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CLSA Webinar Series



Grip Strength as an Indicator for the Assessment of Health Equity Among Older Adults

Dr. Yukiko Asada, Dalhousie University

12 to 1 p.m. ET | April 24, 2018

Grip strength is touted as an objective, easily measured indicator of health in aging populations. A successfully aging population has both a good overall health and a fair distribution of health (health equity). In this study, presented by Dr. Yukiko Asada, the research team investigates the usefulness of grip strength in the assessment of health equity among older adults.

Using baseline data from the CLSA comprehensive sample of adults aged 45-85 years (N=26,562), the team quantifies the magnitude of inequality in grip strength among older adults using the Gini coefficient, and examines what factors explain inequality in grip strength using sex-stratified regression and regression-based inequality decomposition. The team emphasizes the importance of clarifying what grip strength is measuring and which factors associated with grip strength should be considered unfair.

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Canadian Longitudinal Study on Aging
Étude longitudinale canadienne sur le vieillissement

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Grip Strength as an Indicator for the Assessment of Health Equity among Older Adults

Yukiko Asada, PhD
Dalhousie University

CLSA Webinar
April 24, 2018

Team

- Jeremiah Hurley, McMaster University
- Michel Grignon, McMaster University
- Susan Kirkland, Dalhousie University
- Stefan Phipps-Burton, Dalhousie University

Funding

- Canadian Institutes of Health Research

Successful aging and health inequalities and inequities

- Successful aging: a common policy goal
 - Health: a key component
 - Individual and population levels
- Successful aging of a population
 - Good overall level of health
 - Fair distribution of health
- A key indicator of successful aging of a population
 - How health inequalities (differences) and inequities (unfair differences) in the population increase or decrease over the life course

Measuring health inequalities and inequities

- Complex
 - Defining health inequity and incorporating the definition in the measurement
 - Deciding what measure of health to use
 - Different choices can lead to different results
- Definition of health inequity for analyses presented today
 - Policy amenability: differences in health due to factors amenable to policy are unfair
- Measure of health for analyses presented today
 - Grip strength

Grip strength

- An estimate of isometric strength in the upper extremity, indicating overall muscle strength
- Simple, physical measurement
- An indicator of frailty or vulnerability (Syddall 2003)
 - Strong associations with known “aging” markers
- An indicator of well-being (Rijk 2016)
 - Grip strength indicates muscle strength needed to perform basic activity of daily living, which, in turn, influences well-being
- Predictive of future disability, morbidity, and mortality (Sayer 2015)

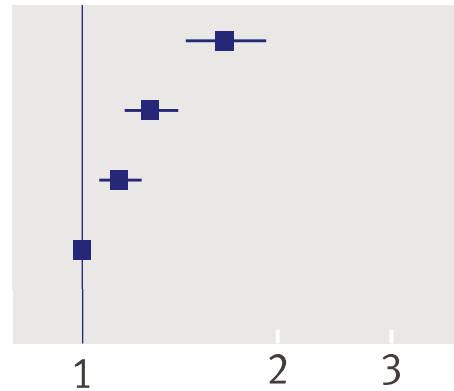
Grip strength (n=14)

Lowest quarter

2

3

Highest quarter



Summary hazard ratio (95% CI)

1.67 (1.45 to 1.93)

1.28 (1.16 to 1.40)

1.15 (1.07 to 1.24)

1.00

Hazard ratio of mortality

Meta-analysis based on 14 data points, adjusted for age, sex, and body size

Source: Cooper (2010)

This talk

- Intension: Measuring inequalities and inequities in grip strength among older adults using the CLSA
- This talk is exploratory, work-in-progress:
 - Presenting noteworthy aspects of grip strength (quite different from general health status measures)
 - Examining whether grip strength is a good measure of health to use in the assessment of health inequalities and inequities and why and why not

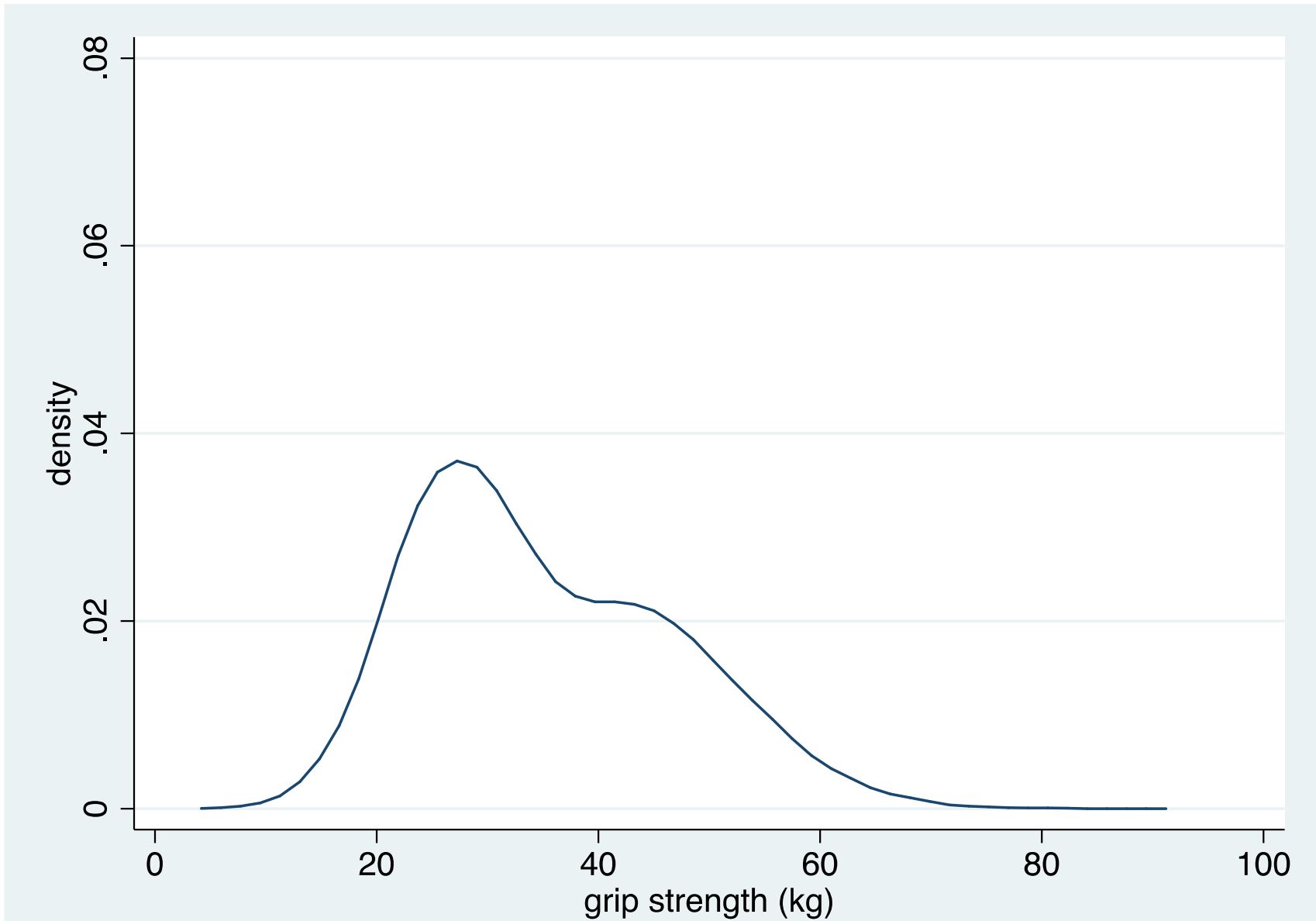
Data

- Canadian Longitudinal Study on Aging (CLSA), Comprehensive
 - Sample: about 30,000 non-institutionalized persons aged 45-85 at the time of recruitment
 - Data collection: In-home interviews and respondent visits to 11 data collection sites across Canada
 - For our analysis: baseline data, $N = 27,182$

