Differential effects of adolescent health behaviors on adult cardiometabolic conditions by parental financial situation:

A population-based cohort study

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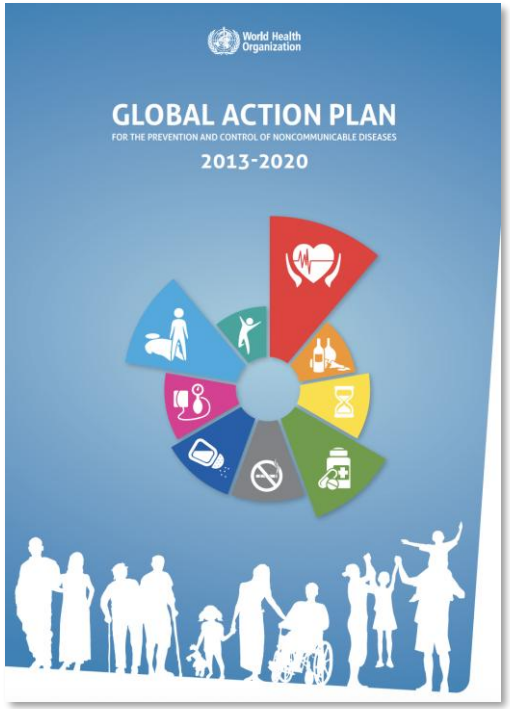
Background

Health behaviors in adolescence can be detrimental for adult cardiometabolic health

- Adolescent cigarette smoking the most critical risk factor for cardiometabolic disease (CMD) in adulthood
- Poor dietary habits and insufficient physical activity in adolescence predictive of CMDs in adulthood
- These health behaviors have also been found to co-occur in clusters, forming habits that make up a lifestyle

CDC, 2012; Kaikkonen et al., 2014 and *Kalio et al., 2021*

Same exposures, different effects?



HEALTHY PEOPLE 2030

- Socioeconomically disadvantaged adolescents may be exposed to more unhealthy behaviors
- They may also experience larger effects of exposure to unhealthy behaviors (diff. susceptibility hypothesis)
- Understanding differential effects helps to develop better public health interventions & target policies to reduce health inequalities

Research objective

To quantify the differential effects of health behaviors among adolescents on adult cardiometabolic conditions based on their family financial situation

Methods

We are using the Add Health participants as our study population

- Ongoing US cohort which began in 1994, five waves since initial collection
- Nationally representative study exploring causes of health & health-related behaviors of adolescents and their outcomes in adulthood
- Comprehensive information of social contexts of adolescent life and their effects on health

Adolescence →	Transition to Adulthood →	Young Adulthood →	Adulthood
Wave I-II (Ages 12-20)	Wave III (Ages 18-26)	Wave IV (Ages 24-32)	Wave V (Ages 31-42)

Getting specific: our exposures and outcomes

Exposures – behaviors (Wave I)

- Physical activity (sports frequency and exercise frequency)
- Alcohol consumption
- Cigarette smoking
- Dietary habits (breakfast skipping)

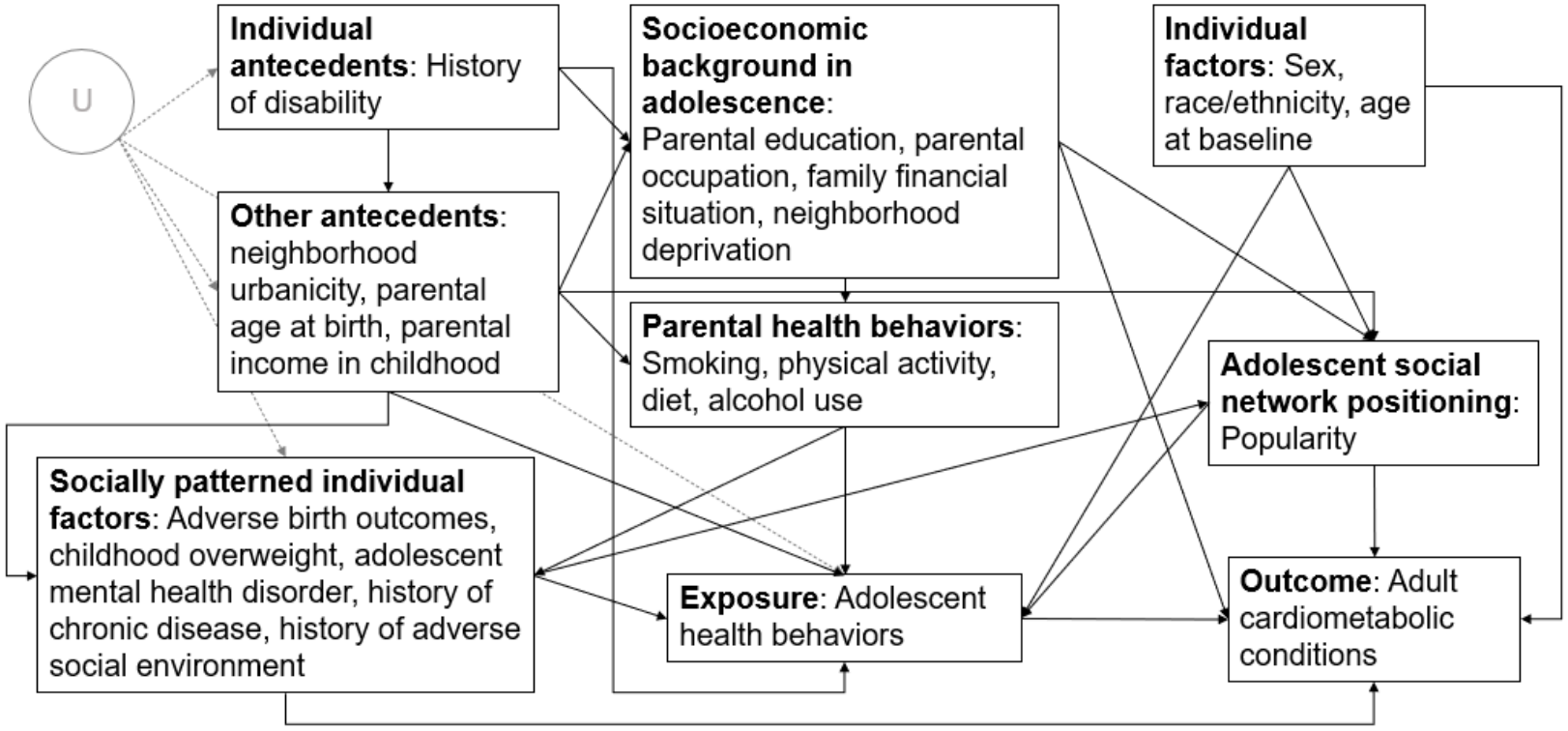
Effect modifier (Wave I)

- Family financial situation

Outcomes – Cardiometabolic conditions (Wave V)

