

Perception and “Reality:” How Three Self-Report Measures of Physical Activity Compare to Data from Wearables

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Measuring Physical Activity is Hard

- There is good reason to be critical of self-reports of physical activity.
 - Low to moderate correlations (Prince et al 2008; Brenner and DeLamater 2013; Steene-Johannessen et al 2016).
 - Large bias in longer-term recall (Matthews et al 2012; Ainsworth et al 2015; Knell 2017).
 - Larger biases in type and intensity (Loney 2011 et al; Downs et al 204).
 - Bias moderated by sociodemographic factors (Cerin 2016 et al; VandeBunte et al 2022).
- Wearables are an improvement over self-reports (An et al 2016; Evenson et al; Germini et al 2022; Hilden et al 2023).
- Wearables also have downsides for a large panel.
 - Selection issues (Ferguson et al 2021).
 - Expensive.
- What to do?
 - Make sure the self-reports we're using are as good as they can be.

The UAS Physical Activity Experiment

- **Basic idea:** See which measure of self-reported physical activity best correlates with data from wearable technology.
- Three self-reported measures of physical activity: **(1) Stanford Activity Survey (2) Active/Sedentary Survey (3) International Physical Activity Questionnaire (IPAQ)**
- Fielded to all UAS participants who had been invited to participate in American Life in Real Time (ALiR).
- Three waves
 - Wave 1: September 2024 – October 2024
 - Wave 2: October 2024 – November 2024
 - Wave 3: December 2024 – January 2025

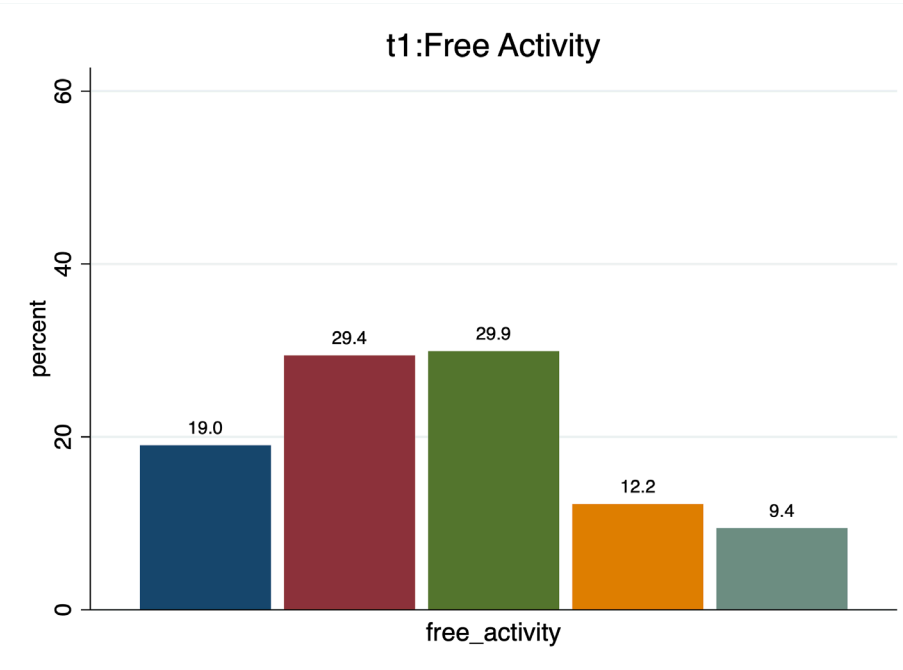
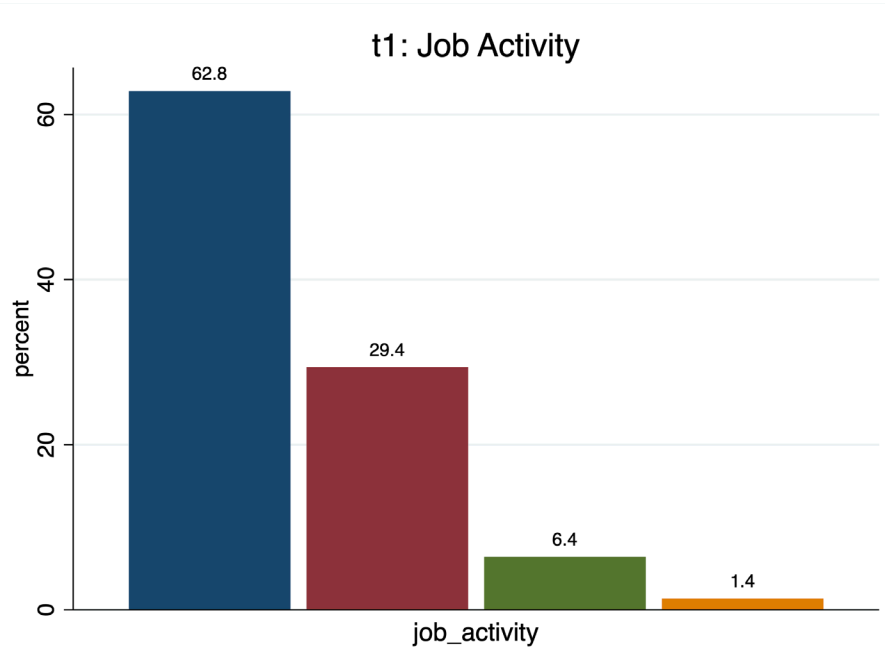
The Physical Activity Treatments

Stanford Activity Survey	Activity/Sedentary Survey	IPAQ
<ul style="list-style-type: none"> • Asked if worked in past year • If worked: How active [1-4] • How active when not working [1-5] • Overall activity [1-10] 	<ul style="list-style-type: none"> • How active last 7 days [1-5] • How sedentary last 7 days [1-5] • Asked if made comparison • Asked who compared themselves to 	<ul style="list-style-type: none"> • How many days vigorous activity in last 7 days • How many days moderate activity in last 7 days • How many days walk for 10 minutes in last 7 days • How much time vigorous/moderate/walking on one of those days

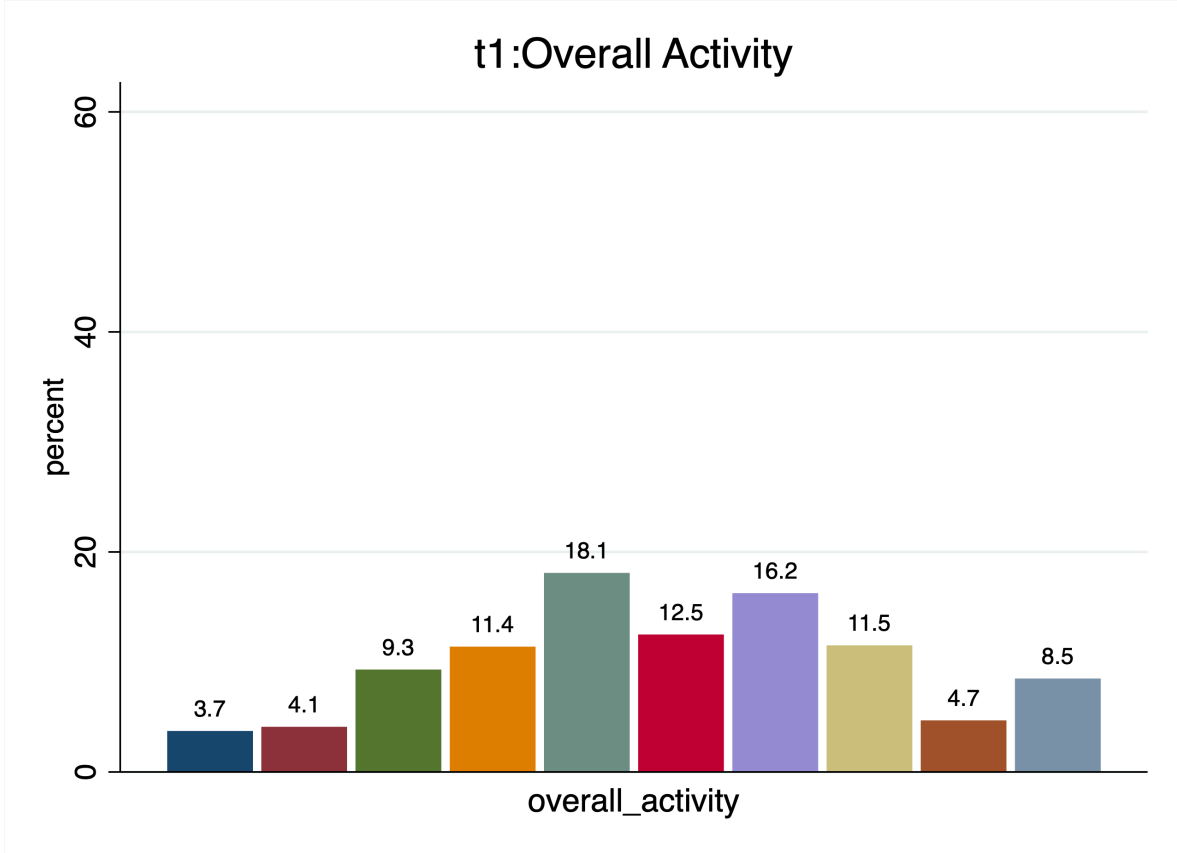
The UAS Physical Activity Experiment

- **Sample:** 4,311 UAS panel members invited to ALiR
 - 703 individuals had a device linked with ALiR in 2024.
- Survey response rate
 - Wave 1: 80%
 - Wave 2: 80%
 - Wave 3: 78%
 - 99% of ALiR participants answered at least one wave.
- ALiR
 - Daily average (annual and week prior to survey)
 - Outcomes: distance, steps, and activity zones: fat burn (50-69% MHR), cardio (60-84% MHR), and peak (+85% MHR).
 - Compliance rate (days with daily data/total number of days): ~63%
- Analysis
 - Simple linear regression of ALiR outcomes on standardized survey measures.