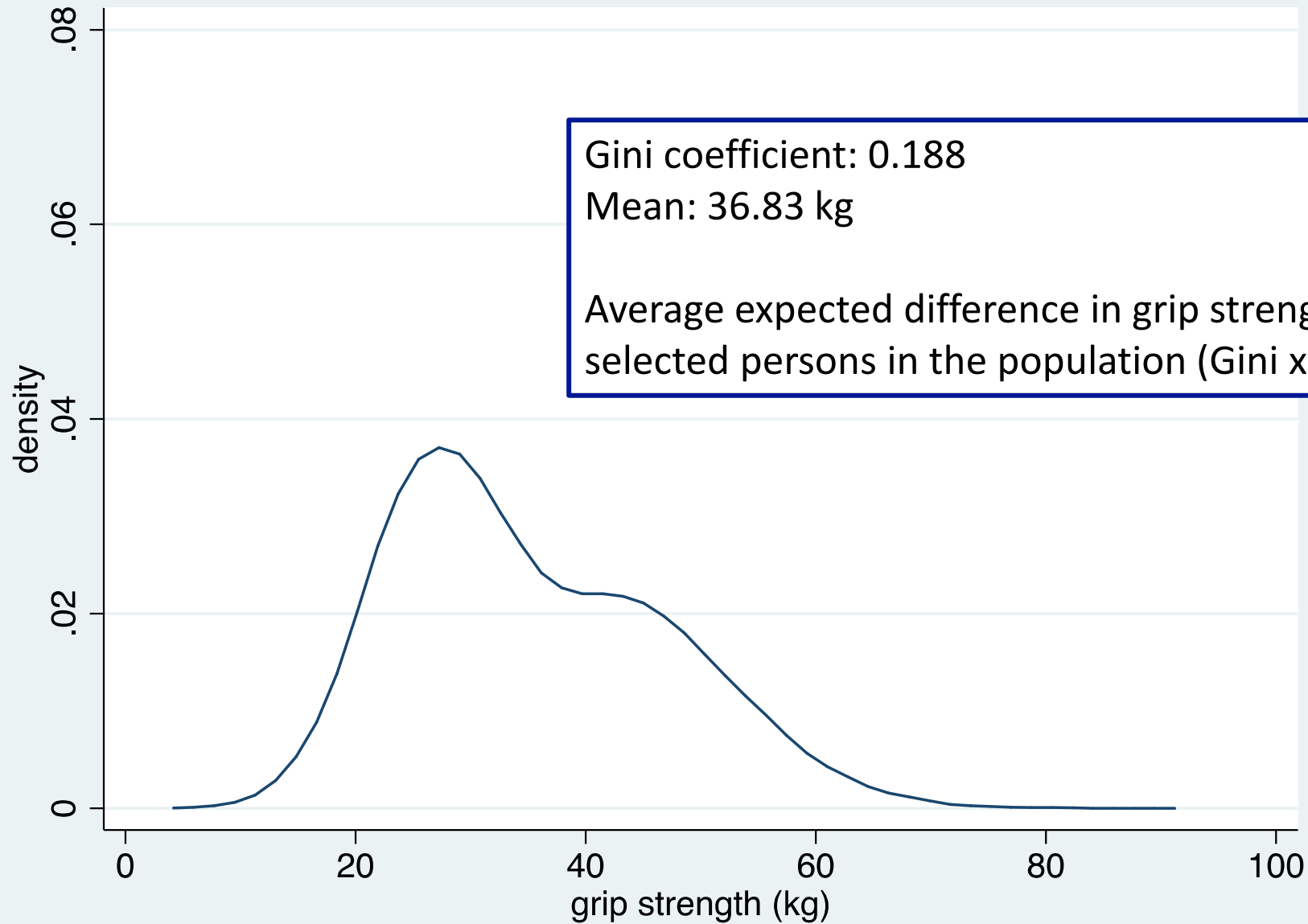
Variables

- Grip strength
 - Measured in kilograms
 - The maximum value of three measurements of the dominant hand, using the Tracker Freedom Wireless Grip Dynamometer
- Other variables
 - Age, sex, height
 - Ethnicity and Aboriginal status, sexual orientation, rurality, province of residence
 - Marital status, social participation
 - Household income, education, home ownership
 - Alcohol use, physical activity, waist circumference

Distribution of grip strength (both sexes)



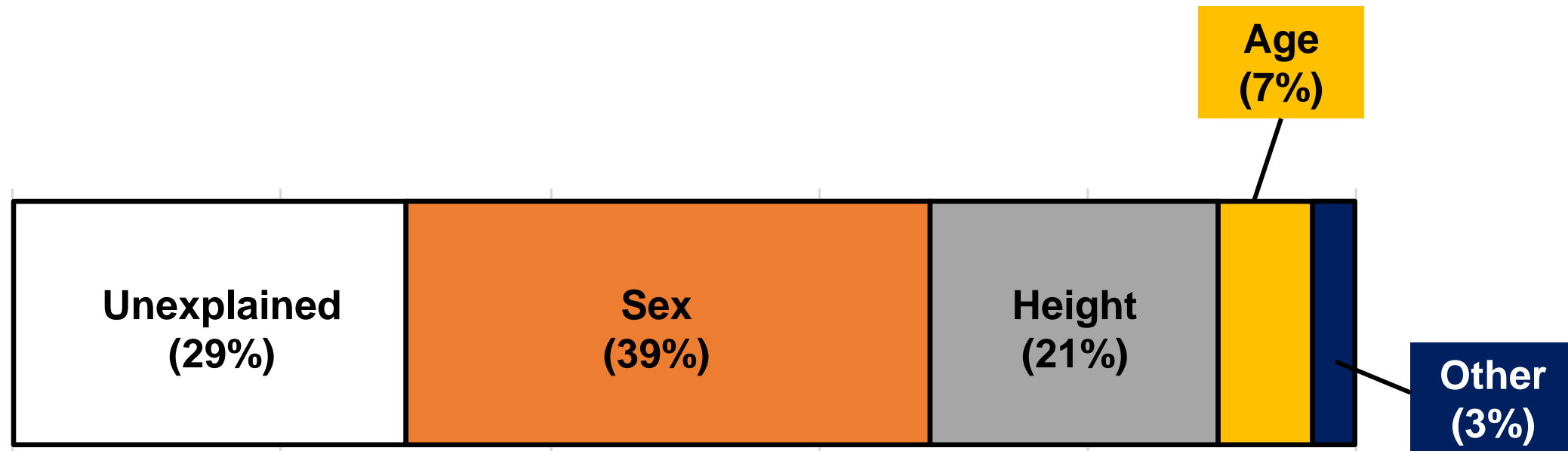
Distribution of grip strength (both sexes)



Considering inequality and inequity in grip strength

- Inequality = overall distribution of grip strength
- Inequity
 - Policy amenability: differences due to factors amenable to policy are unfair
 - Are there any factors associated with grip strength that we cannot do anything about through policy?
 - Suspects: age, sex, and height – known to be strongly associated with grip strength

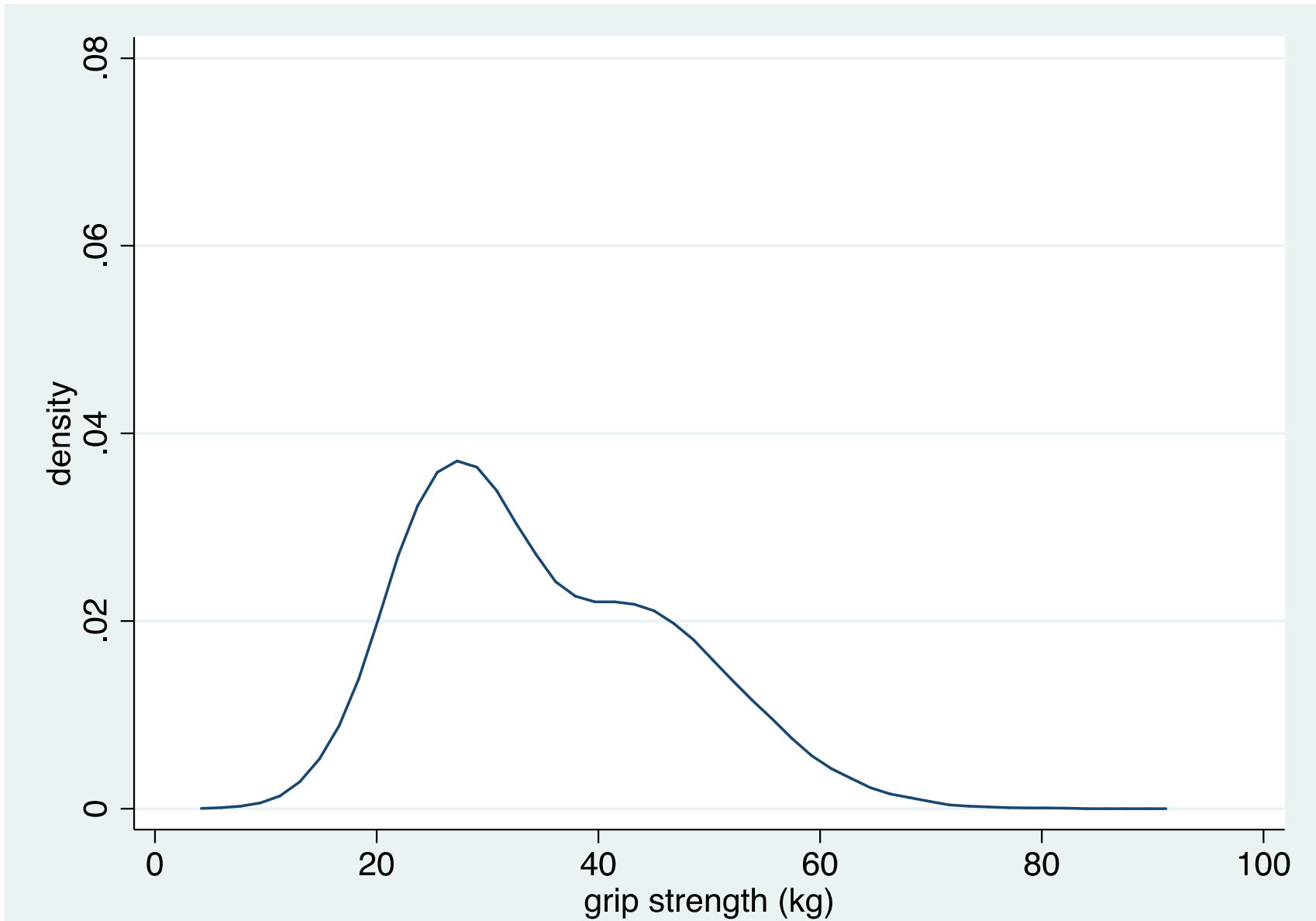
% of variation in grip strength explained