- Hypertension
- Stroke
- Heart failure
- Diabetes
- Chronic kidney disease

Our assumed causal model attempts to capture the complexity of this relationship



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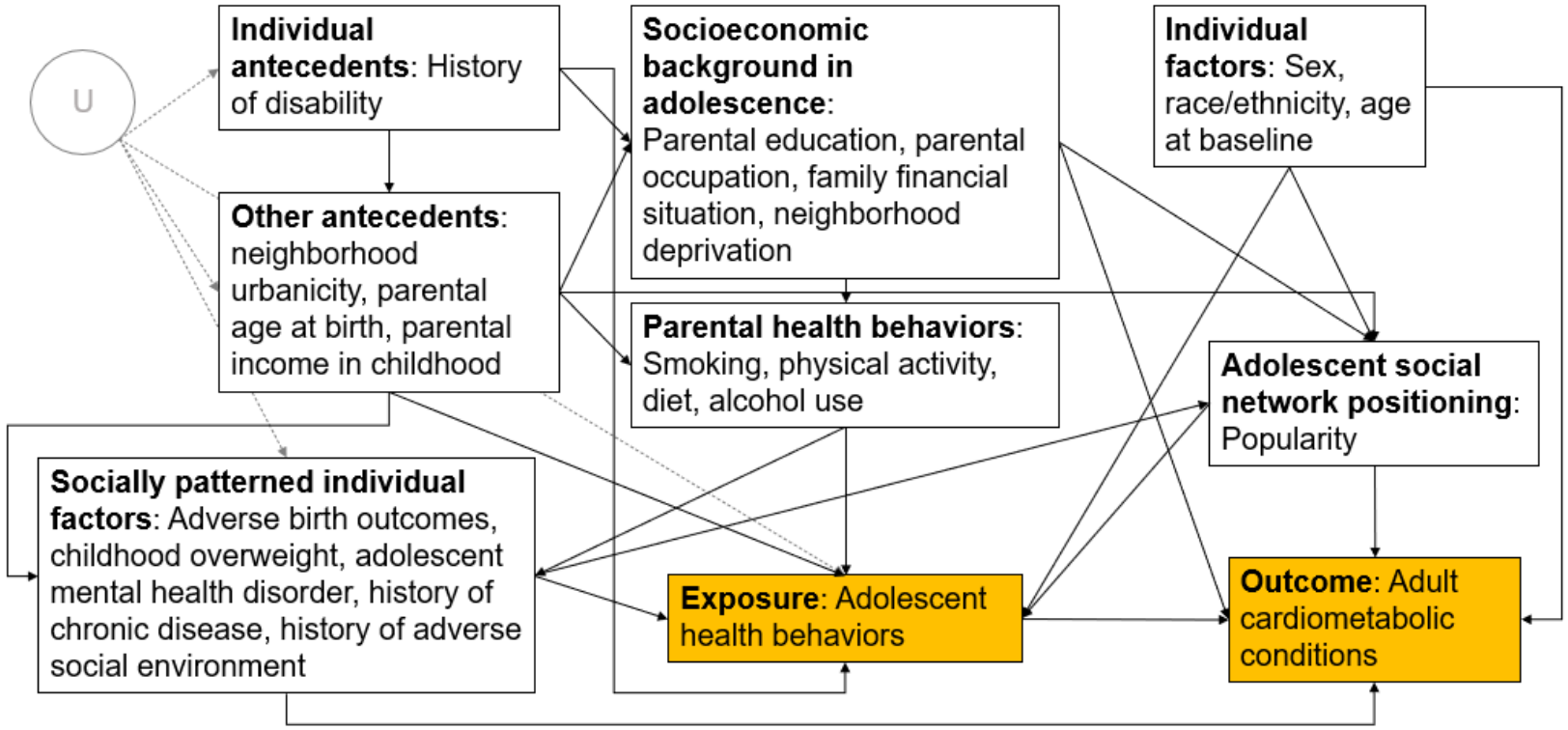


Our statistical analysis in two stages

Health behavior clustering

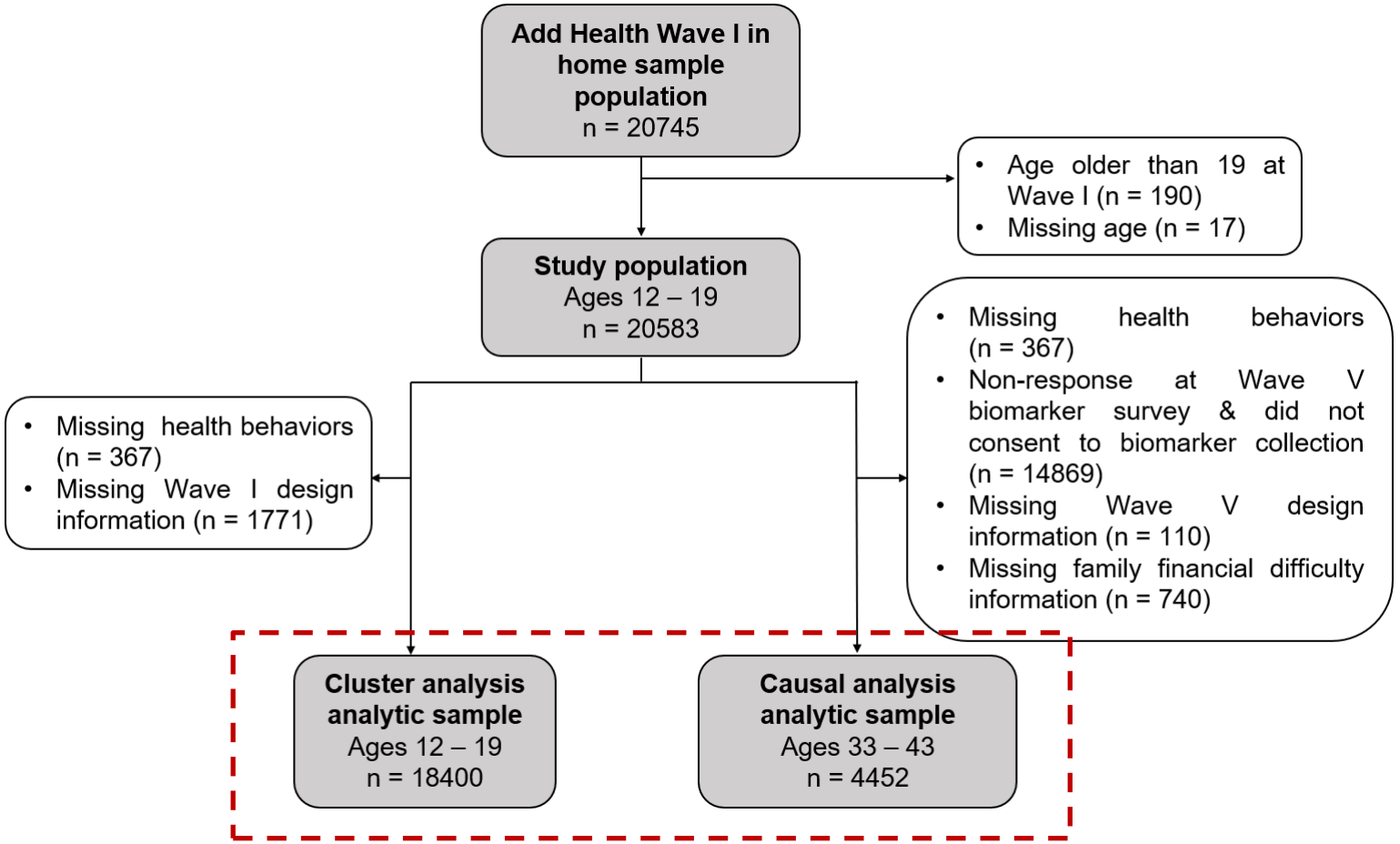
Latent class analysis of physical activity levels, smoking levels, alcohol consumption and dietary habits

Differential effect of adolescent health behaviors on adult cardiometabolic conditions

Inverse probability-weighted marginal structural model

- Estimand: conditional average causal effect (cACE)
- Difference in cACE according to family financial situation
- Multiple imputation for missing data and used survey weights for representativeness