Distributions for Survey Measures

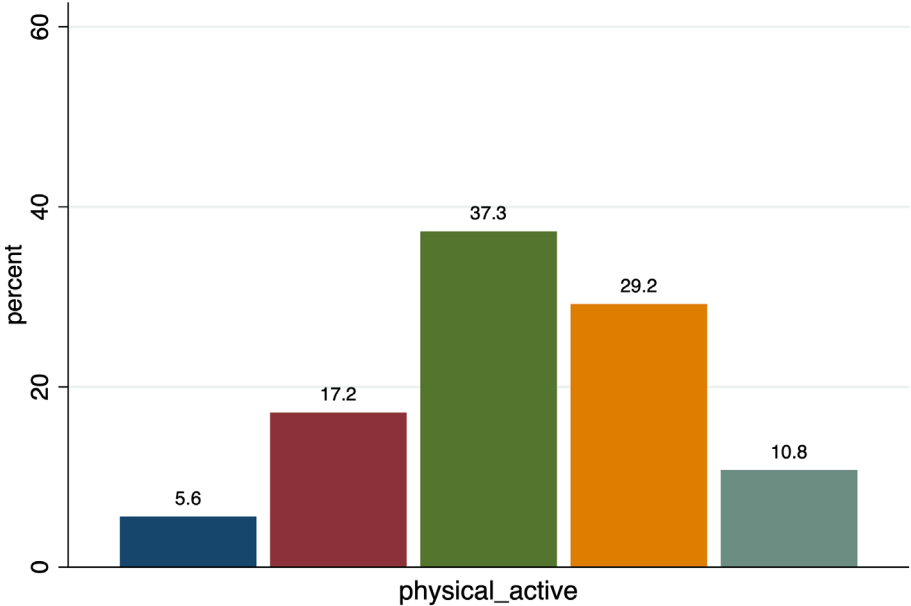


Distributions for Survey Measures

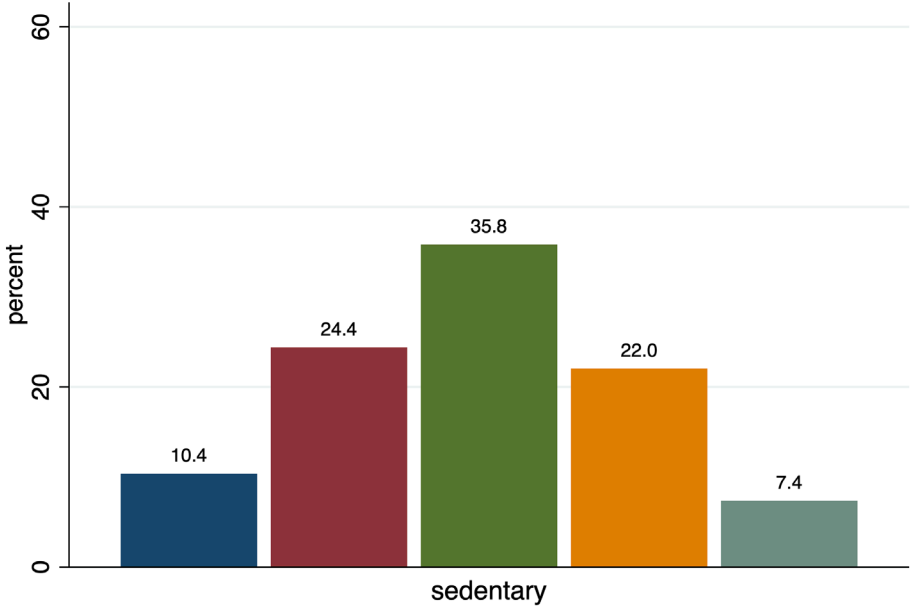


Distributions for Survey Measures

t2:Physically Active

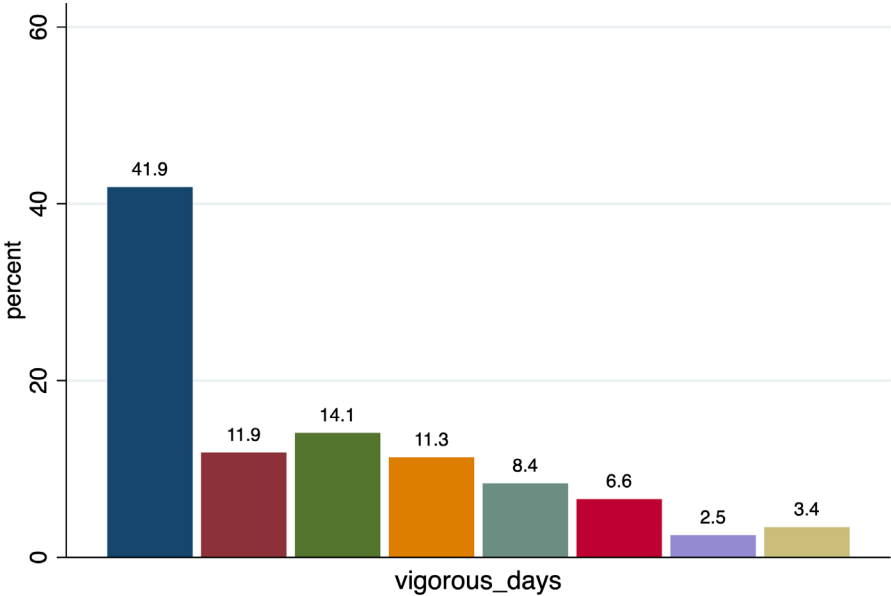


t2:Sedentary

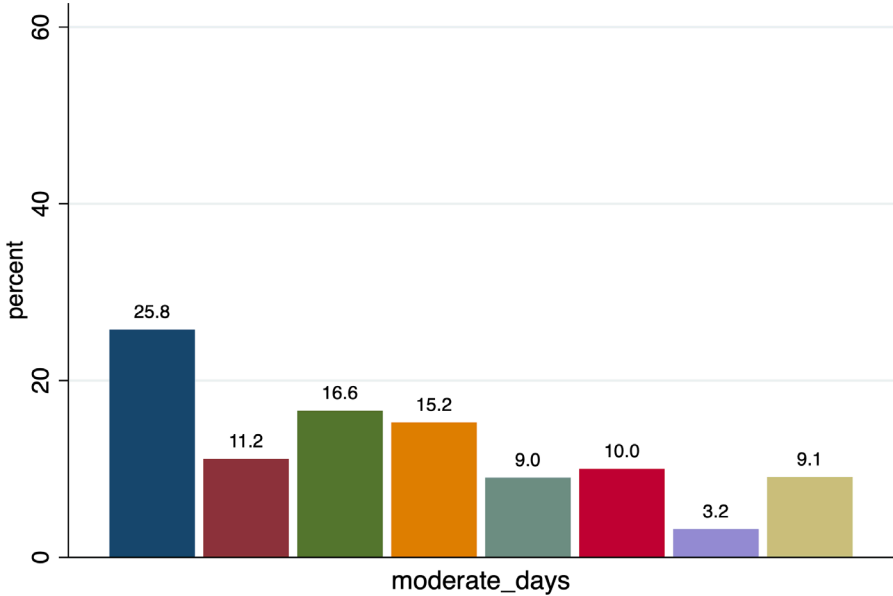


Distributions for Survey Measures

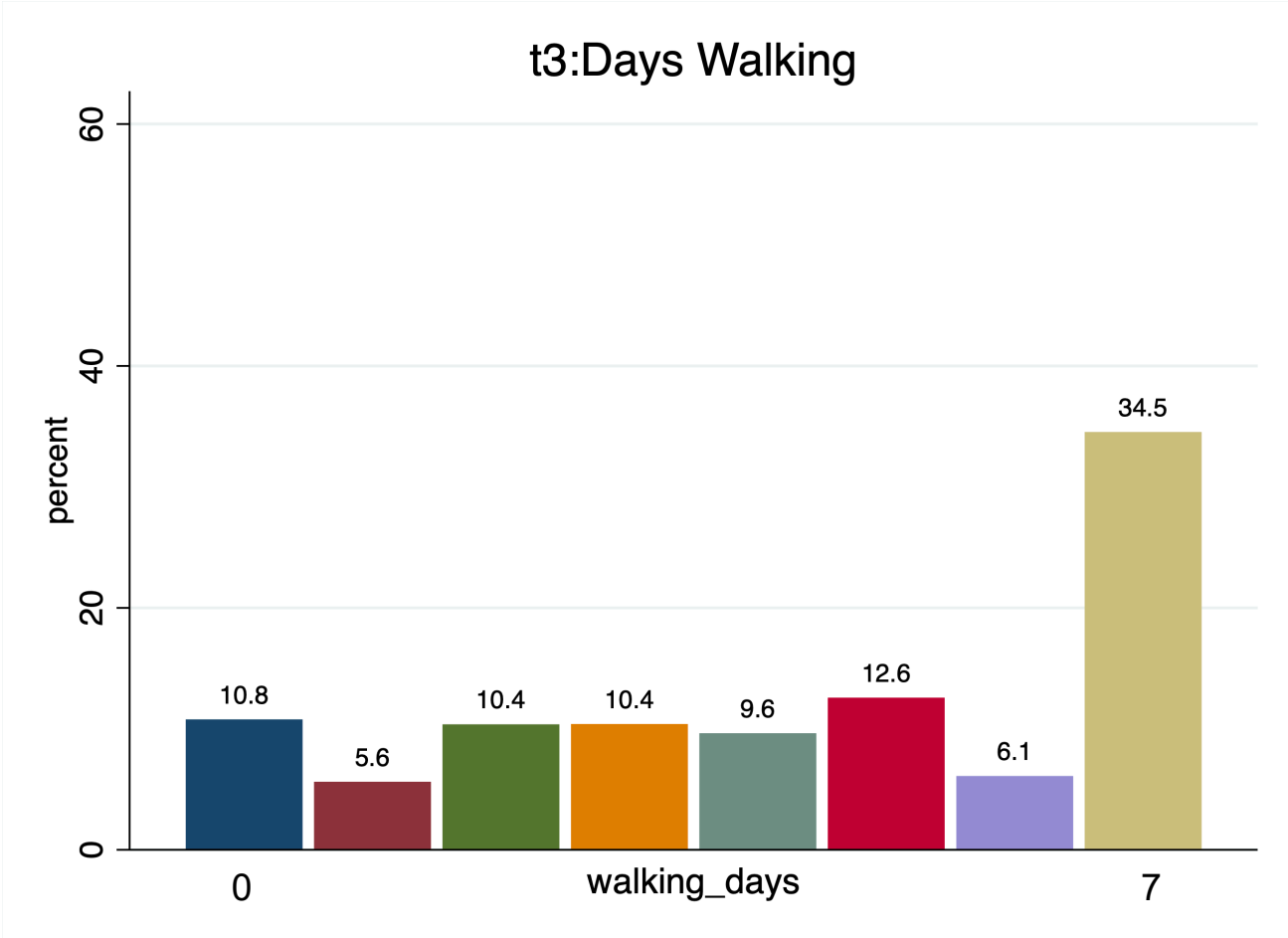
t3:Days Vigorous



t3:Days Moderate



Distributions for Survey Measures



Distributions for Fitbit Measures

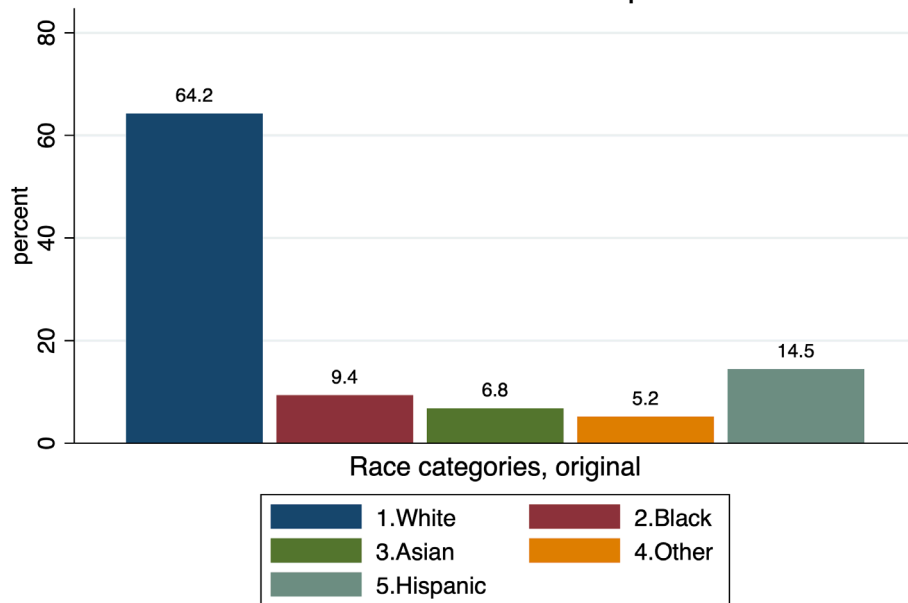
Variable	Median	Mean	Std.
Active Zone Minutes	38.97	54.25	59.23
Fat Burn	32.35	40.12	29.98
Cardio	5.63	11.39	17.7
Peak	.24	2.73	31.08
Steps	5286.39	5556.81	4099.47
Distance	3.67	3.86	2.92