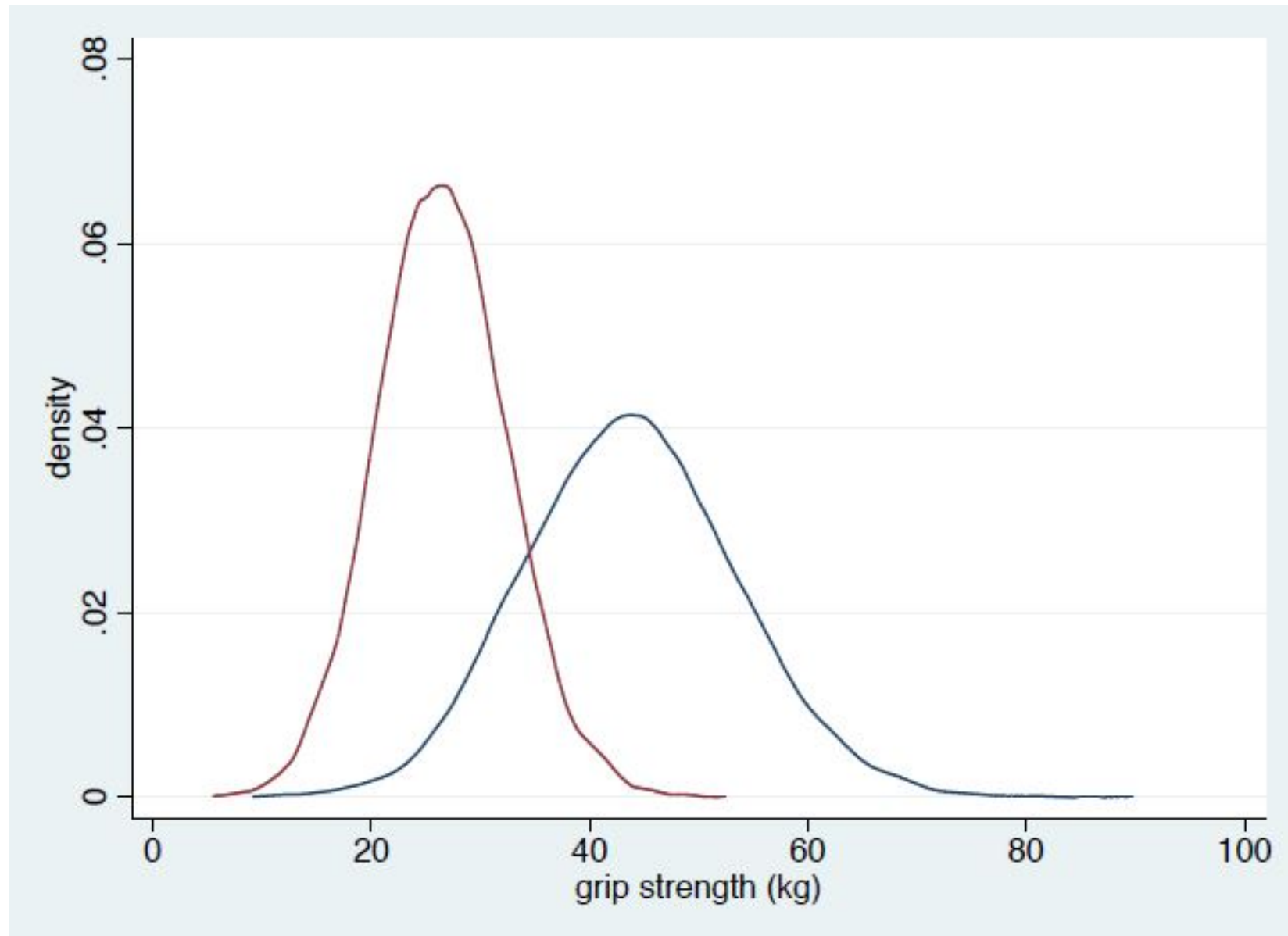
Based on regression-based inequality decomposition analysis

Regression model includes: age, sex, height, ethnicity and Indigenous status, sexual orientation, rurality, province of residence, marital status, social participation, household income, education, home ownership, alcohol use, physical activity, waist circumference

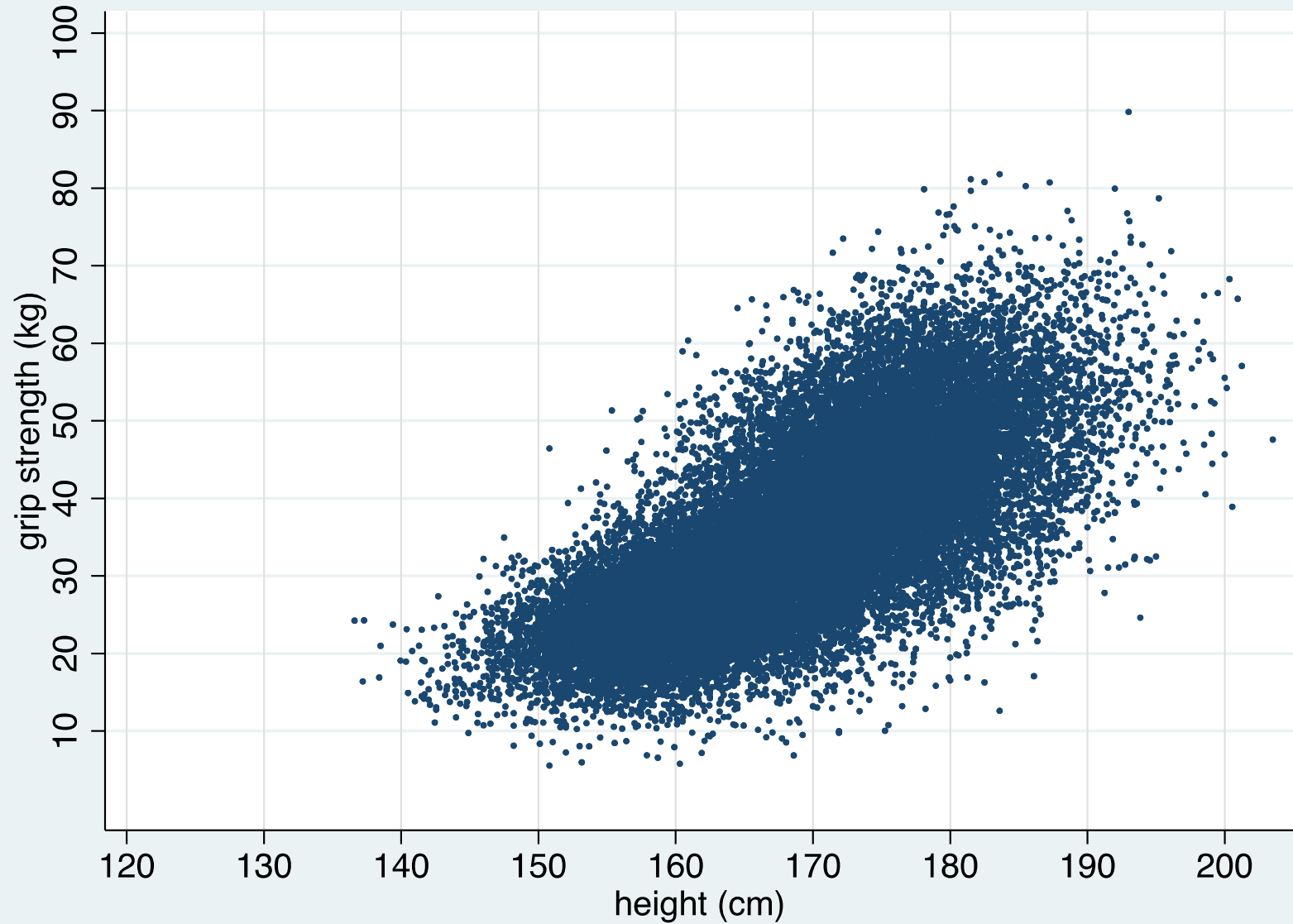
Distribution of grip strength (both sexes)