Flowchart for participant selection

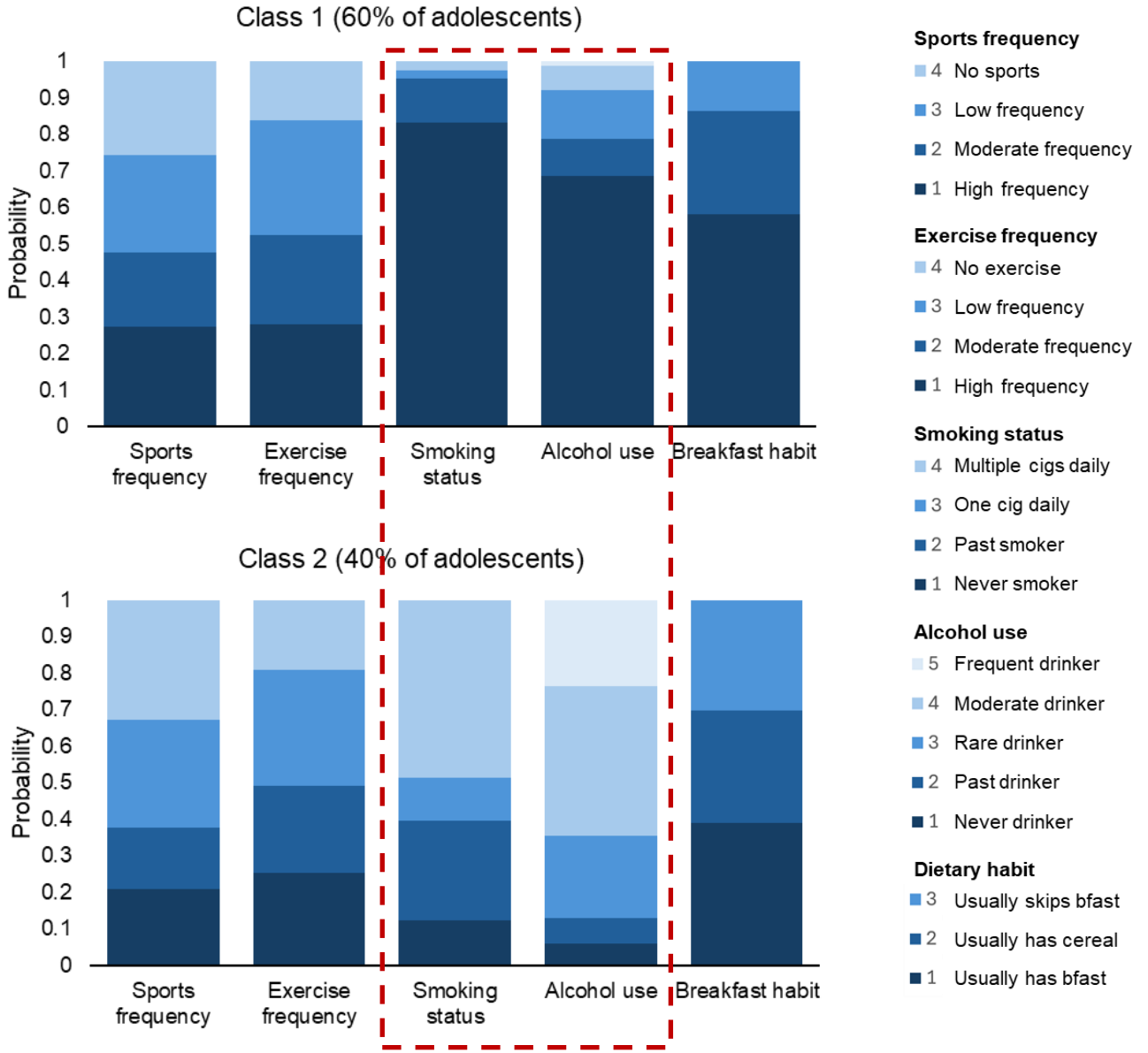


Results

Cigarette smoking and alcohol consumption clustered

- Two behavioral patterns identified:
  - low risk health behaviors (60%)
  - High risk health behaviors (40%)
- Co-occurrence of smoking & alcohol use