Sample Demographics: Race

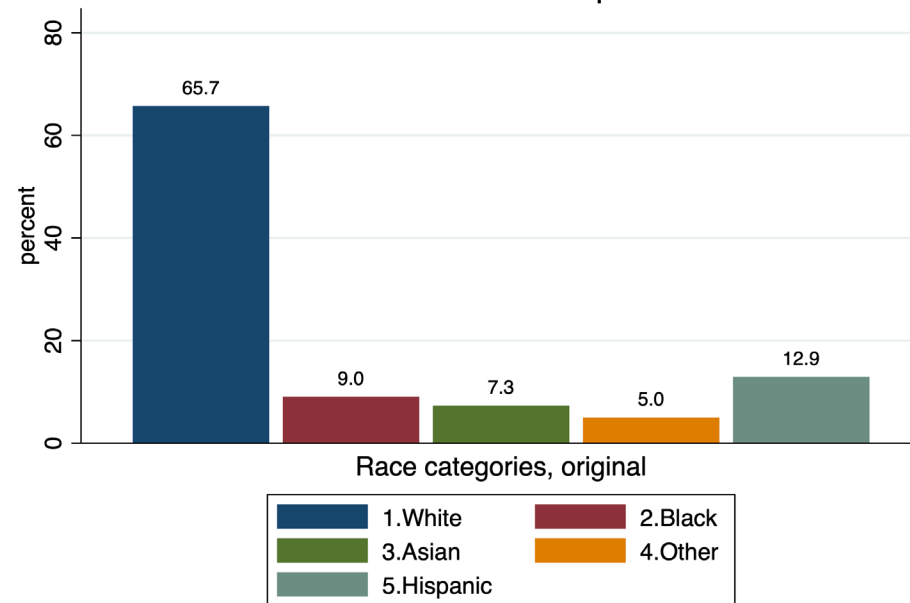
Non-ALiR Participants

ALiR Participants

Race: Non-ALiR Participants



Race: ALiR Participants

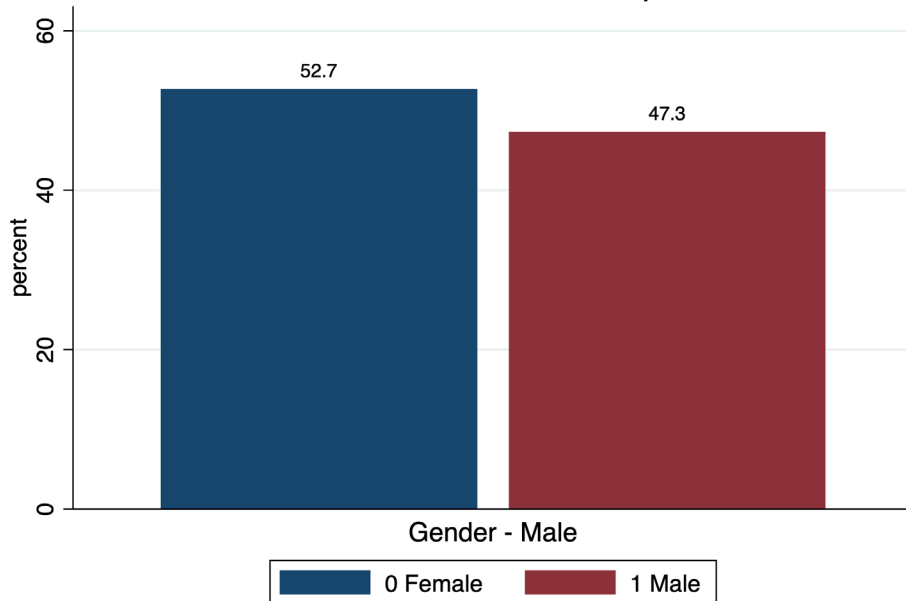


Sample Demographics: Gender

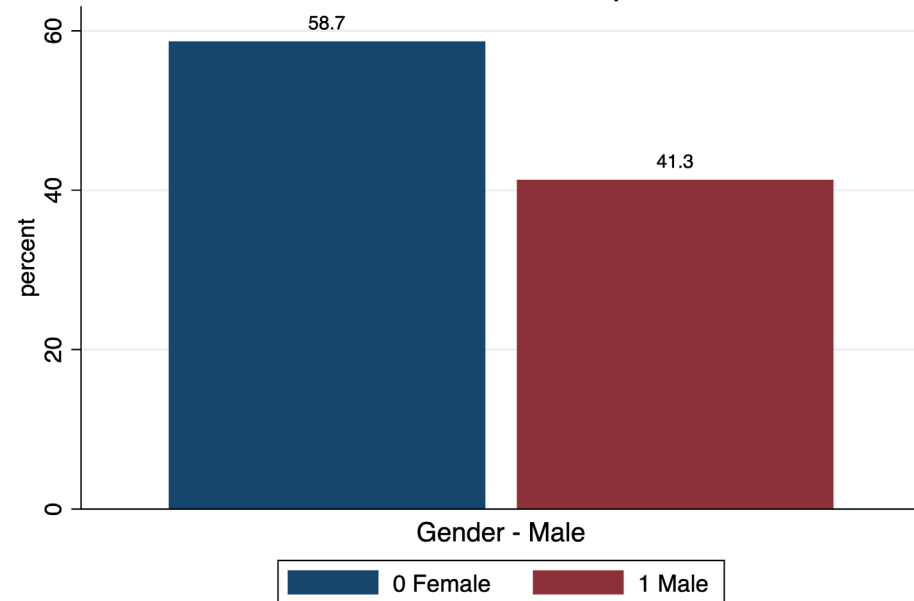
Non-ALiR Participants

ALiR Participants