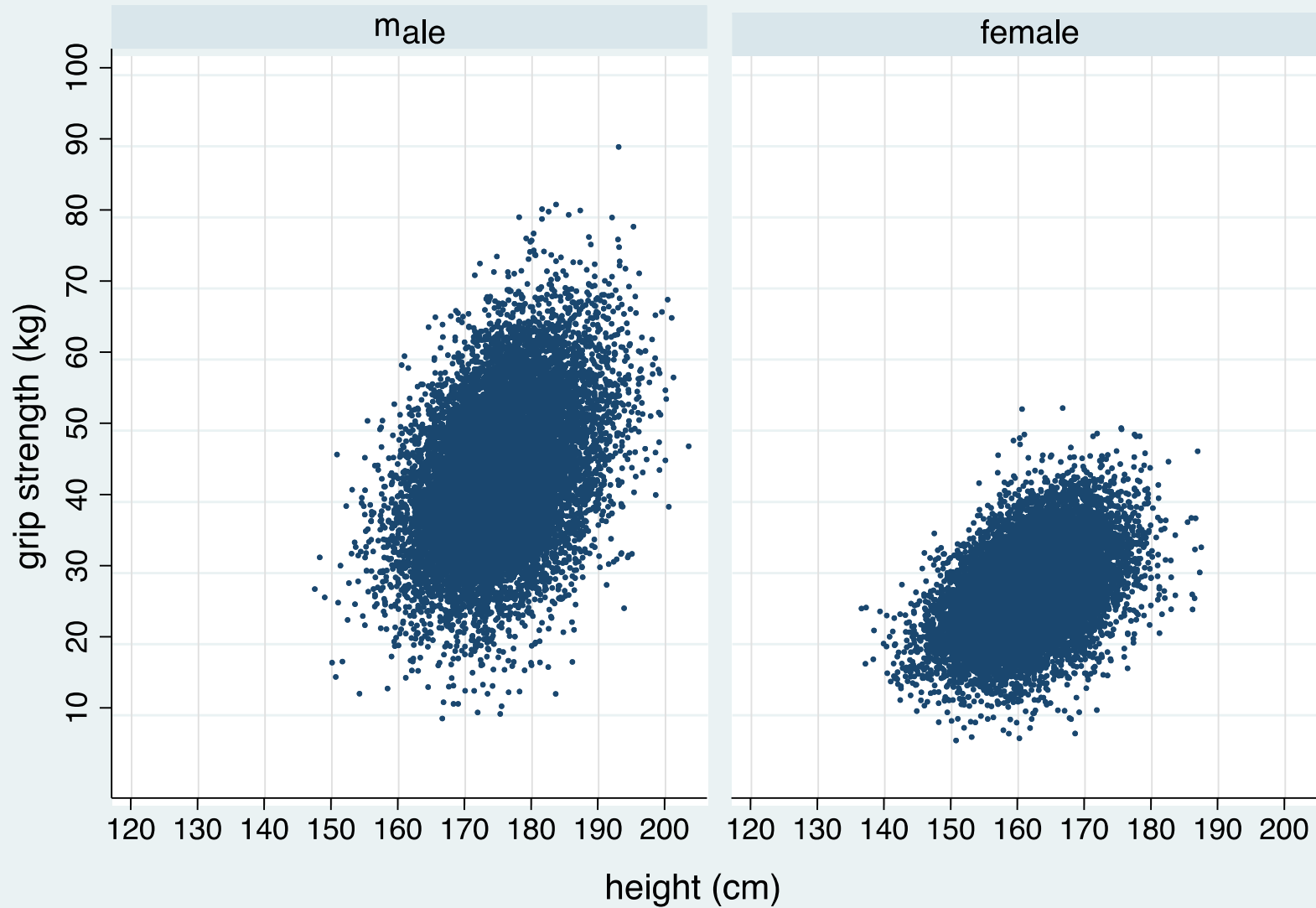
Distribution of grip strength by sex



Grip strength by height

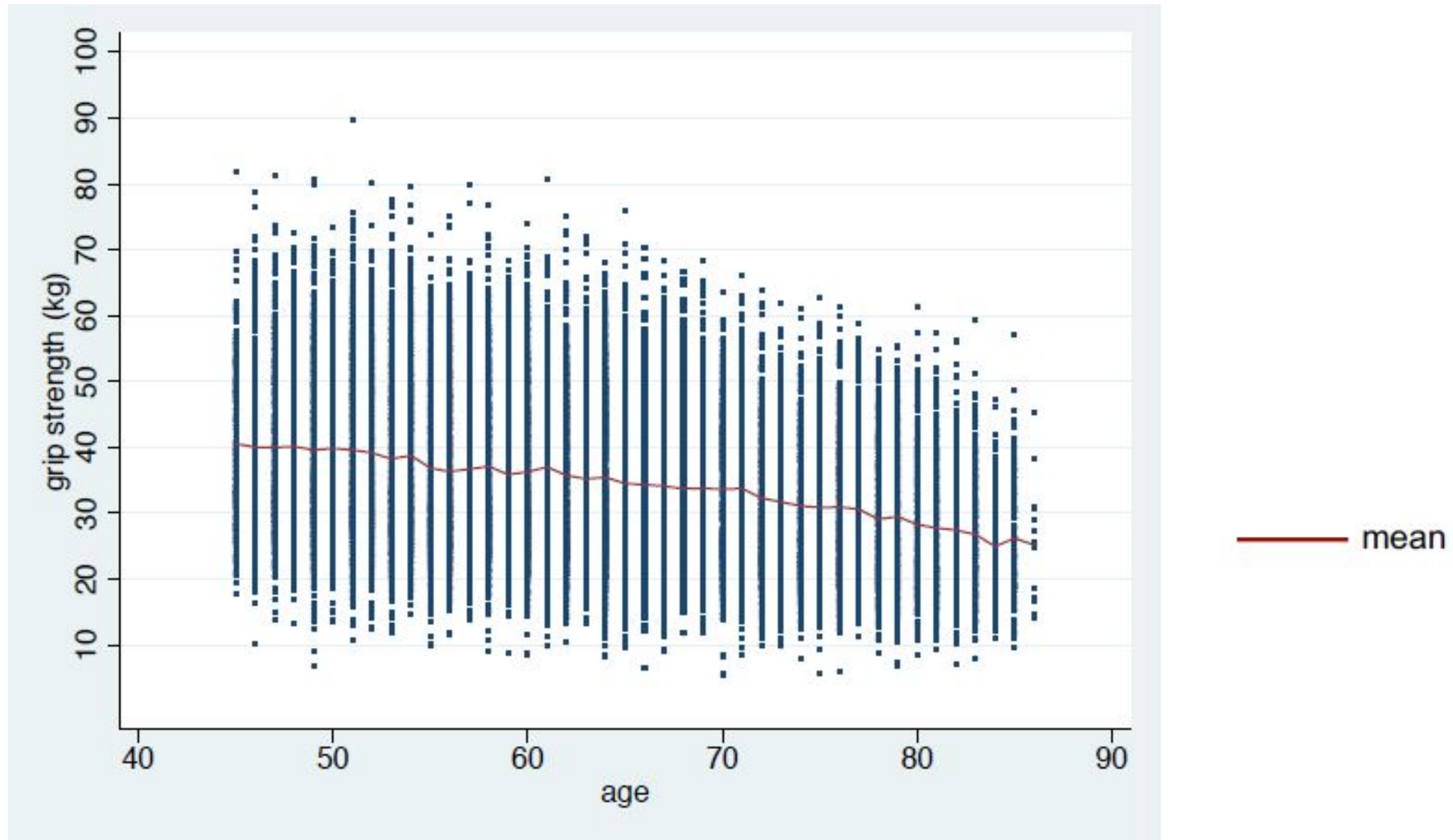


Grip strength by height and sex

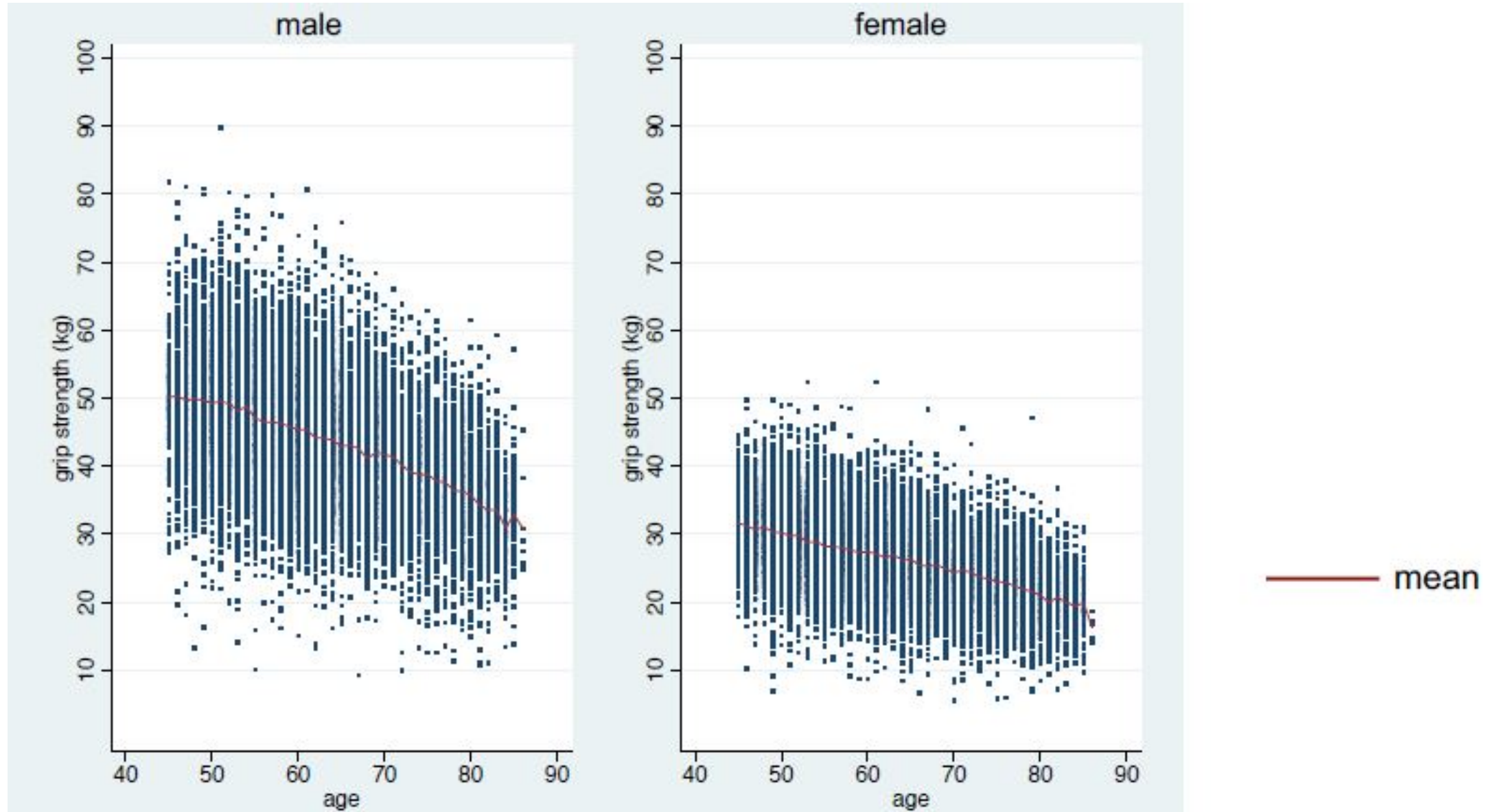


Graphs by sex

Grip strength by age

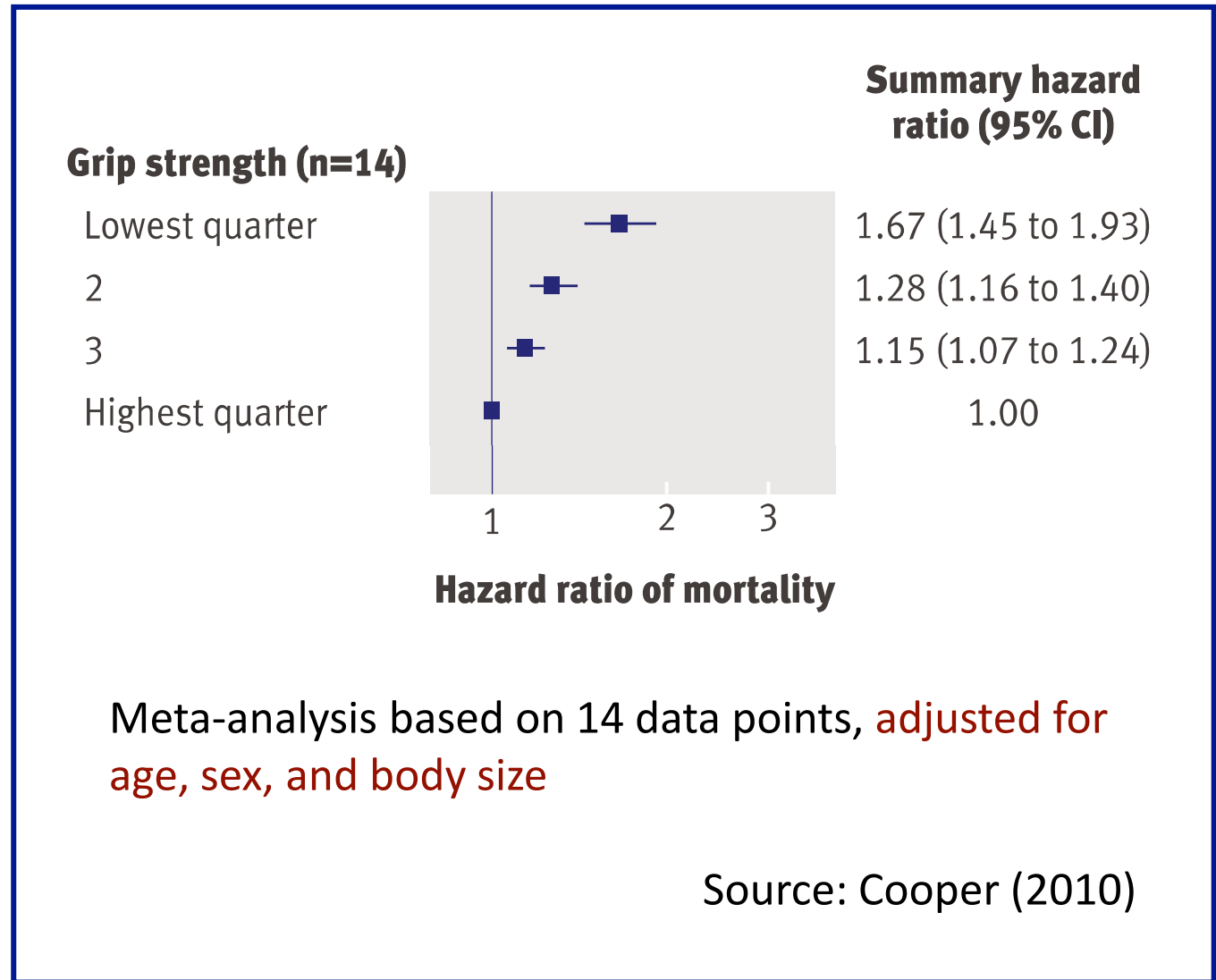


Grip strength by age and sex



Revisiting prognostic values of grip strength

- Studies vary in adjustment when estimating prognostic values of grip strength
- A loose consensus for adjustment: age, sex, and body size



What is the unfair distribution of grip strength?

- Inequity
 - Policy amenability: differences due to factors amenable to policy are unfair
 - If we assume differences in grip strength due to age, sex, and height are not something we can address by policy
 - Deviations from the “norm” set by age, sex, and height are unfair