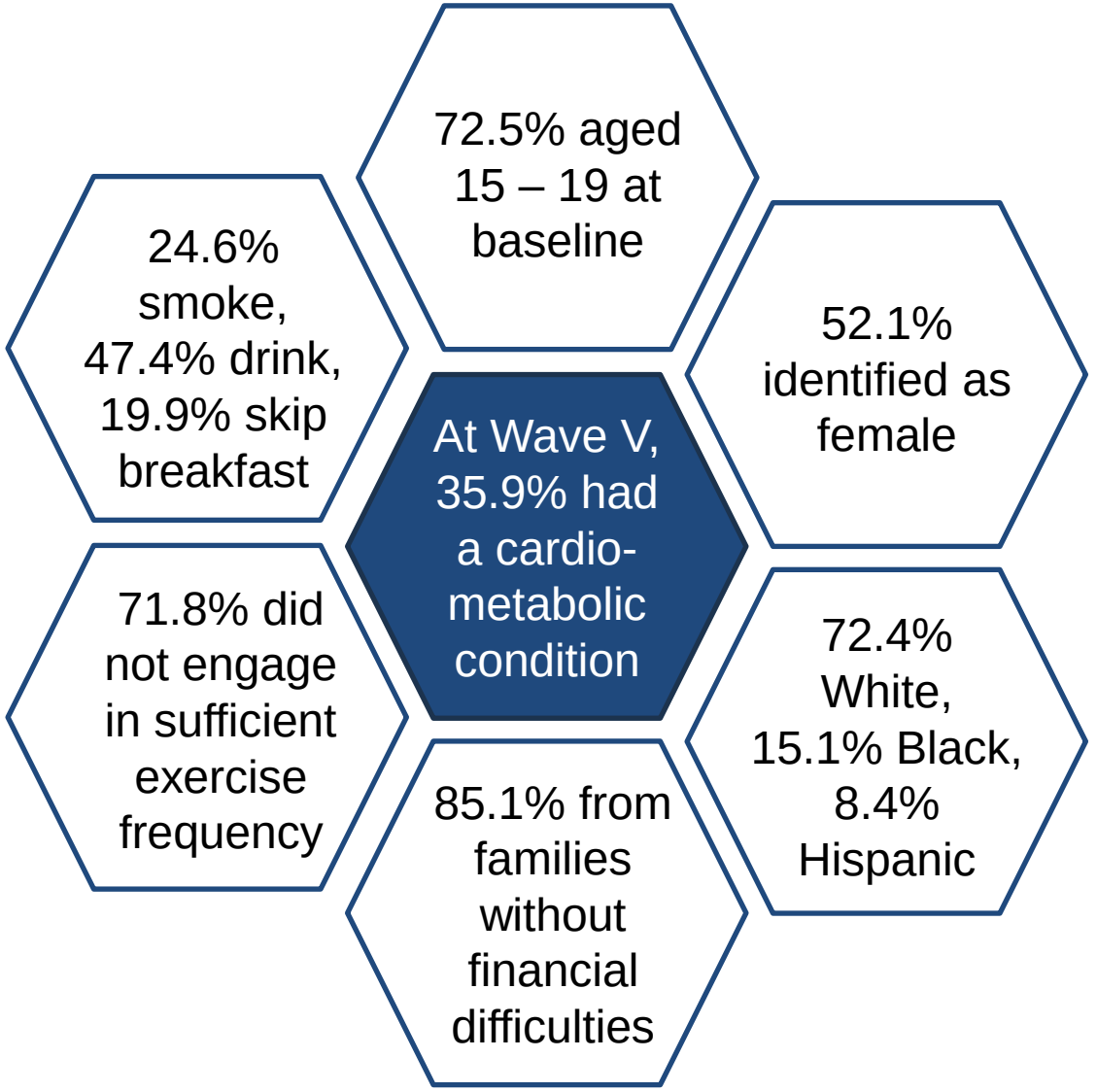
n = 18,400



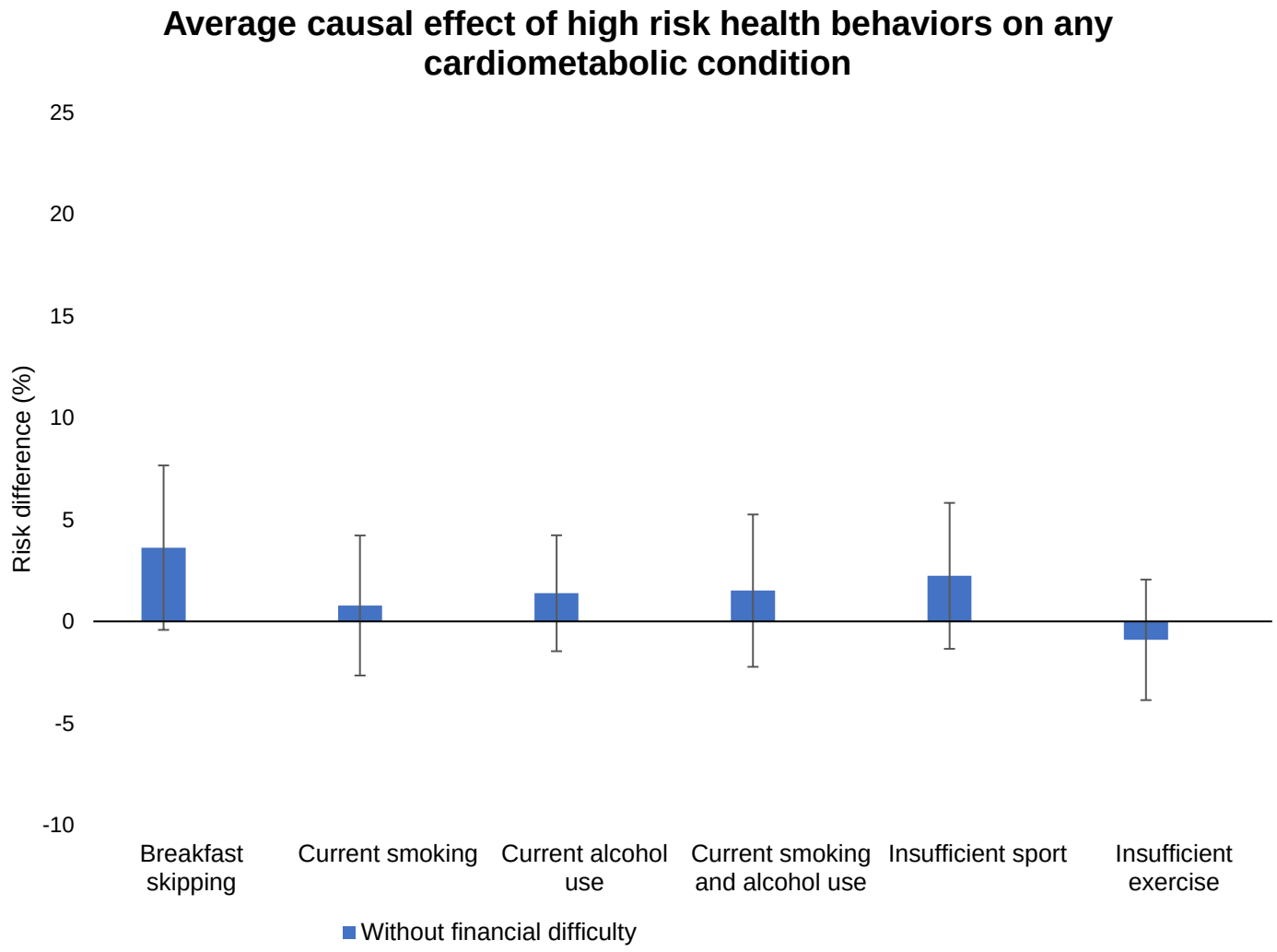
Key characteristics of the causal analytic sample

n = 4,452

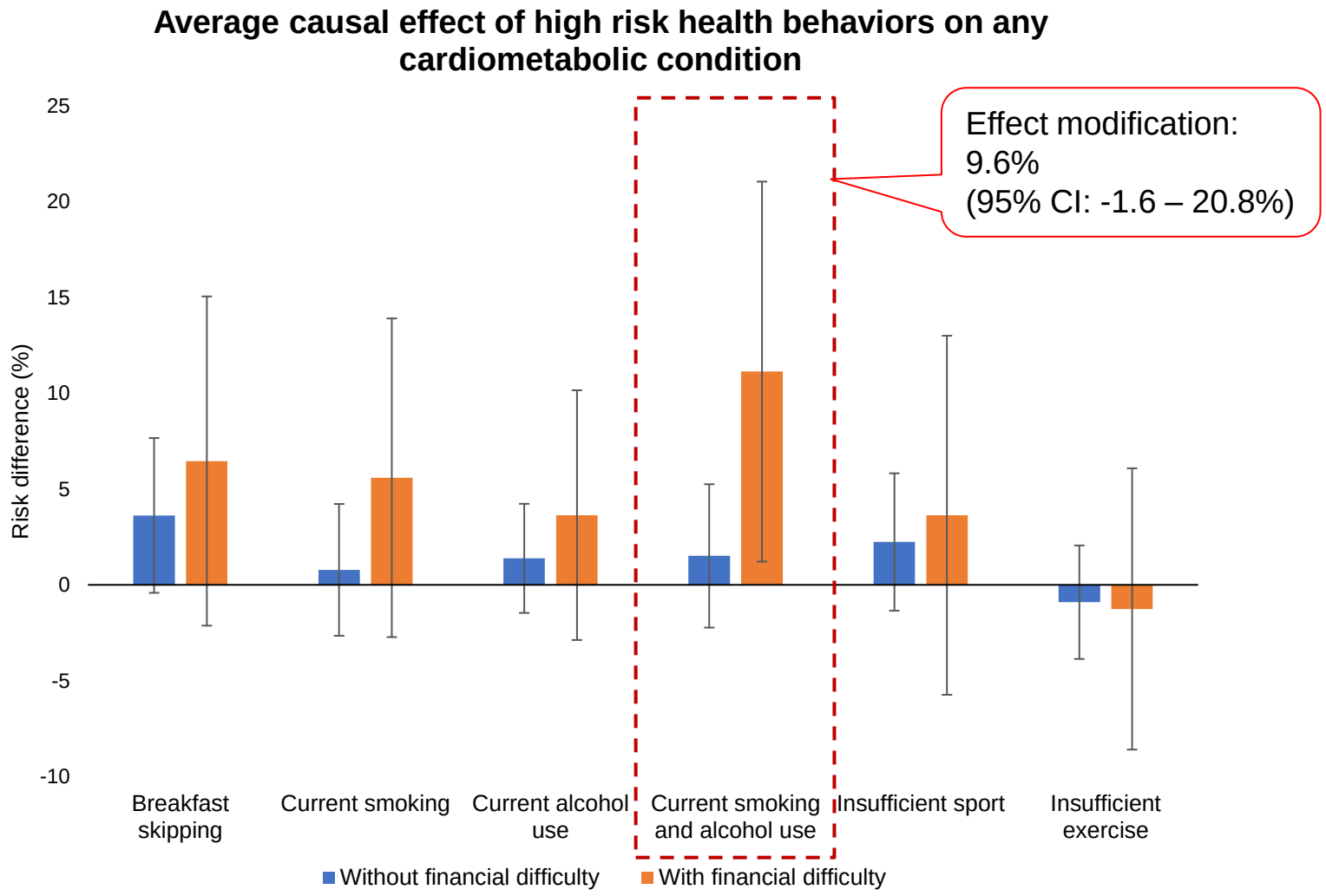
% based on weighted population



Limited effect of risky health behaviors on cardiometabolic conditions for financially advantaged adolescents