Gender: Non-ALiR Participants



Gender: ALiR Participants

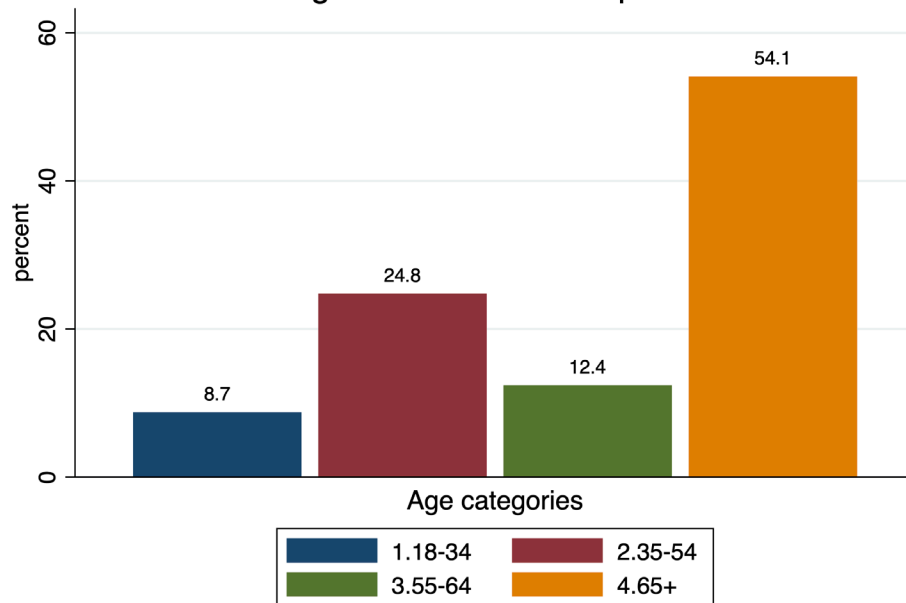


Sample Demographics: Age

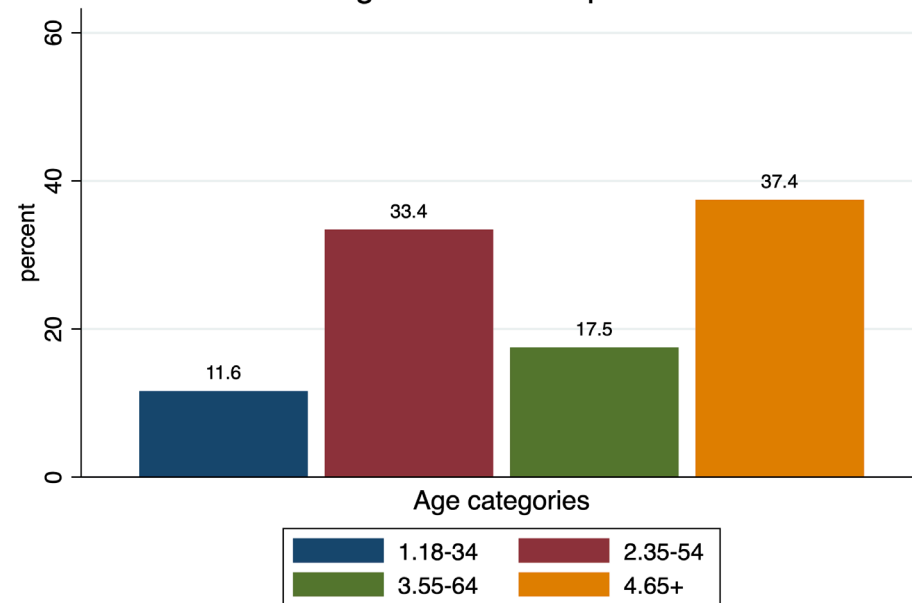
Non-ALiR Participants

ALiR Participants

Age: Non-ALiR Participants



Age: ALiR Participants

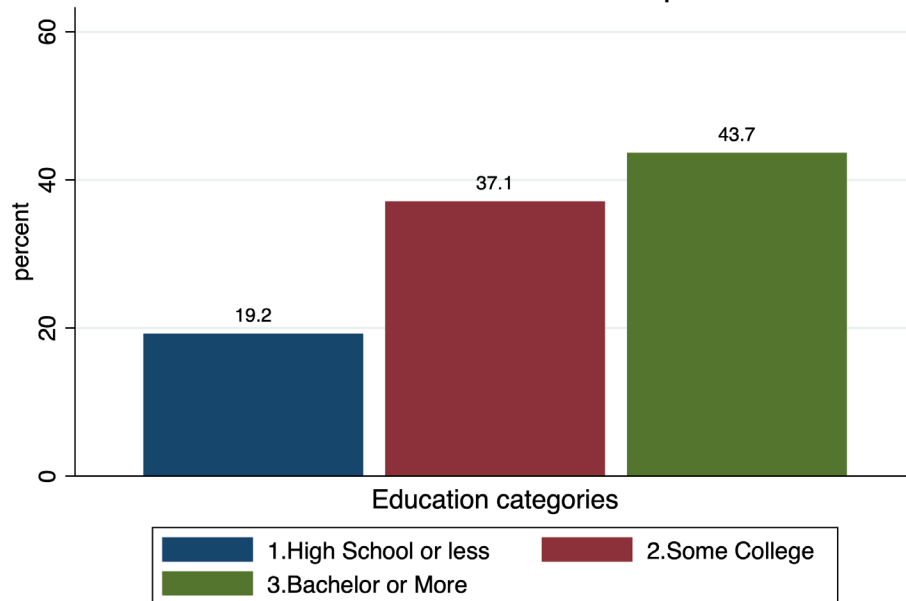