Analyzing deviations from the norm

- Standardized distributions
 - Z-scores (the norm is age dependent)
 - T-scores (the norm is based on the age of the "peak performance")
- Examples
 - Child malnutrition (e.g., height-for-age, weight-for-age)
 - Bone density
 - Cognition (see Dr. Holly Tuokko's CLSA Webinar on January 16, 2018)
- Z-scores and T-scores for grip strength
 - Emerging interests (e.g., Cheug 2013, Bahannon & Magasi 2015)
 - Canadian reference values from 2007-2013 Canadian Health Measures Survey (Wong 2016)
 - No agreed-upon cut-off to indicate a "deficiency"

Calculating z-scores for grip strength using CLSA

- For each observation, i , male and female separately:

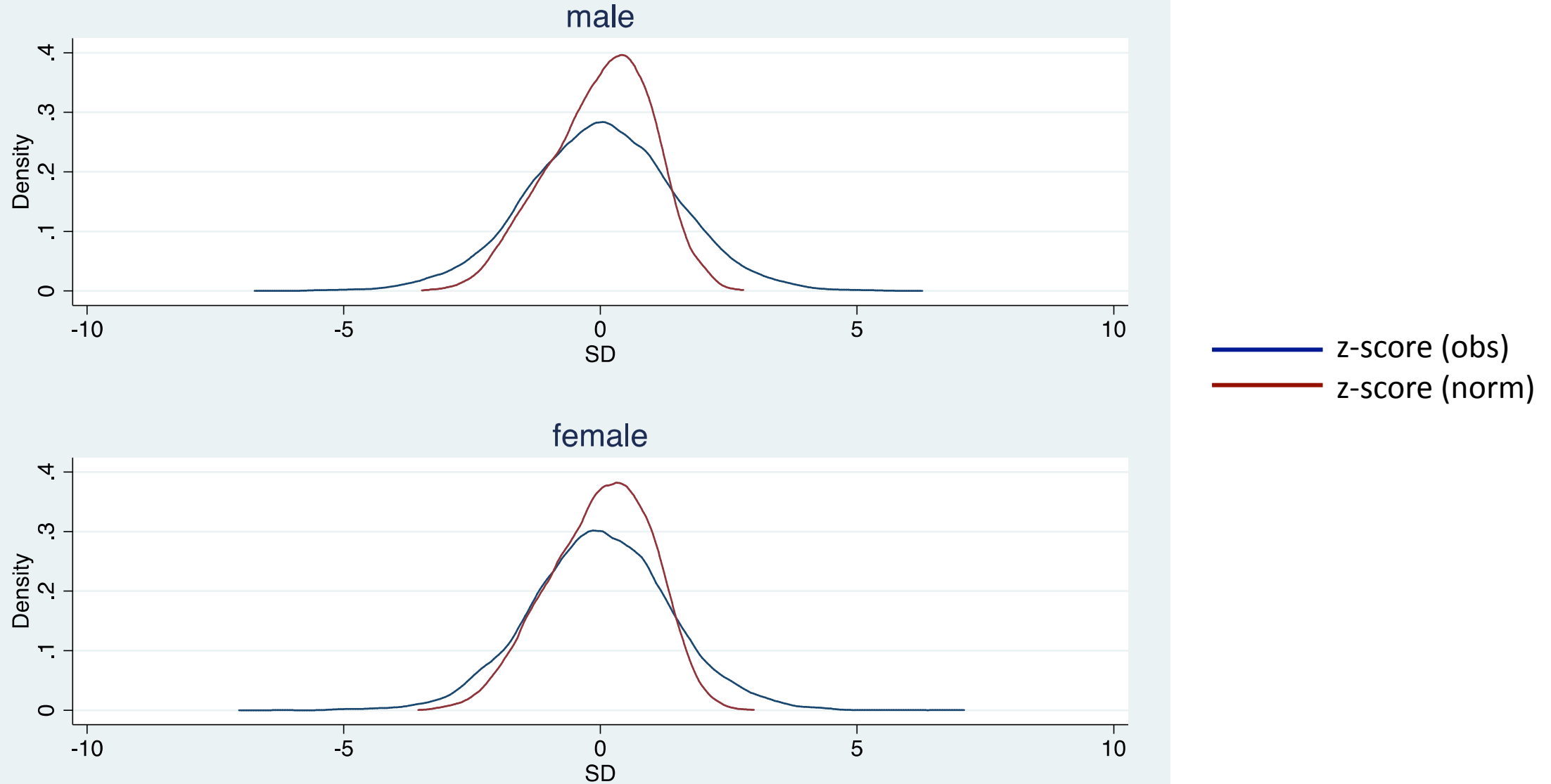
$$g_i = \beta_0 + \beta_1 \cdot a_i + \beta_2 \cdot a_i^2 + \beta_3 \cdot h_i + \varepsilon_i$$