Adolescents from financially disadvantaged families experienced greater harm from risky behaviors

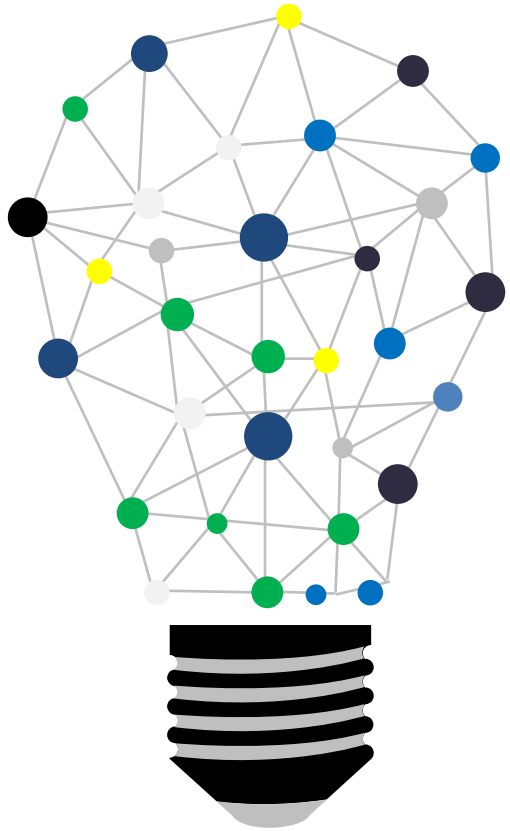


Conclusions

Findings & potential significance

- Smoking and alcohol use in adolescence leads to unequal increases in adult cardiometabolic conditions

- Targeting high risk behaviors e.g. smoking and alcohol use in adolescence may reduce socioeconomic inequalities in adult cardiometabolic health



Thank you for your interest!

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Project collaborators: Dr Josephine Jackisch, Dr Arnaud Chiolero, Dr Kathleen Mullan Harris and Dr Cristian Carmeli

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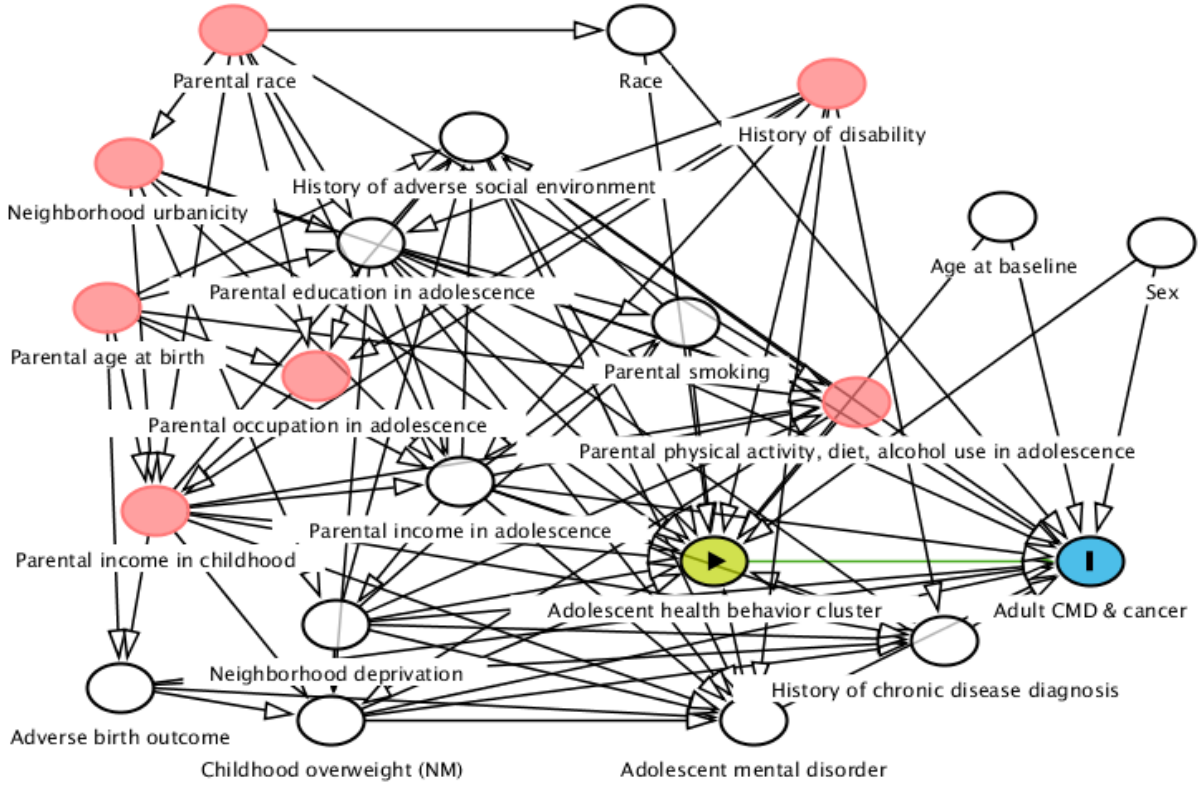
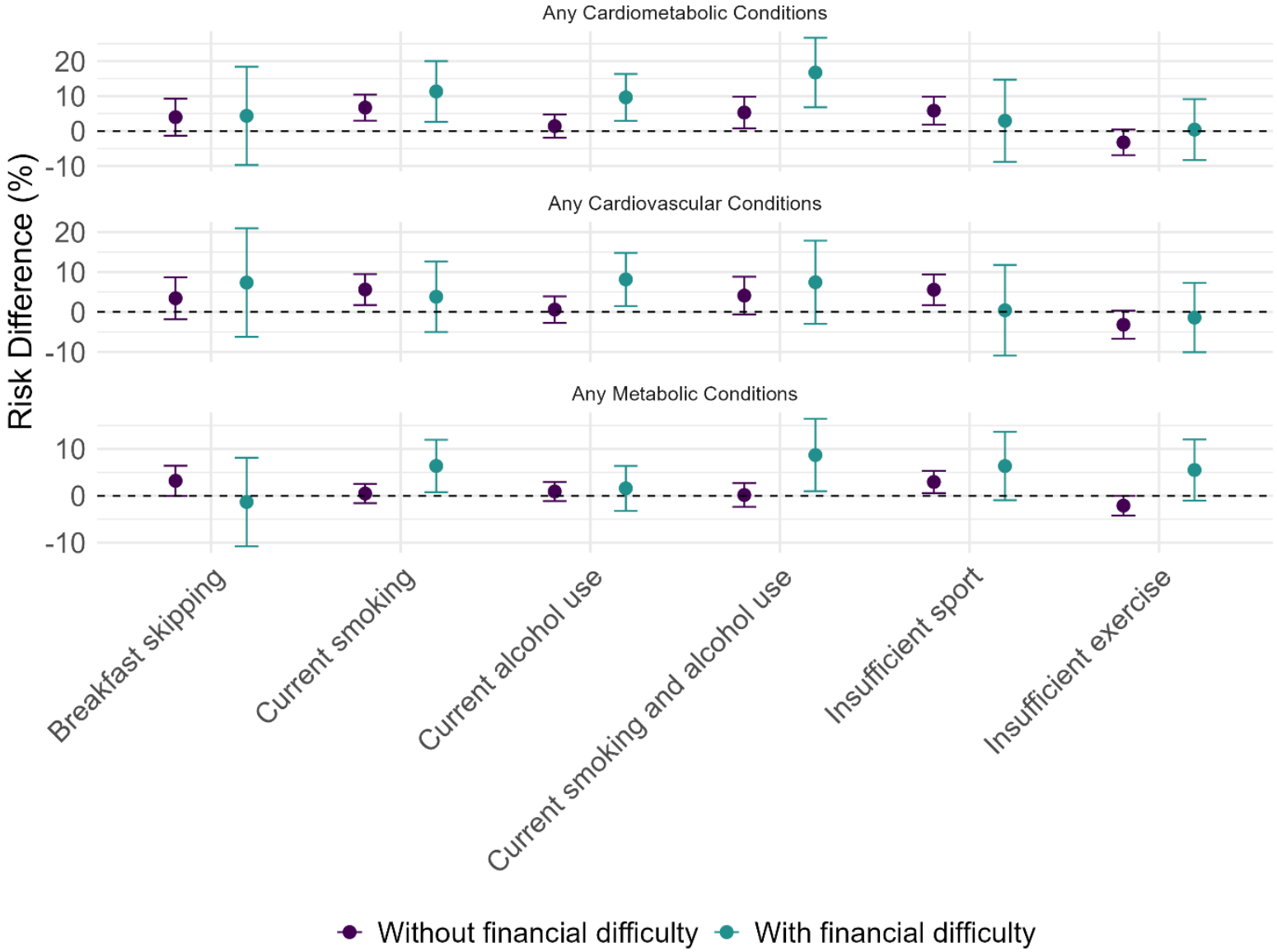
Appendix