Sample Demographics: Education

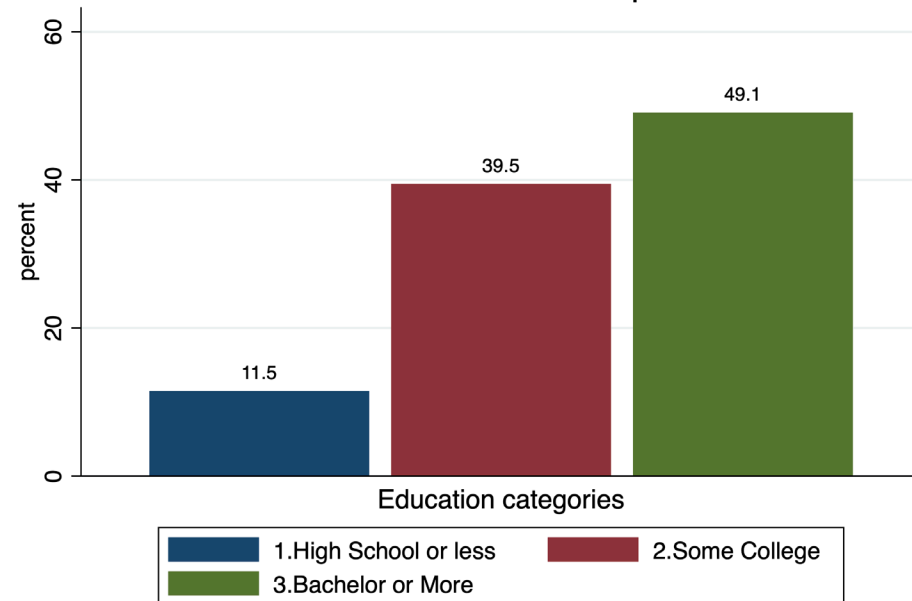
Non-ALiR Participants

ALiR Participants

Education: Non-ALiR Participants



Education: ALiR Participants

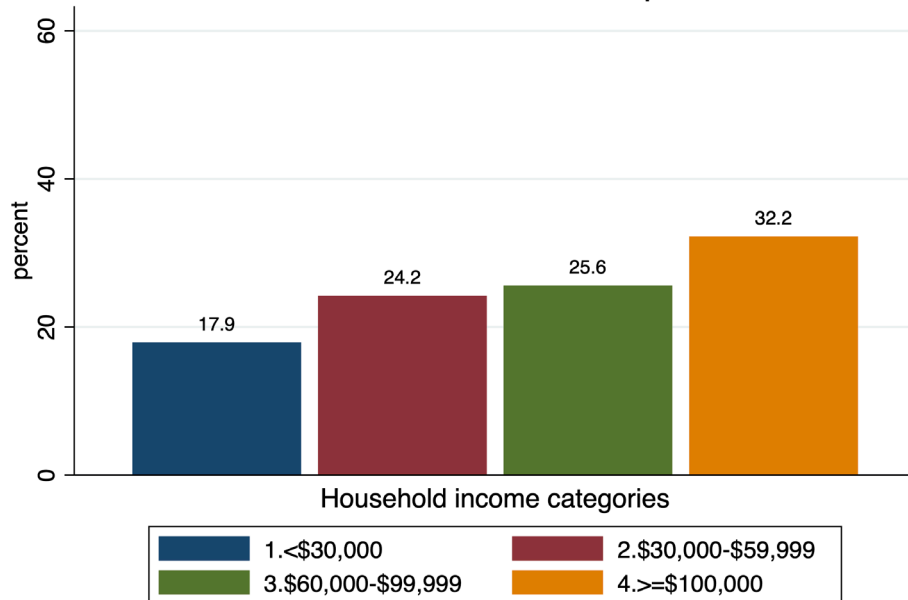


Sample Demographics: Income

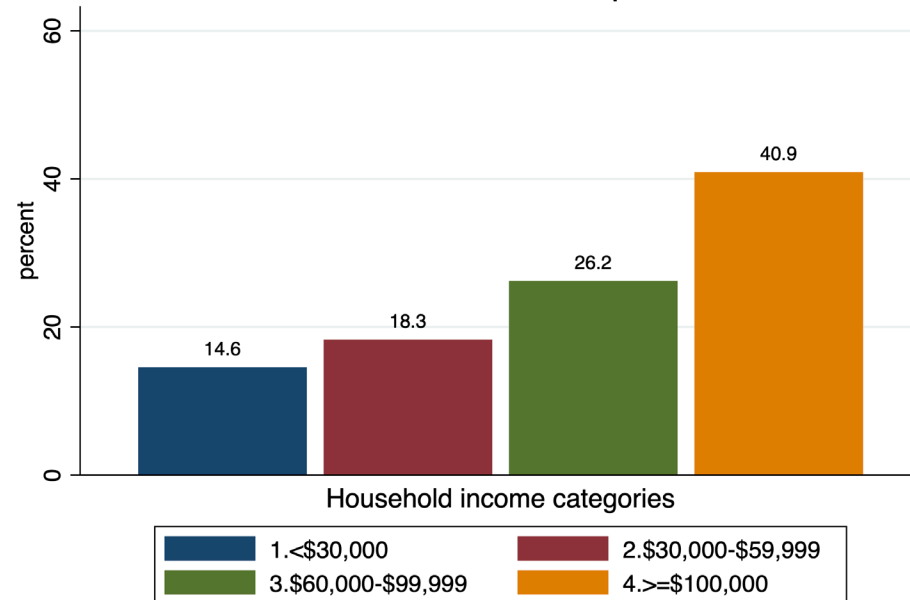
Non-ALiR Participants

ALiR Participants