$$\hat{g}_i = \hat{\beta}_0 + \hat{\beta}_1 \cdot a_i + \hat{\beta}_2 \cdot a_i^2 + \hat{\beta}_3 \cdot h_i$$

$$z_i = \frac{g_i - \hat{g}_i}{SD_{\hat{g}_i}}$$

Where g is grip strength; a is age; h is height; and SD is standard deviation

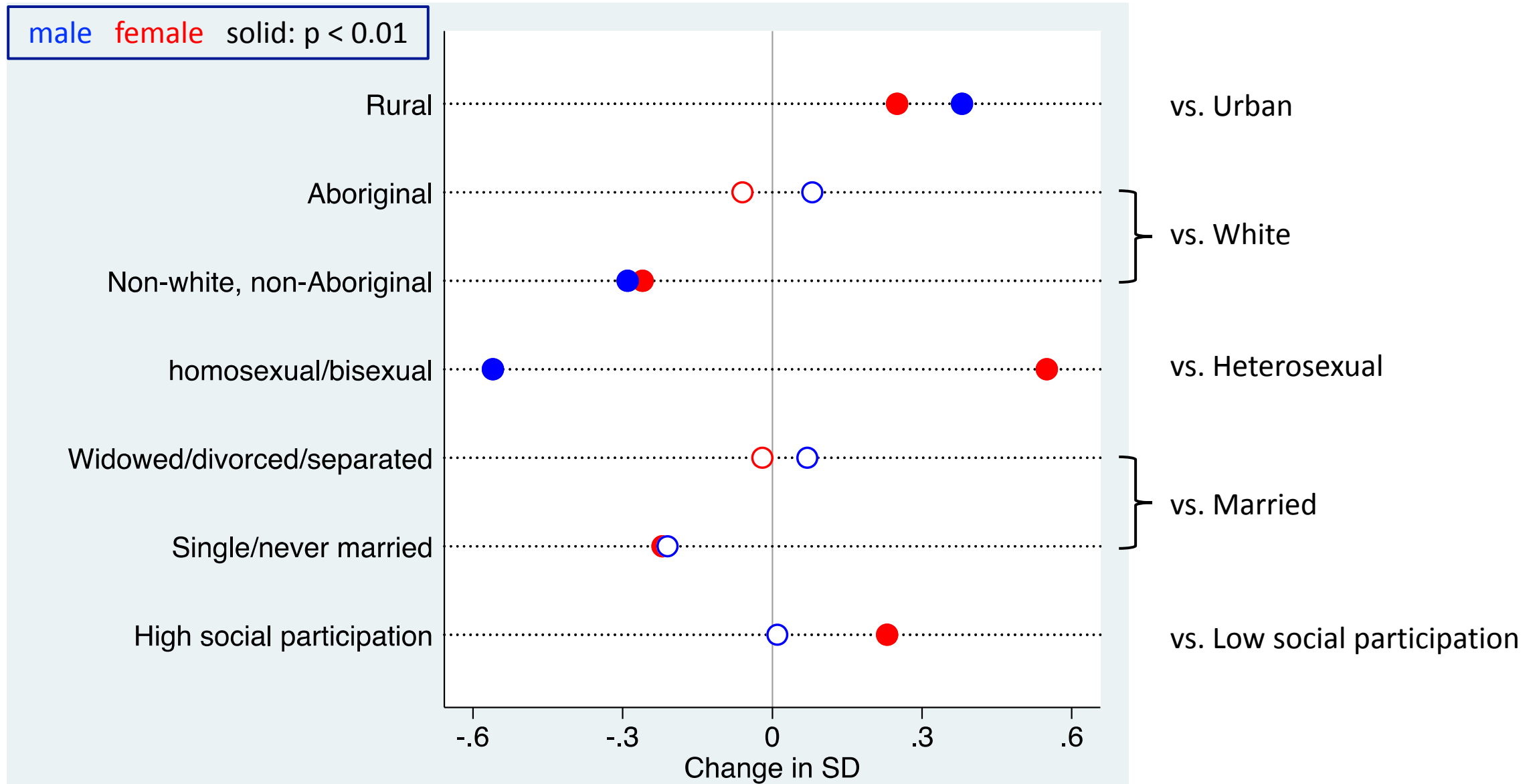
Observed and “norm” z-score distributions



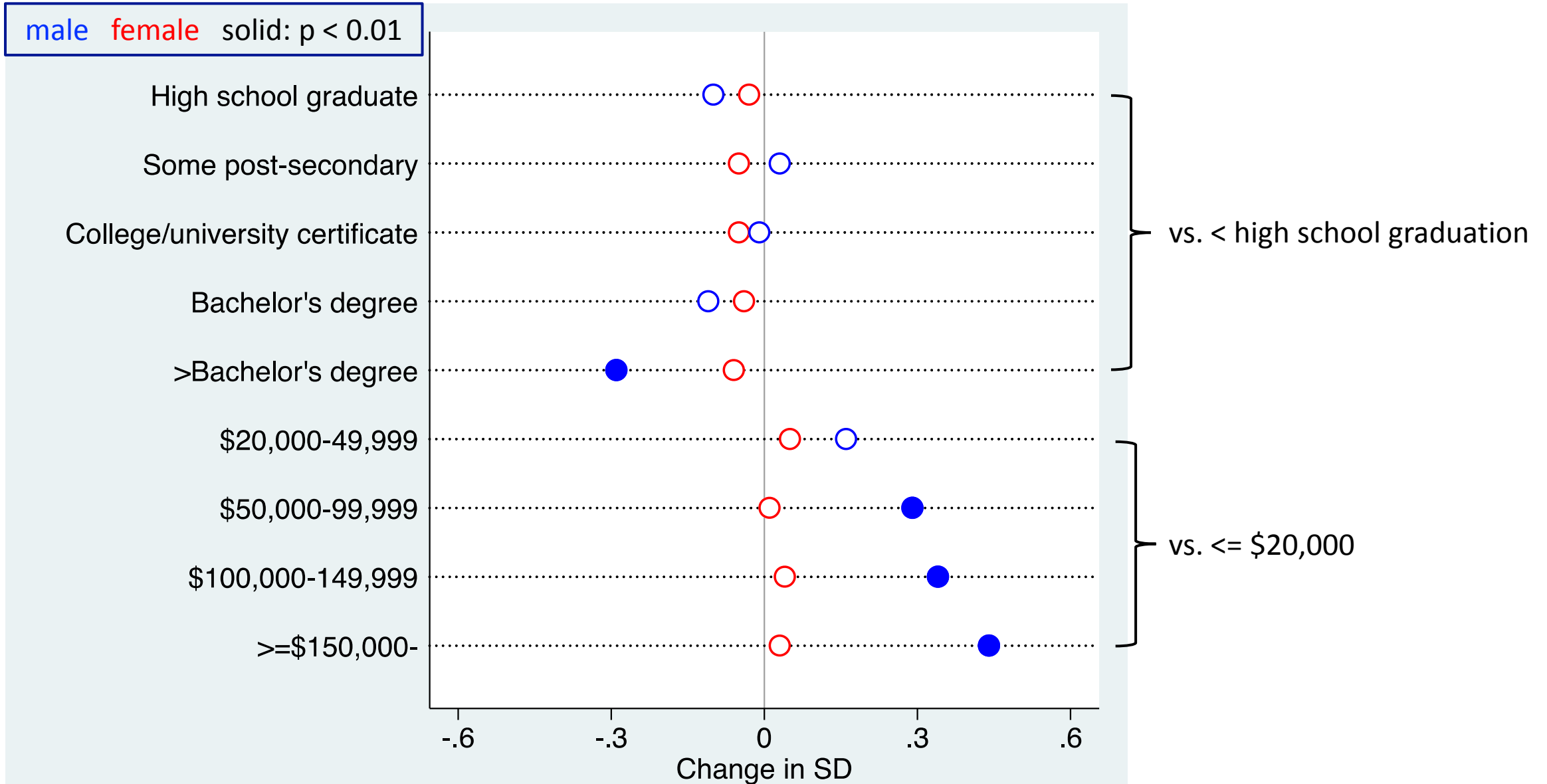
What factors are associated with z-scores?