What's in our minimally sufficient adjustment set (i.e. our confounding)?



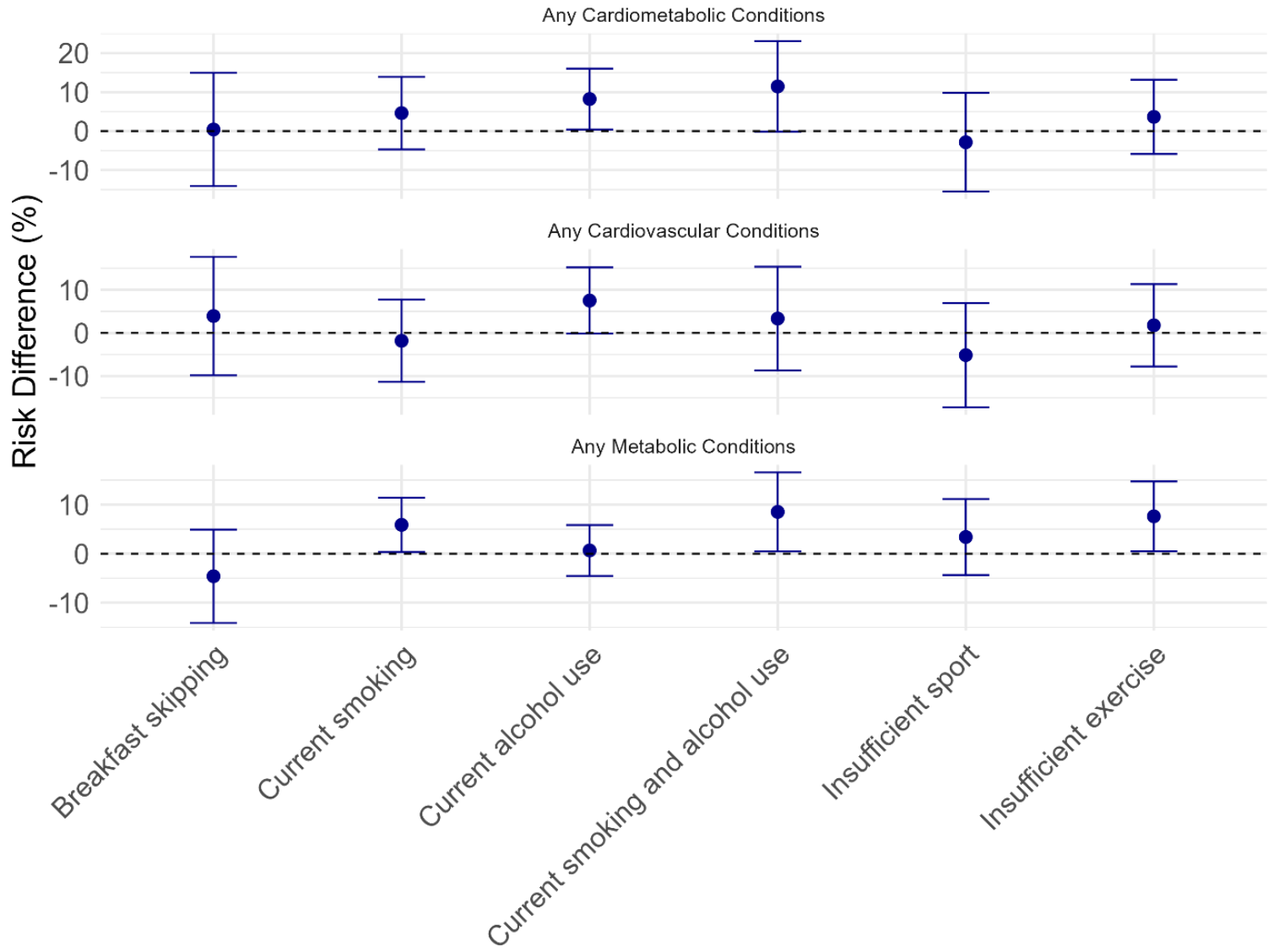
- Our directed acyclic graph (DAG) built using dagitty
- Age at baseline survey, sex, race, adverse birth outcomes, history of adverse social environment, history of chronic disease diagnosis, adolescent mental disorder, neighborhood deprivation, parental education, parental income, parental smoking and childhood overweight (unmeasured in Add Health)