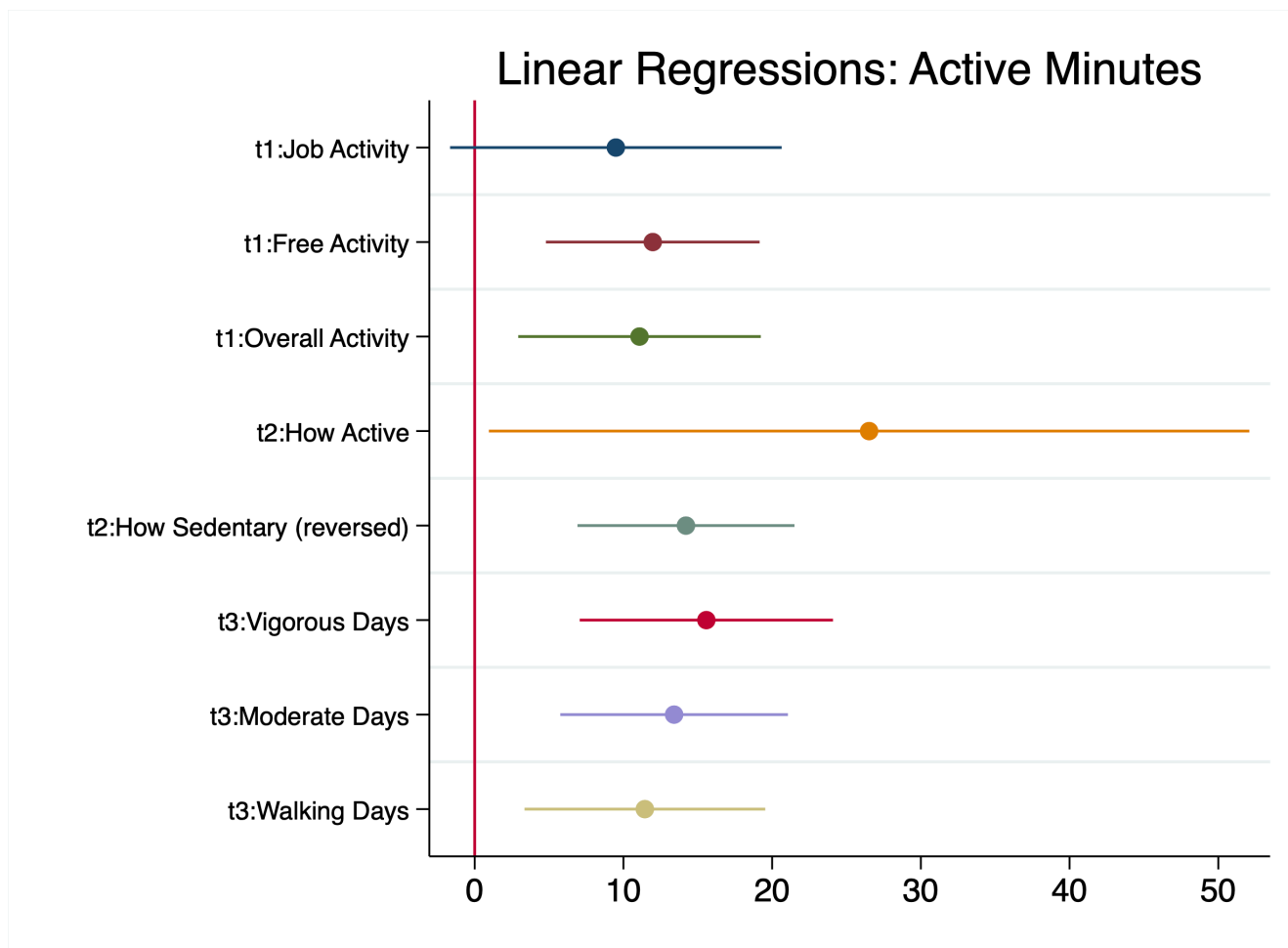
Income: Non-ALiR Participants



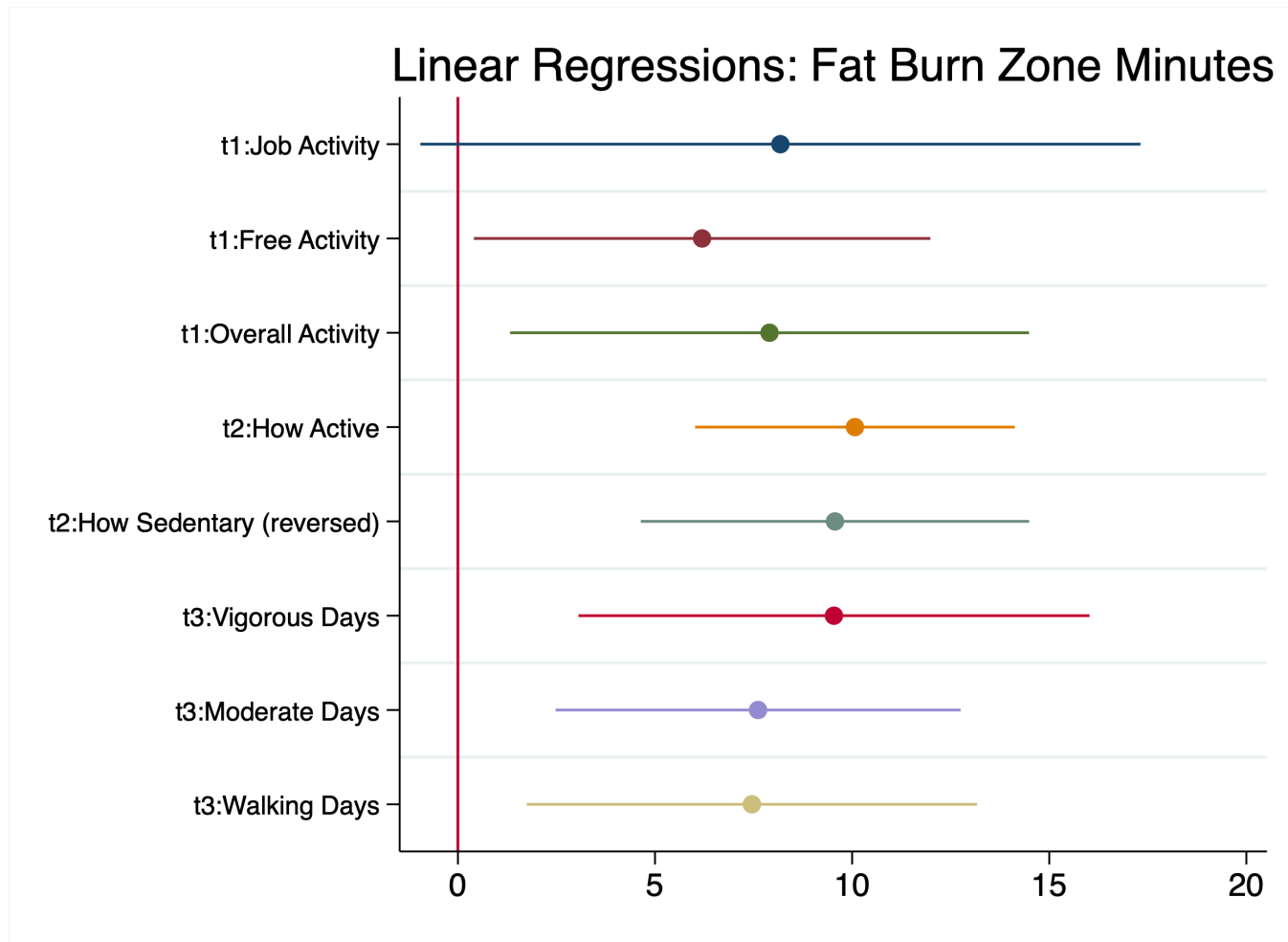
Income: ALiR Participants



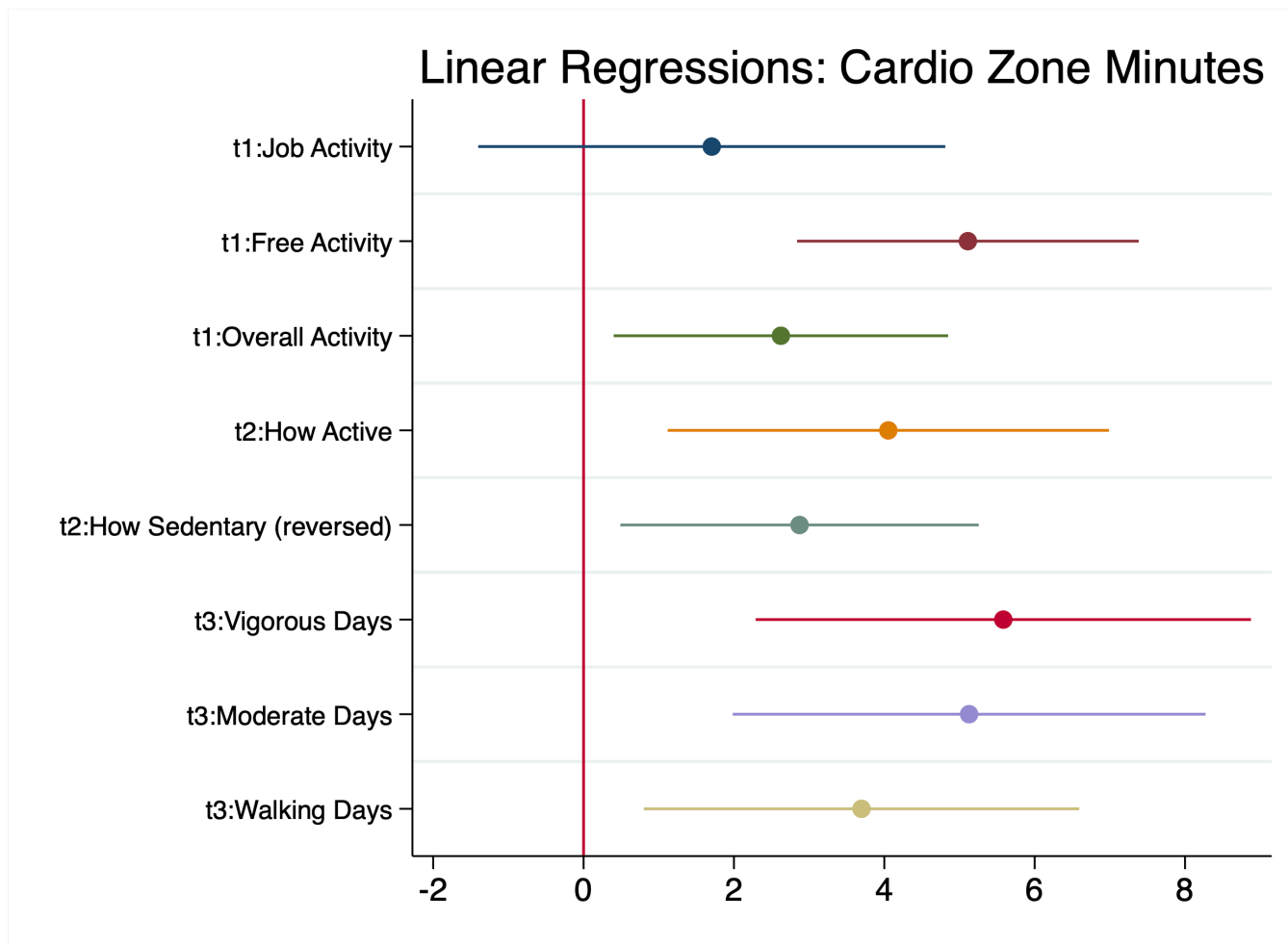
Results: Activity & Activity Zone Minutes



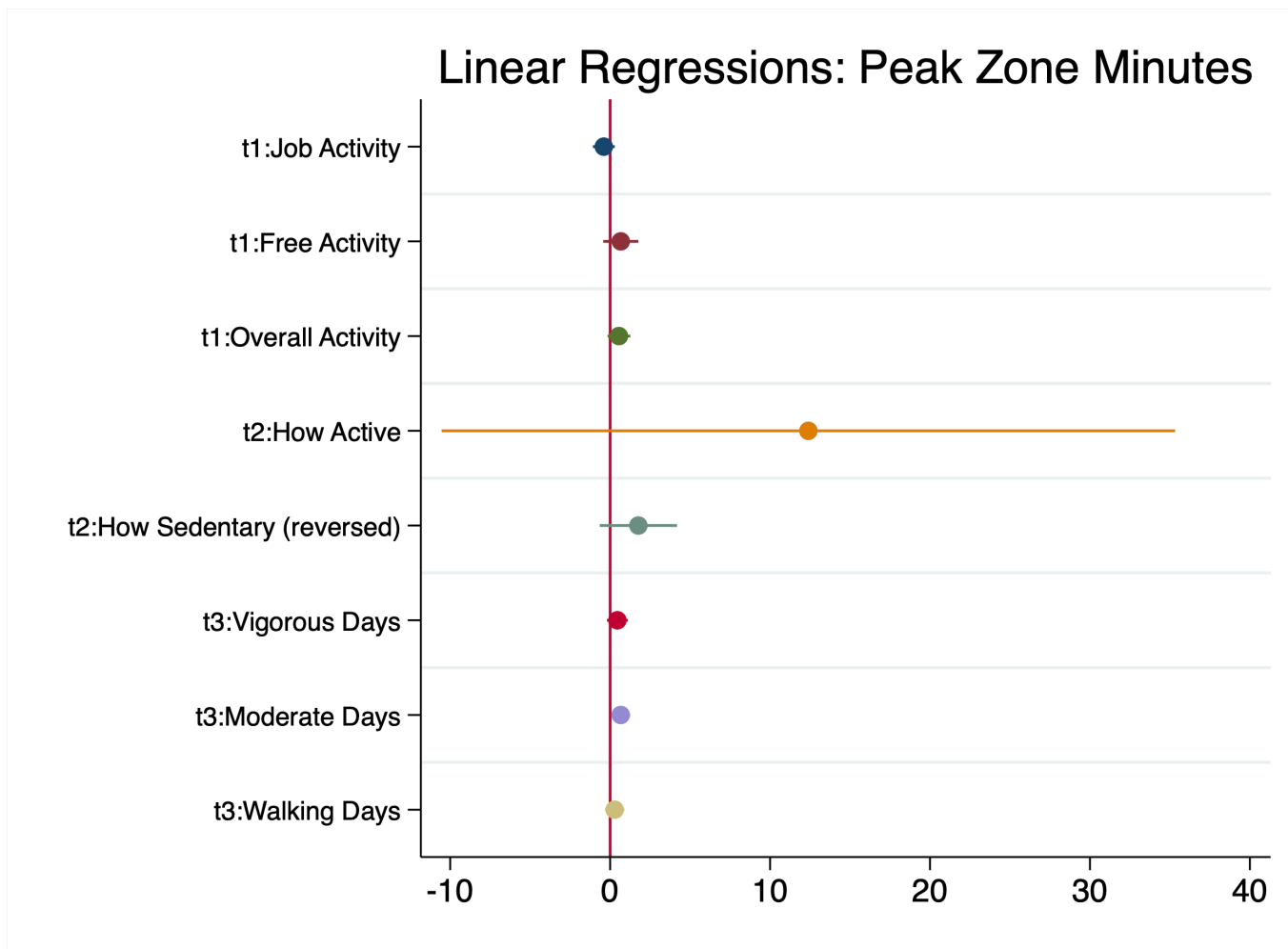
Results: Activity & Activity Zone Minutes