- Separately for male and female, ran regression analysis with grip strength z-score as the dependent variable
- Independent variables in the model:
 - Ethnicity and Aboriginal status, sexual orientation, rurality, province of residence
 - Marital status, social participation
 - Household income, education, home ownership
 - Alcohol use, physical activity, waist circumference
- Model specification: Ordinary Least Squares (OLS)
- Sample weighted and variance estimation accounting for the complex survey design

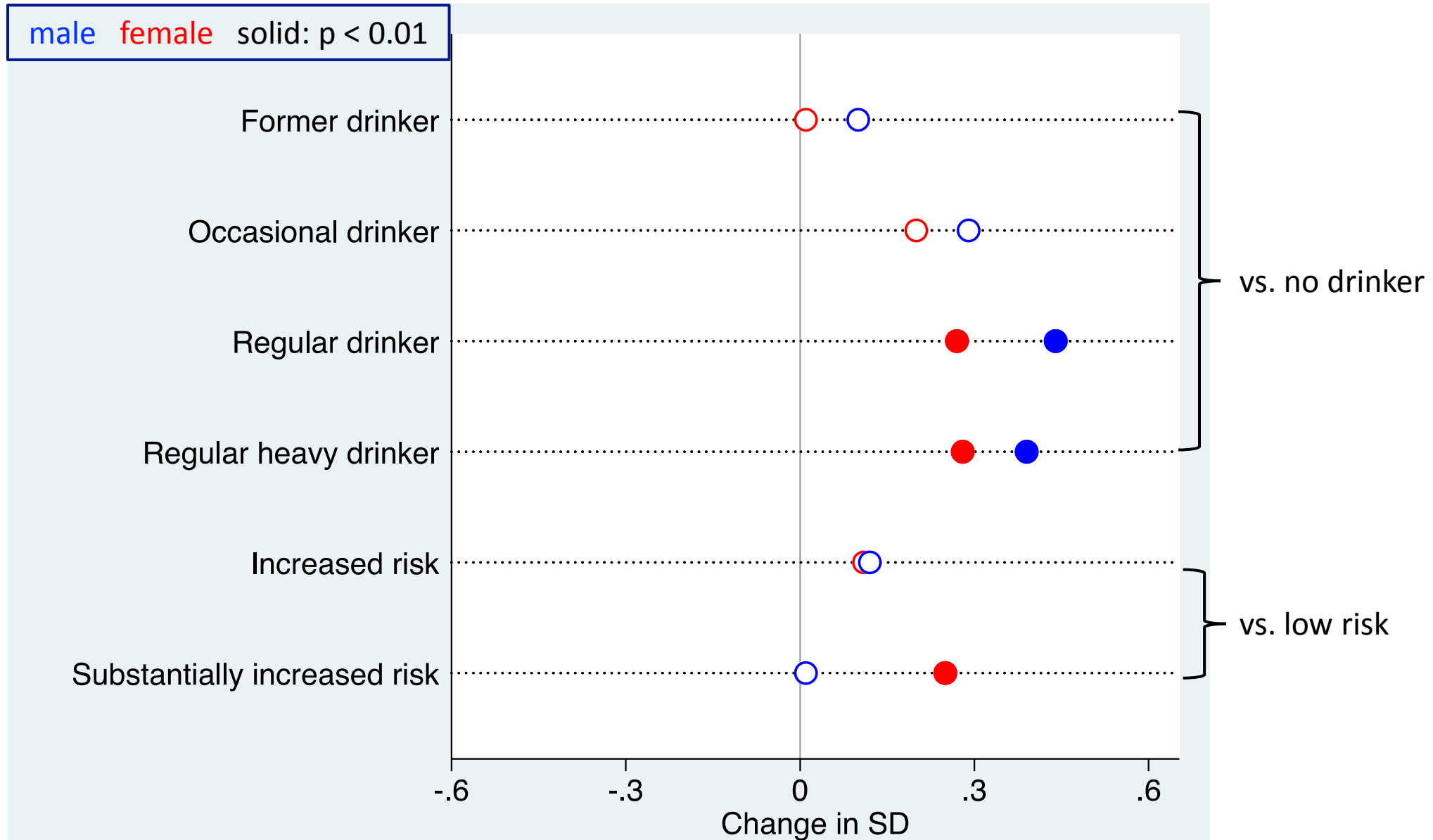
Associations with social factors



Associations with socioeconomic factors



Associations with health behaviours

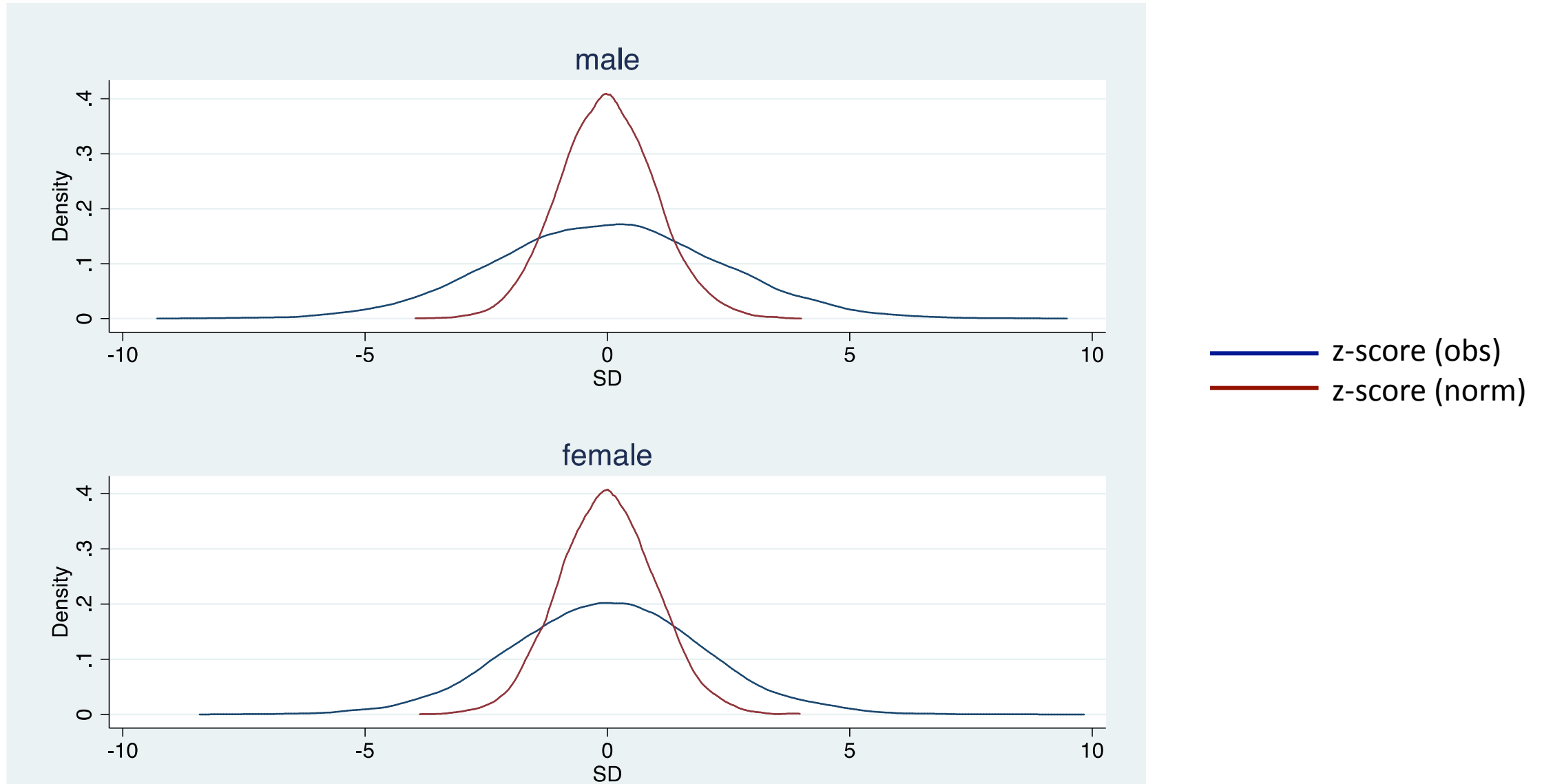


Key questions when considering grip strength for health inequity analysis

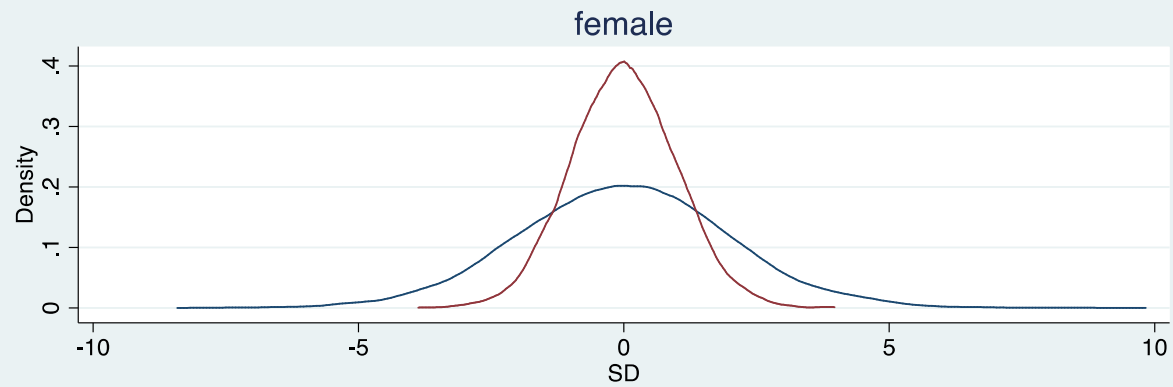
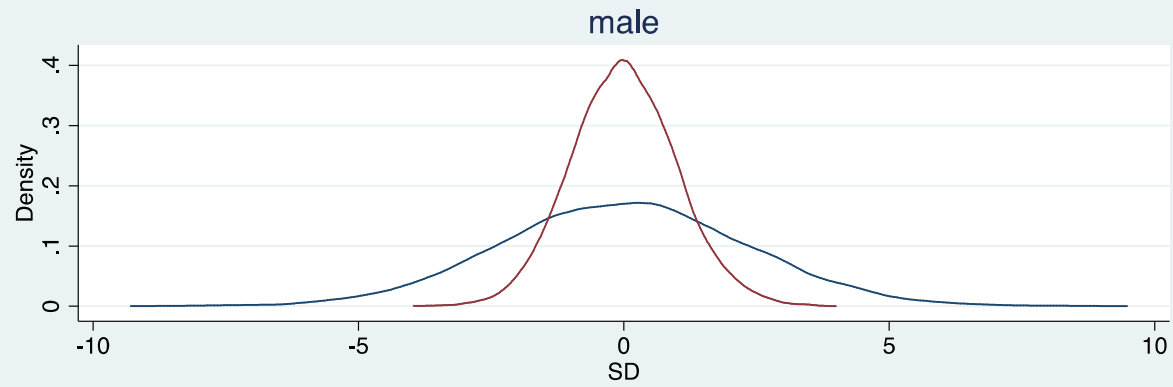
Key question 1

- What should the fair distribution of grip strength look like?
 - Is weaker grip strength associated with being older, female, and shorter something we cannot do anything about through policy?