Available online at dagitty.net/mvd9diV



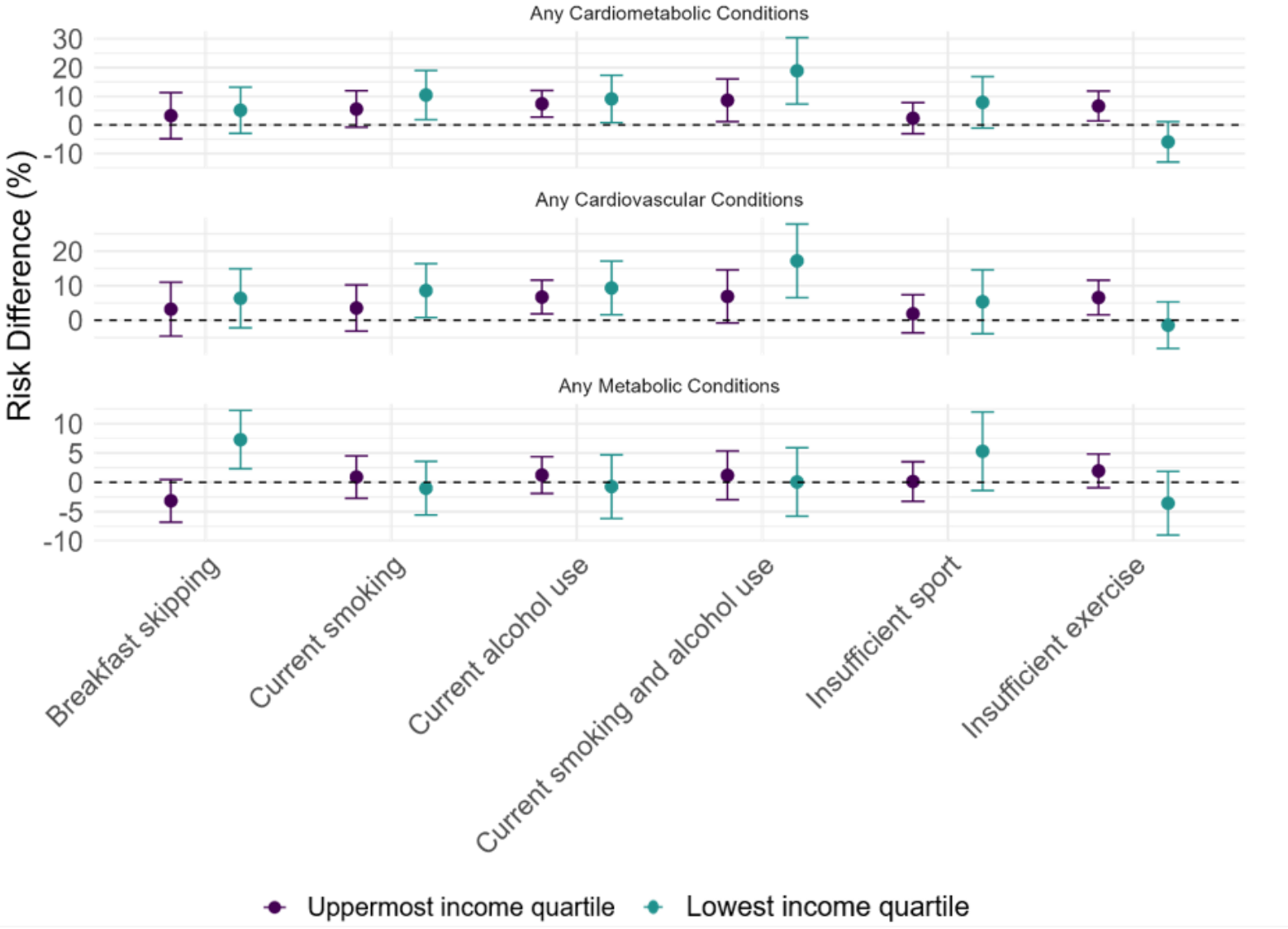
Sensitivity analysis:

Average causal effect of high-risk health behaviors on cardiometabolic conditions among adolescents with family financial difficulty and among adolescents without family financial difficulty using Wave II behaviors as exposure



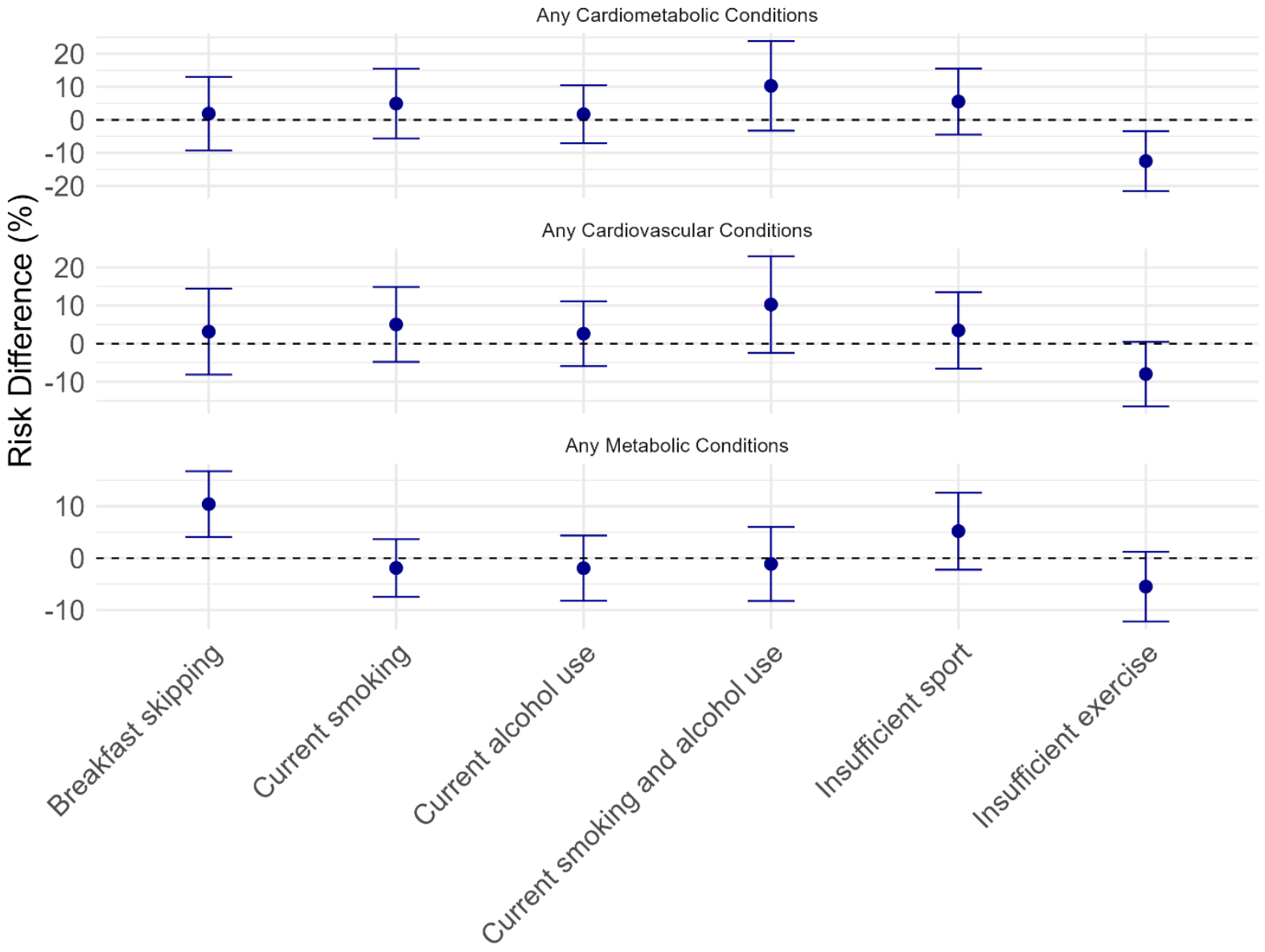
Sensitivity analysis:

Effect modification due to family financial situation using Wave II behaviors as exposure**.**



