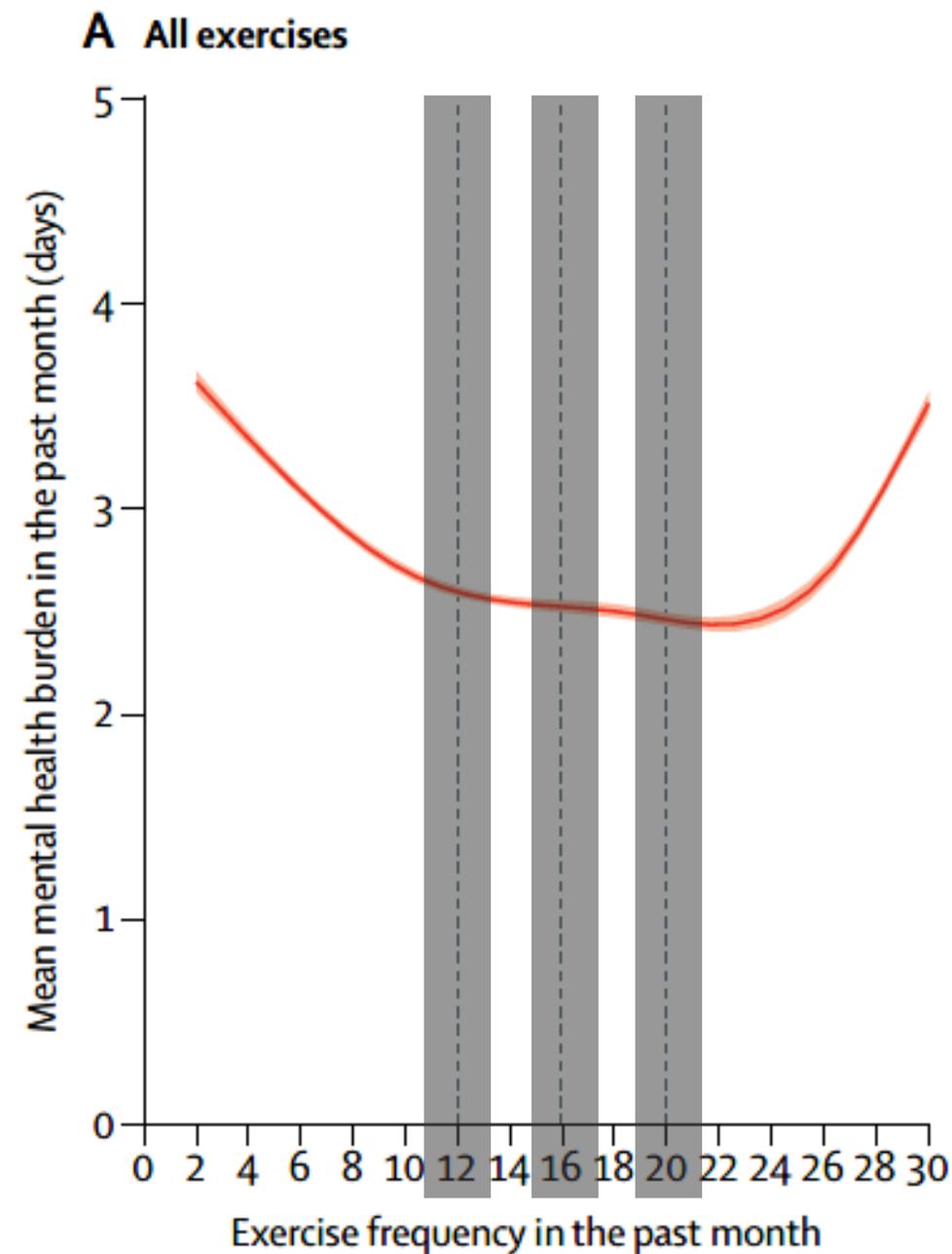
Limitations

- 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