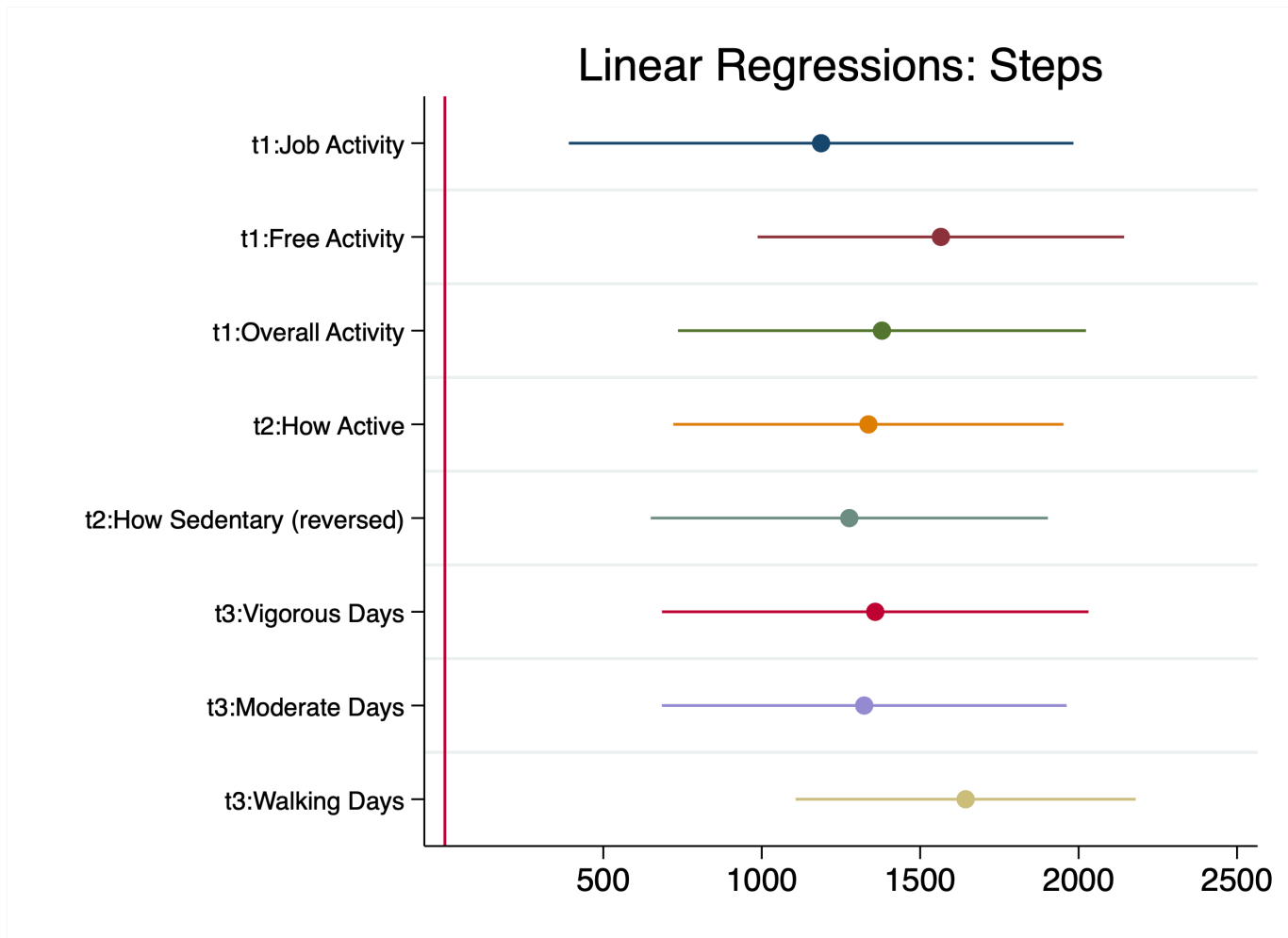
Results: Activity & Activity Zone Minutes



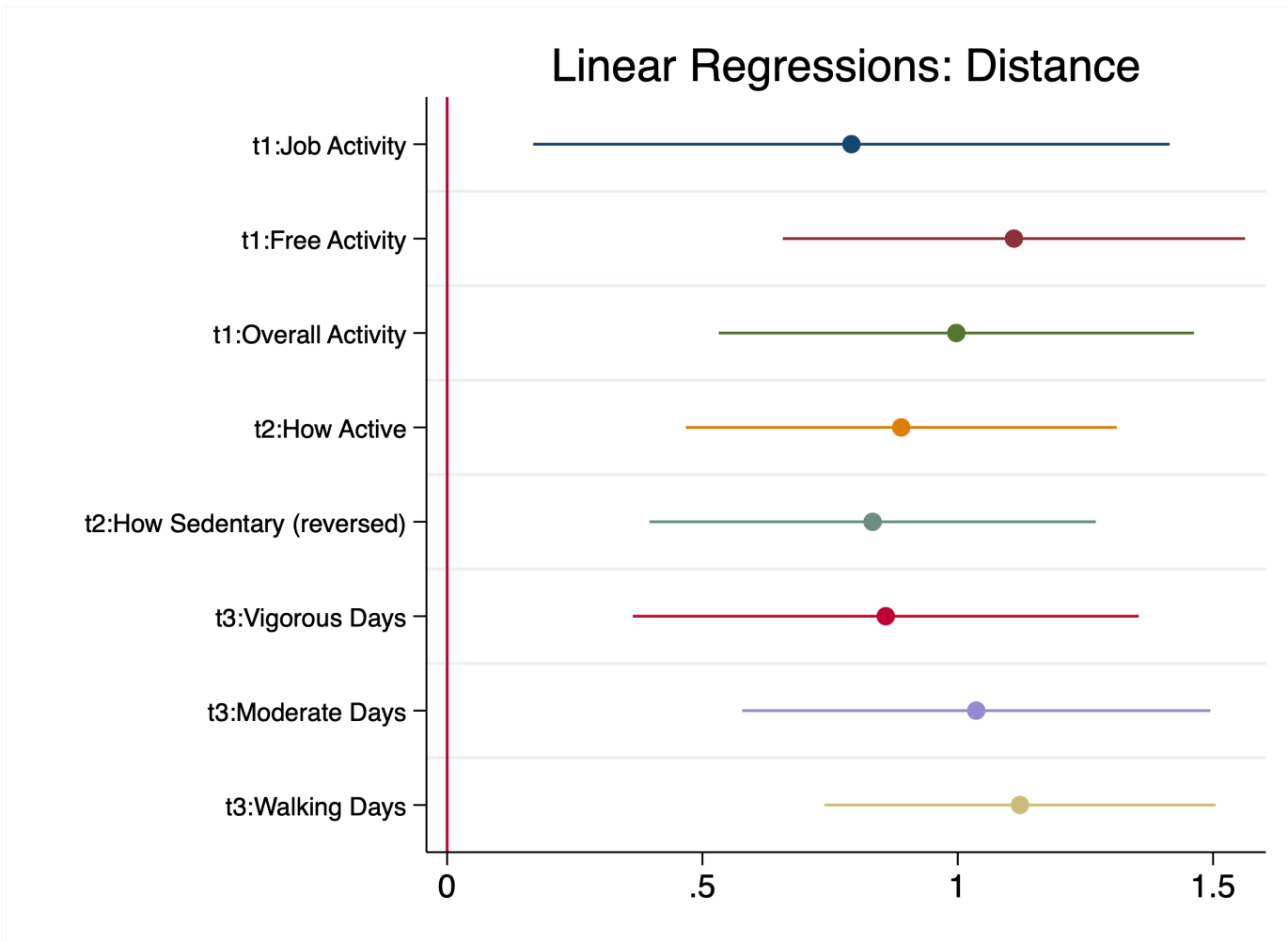
Results: Activity & Activity Zone Minutes