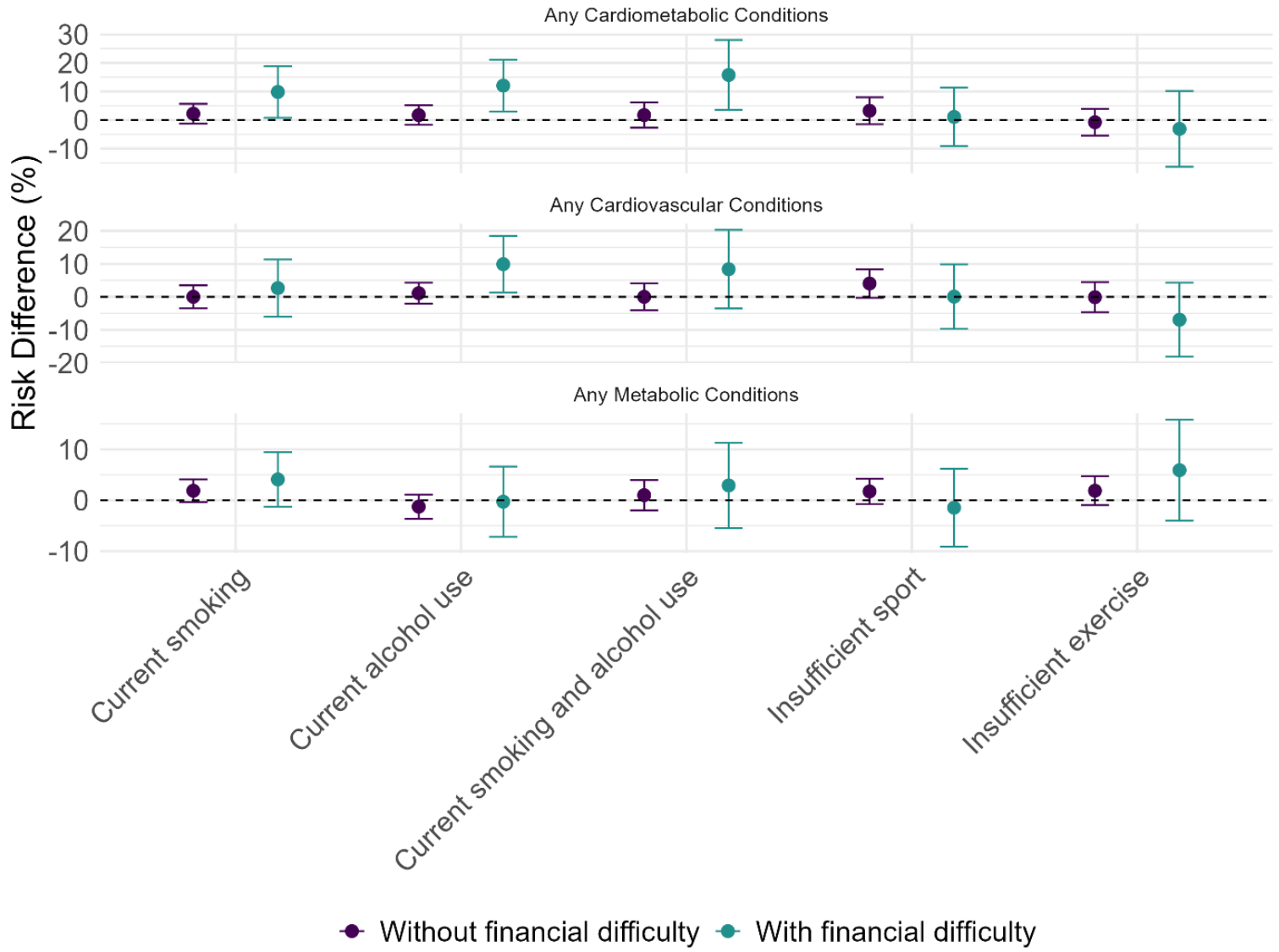
Sensitivity analysis:

Average causal effect of high-risk health behaviors on cardiometabolic conditions among adolescents with higher parental income (uppermost income quartile) and among adolescents with lower parental income (lowest income quartile)



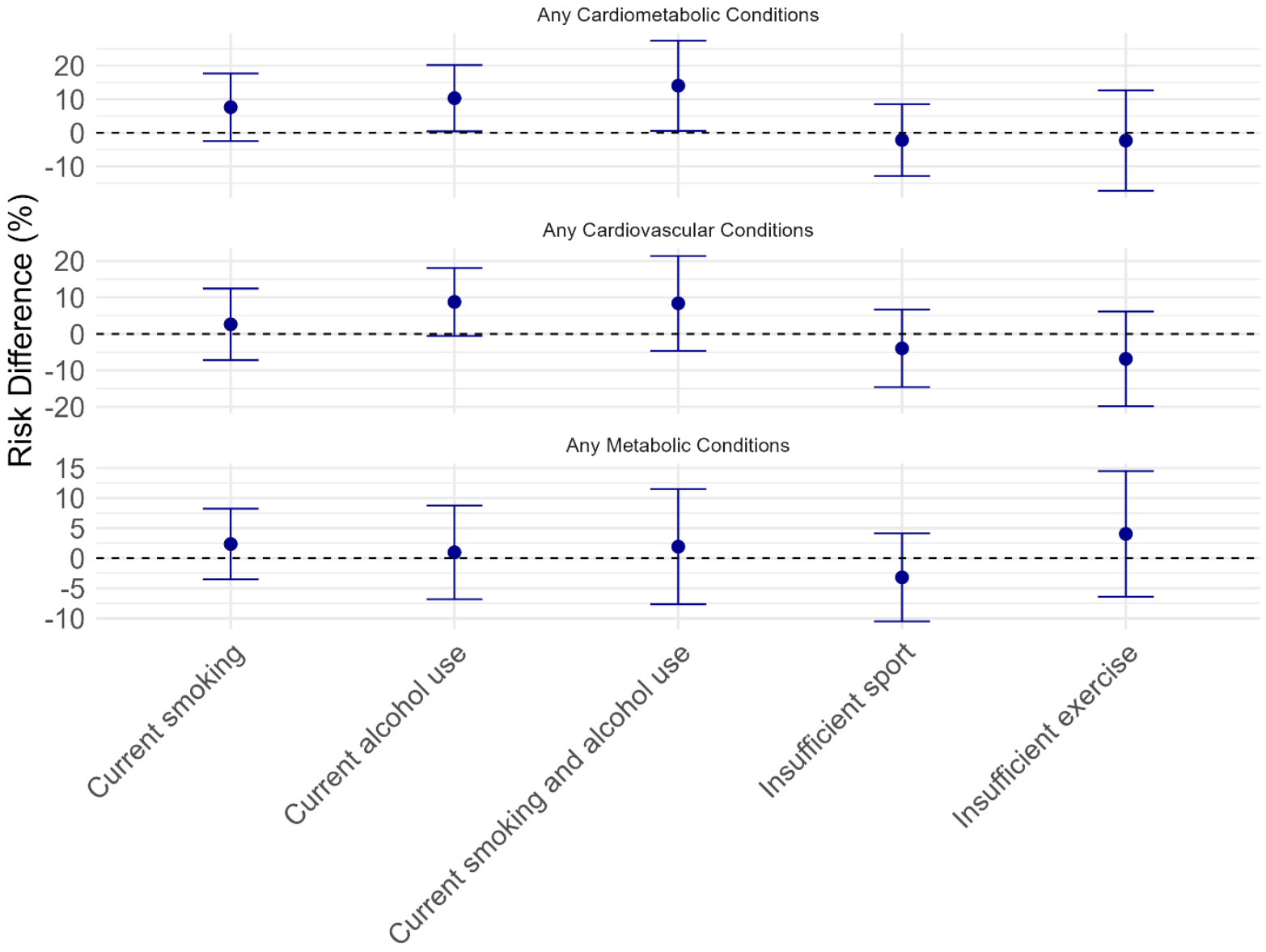
Sensitivity analysis:

Effect modification due to parental income.



Sensitivity analysis:

Average causal effect of high-risk health behaviors vs low-risk on cardiometabolic conditions among adolescents with family financial difficulty and among adolescents without family financial difficulty, using three levels of risk for health behaviors (low, moderate, high)



Sensitivity analysis:

Effect modification due to family financial situation when using three levels (low, moderate, and high) of risk for health behaviors.

Strengths and limitations

Strengths

- Survey weights for generalizability to US population
- Descriptive analysis to inform operationalization of exposures for causal analysis
- Financial situation captures not just income but also effects of wealth & expenses

Limitations

- Behavior variables in Wave I are not well-defined
- Measurement bias from self reported behaviors