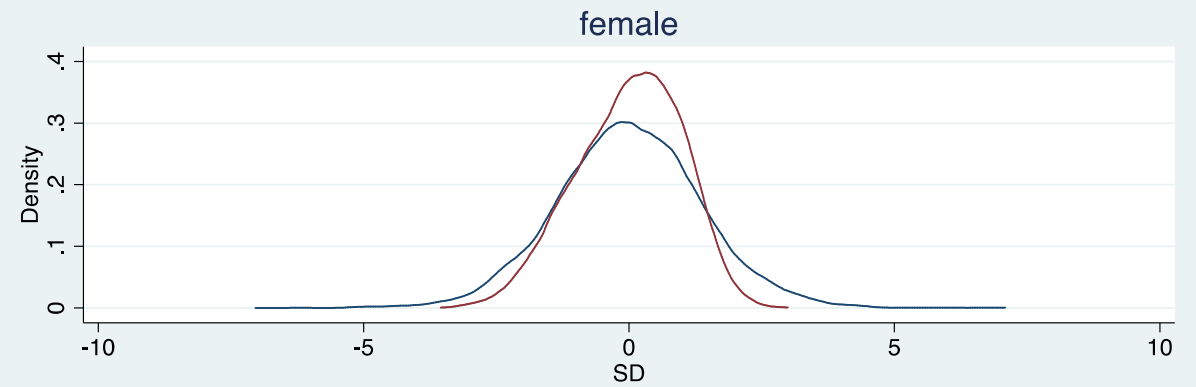
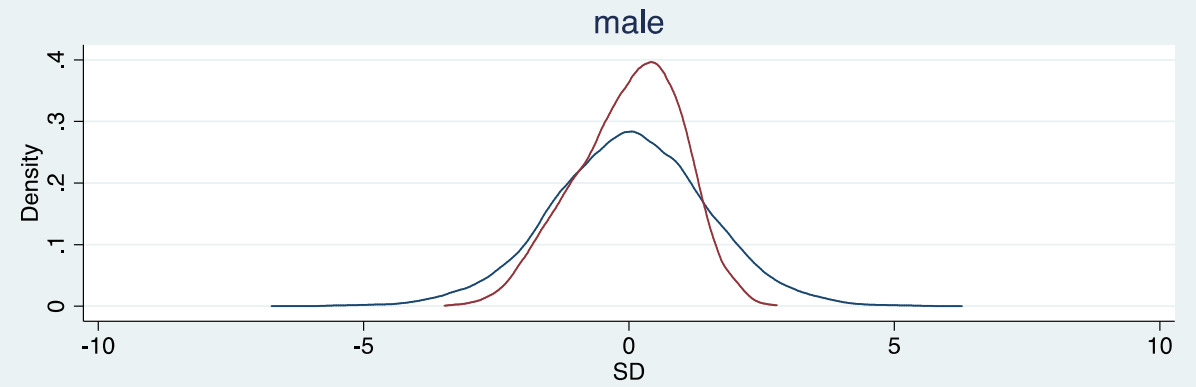
What if the norm is set by sex and height only?



Norm set by sex and height

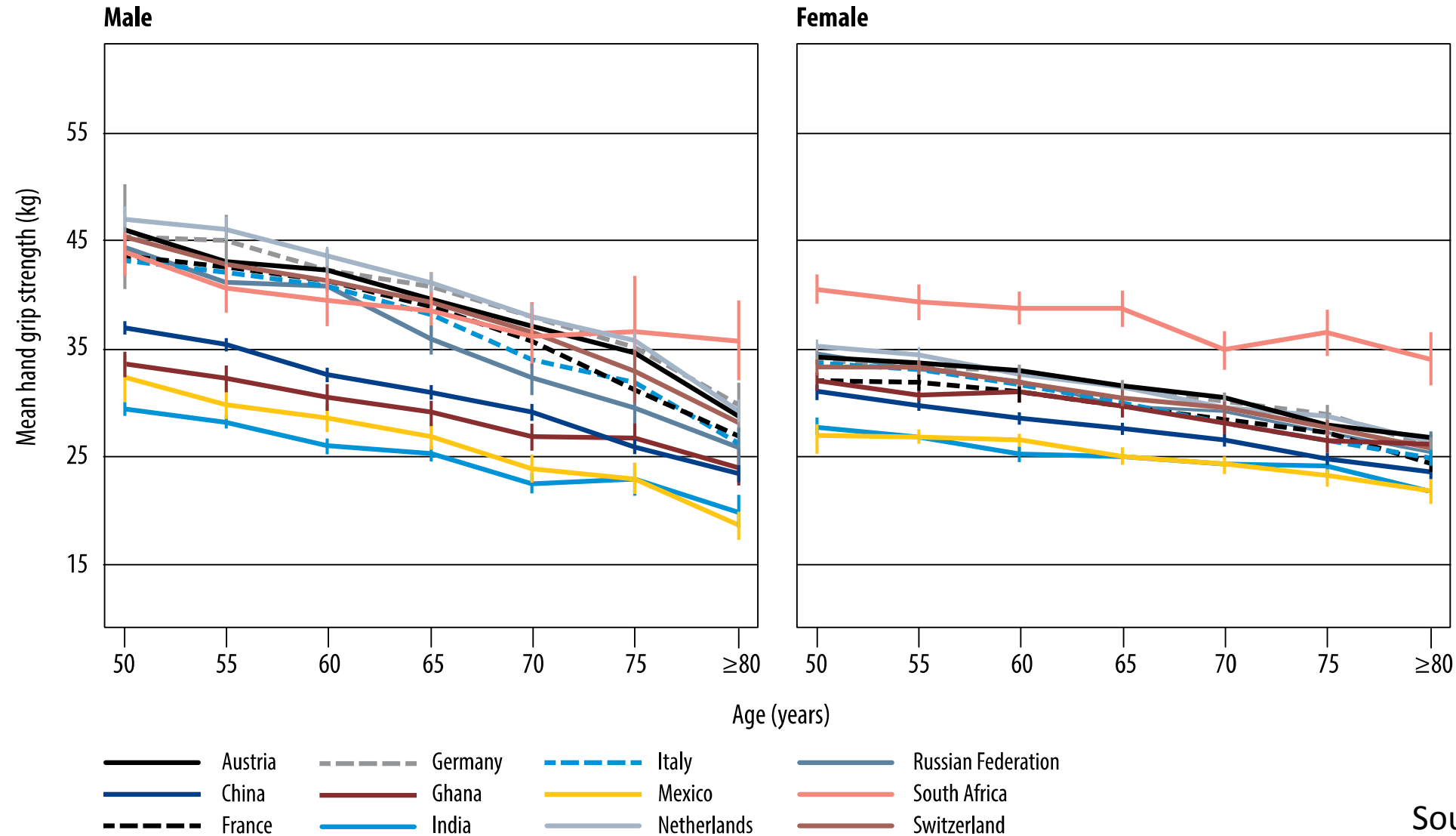


Norm set by age, sex, and height



— z-score (obs)
— z-score (norm)

Grip strength by sex and country



Source: WHO (2015)
Data sources: SAGE and SAHRE

Key question 2

- To what extent should we expect that inequity in grip strength is associated with social disadvantage?
- More concretely, how should we think about:
 - No clear, less-than-expected, or counter-intuitive socioeconomic gradient in the deviation from the norm
 - Regular heavy drinking associated with grip strength better than the norm
- Further issues to consider:
 - Puzzling associations we observed may be spurious due to limitations of our simple models
 - Should a good measure of health for health equity analysis to assess successful aging of a population be sensitive to social disadvantage and unhealthy behavior?

Summary

- Grip strength is touted an objective, simple measure of health in aging population
- A successfully aging population has both a good overall level of health and a fair distribution of health
- Assessing inequality and inequity in grip strength appears promising, but the use of grip strength requires caution
- It is important to consider what the fair distribution of grip strength should look like, but the answer is not straightforward
- Persons with social disadvantage and unhealthy behavior may have stronger grip strength than expected, casting a doubt on its use for health equity analysis as a barometer of successful population aging

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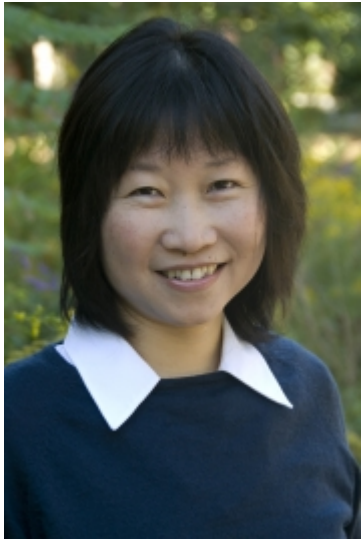
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Questions?

Upcoming CLSA Webinars



“Exploring the Geography of Cognitive Function and Social Support Availability: A Spatial Analysis of the CLSA”

Dr. Jane Law and Matthew Quick

May 29, 2018 | 12 p.m. EST

Register: bit.ly/clsawebinars