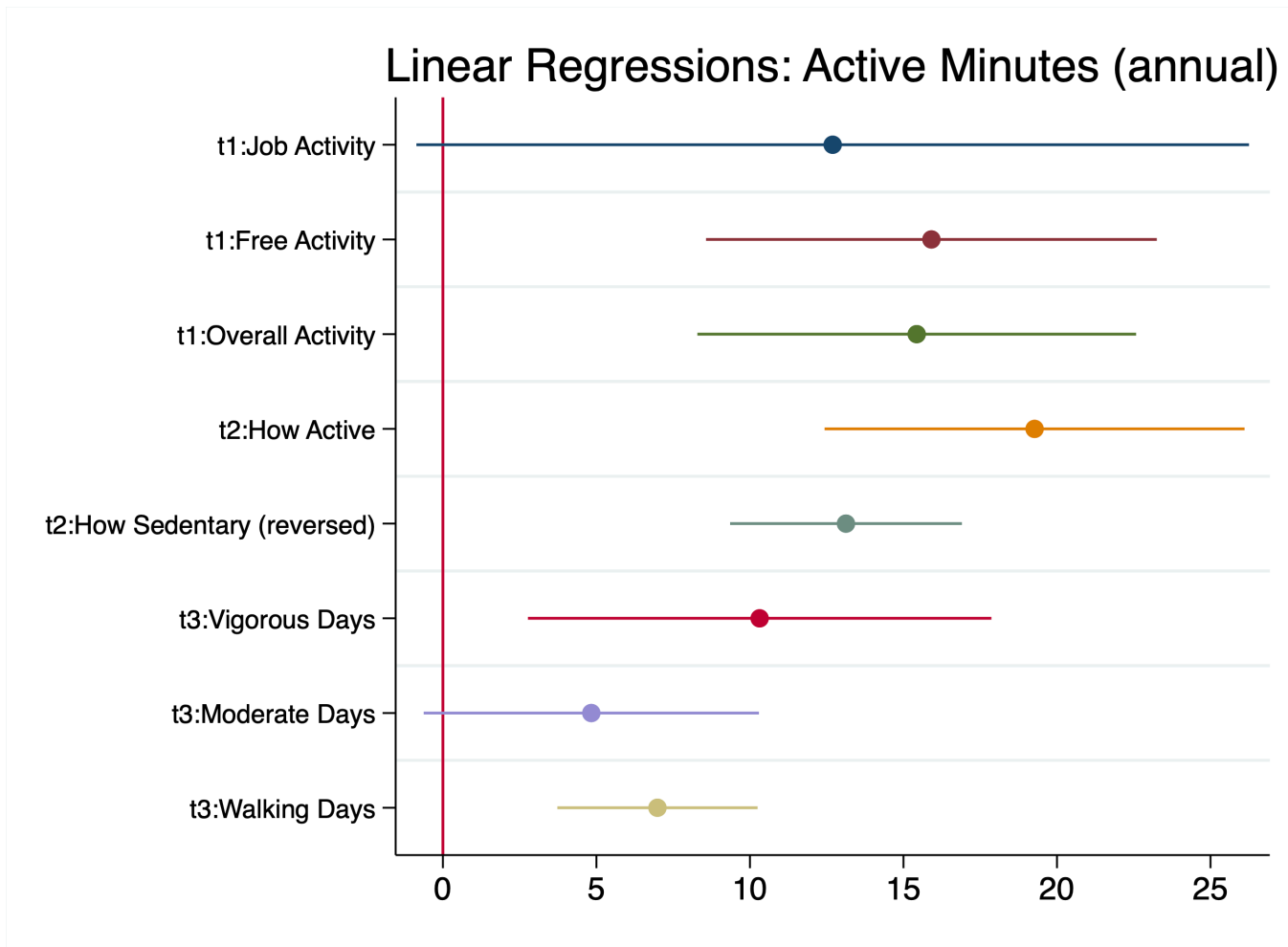
Results: Activity & Steps



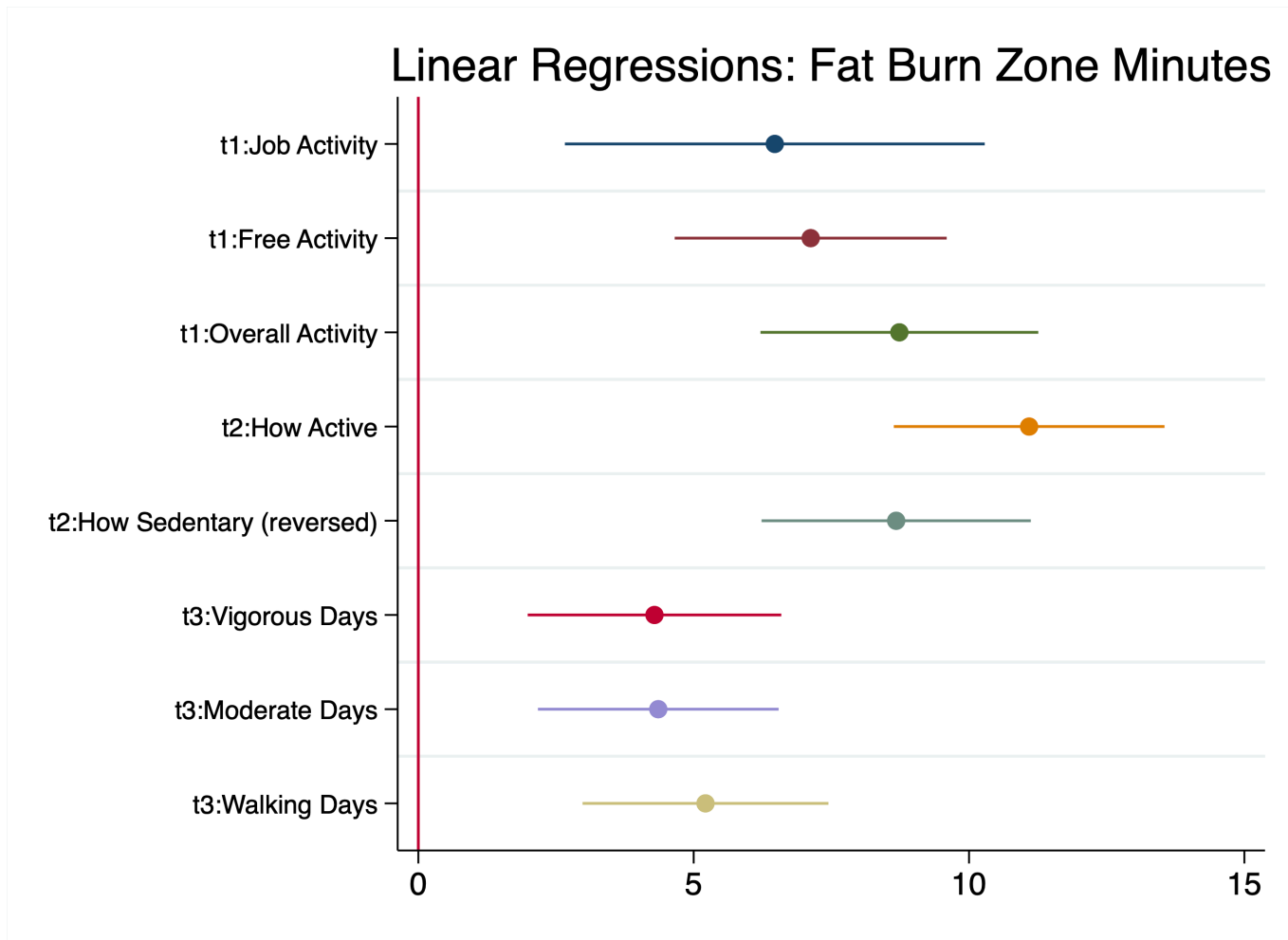
Results: Activity & Distance



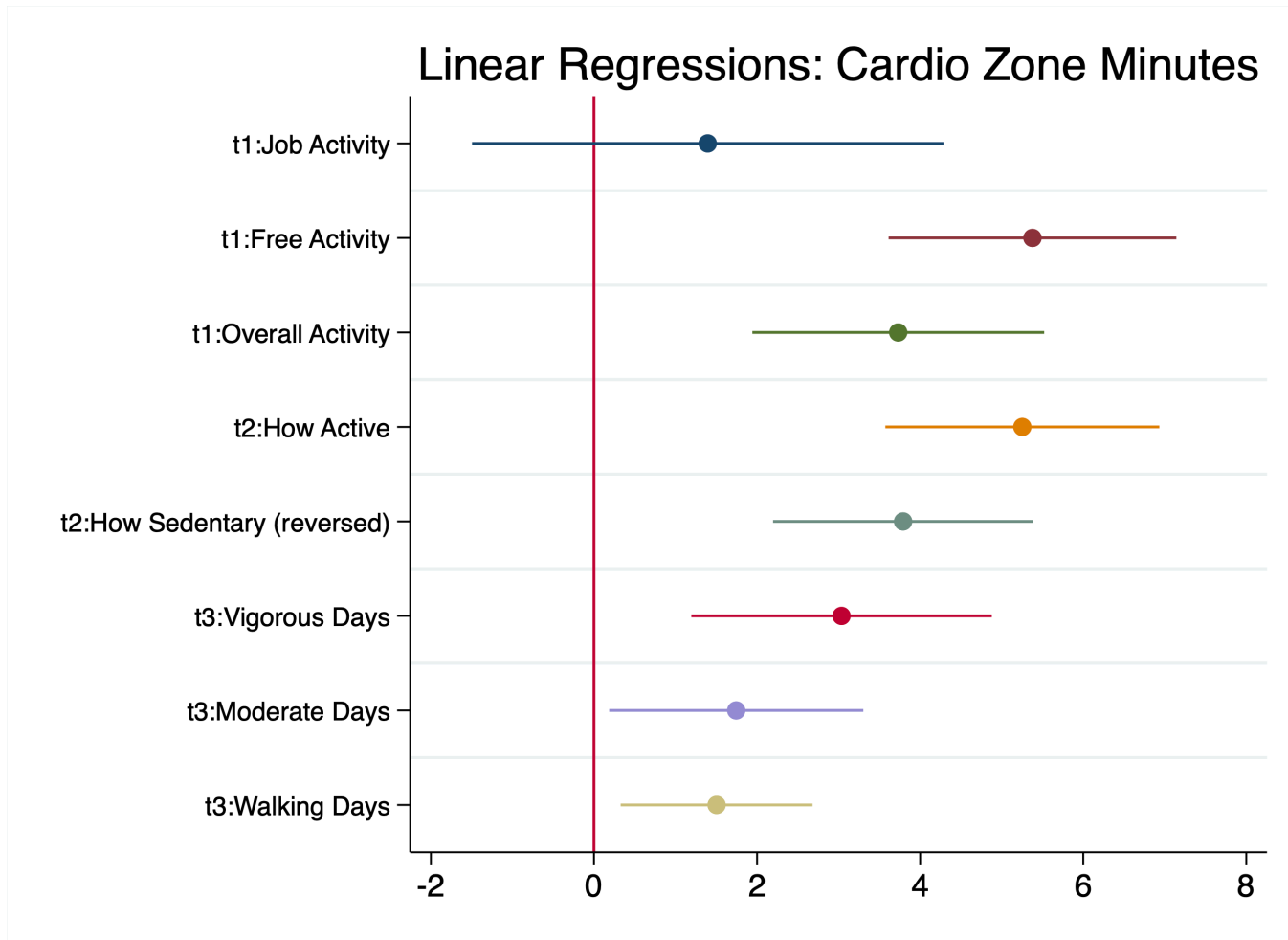
Results: Activity & Activity Zone Minutes (Annual)



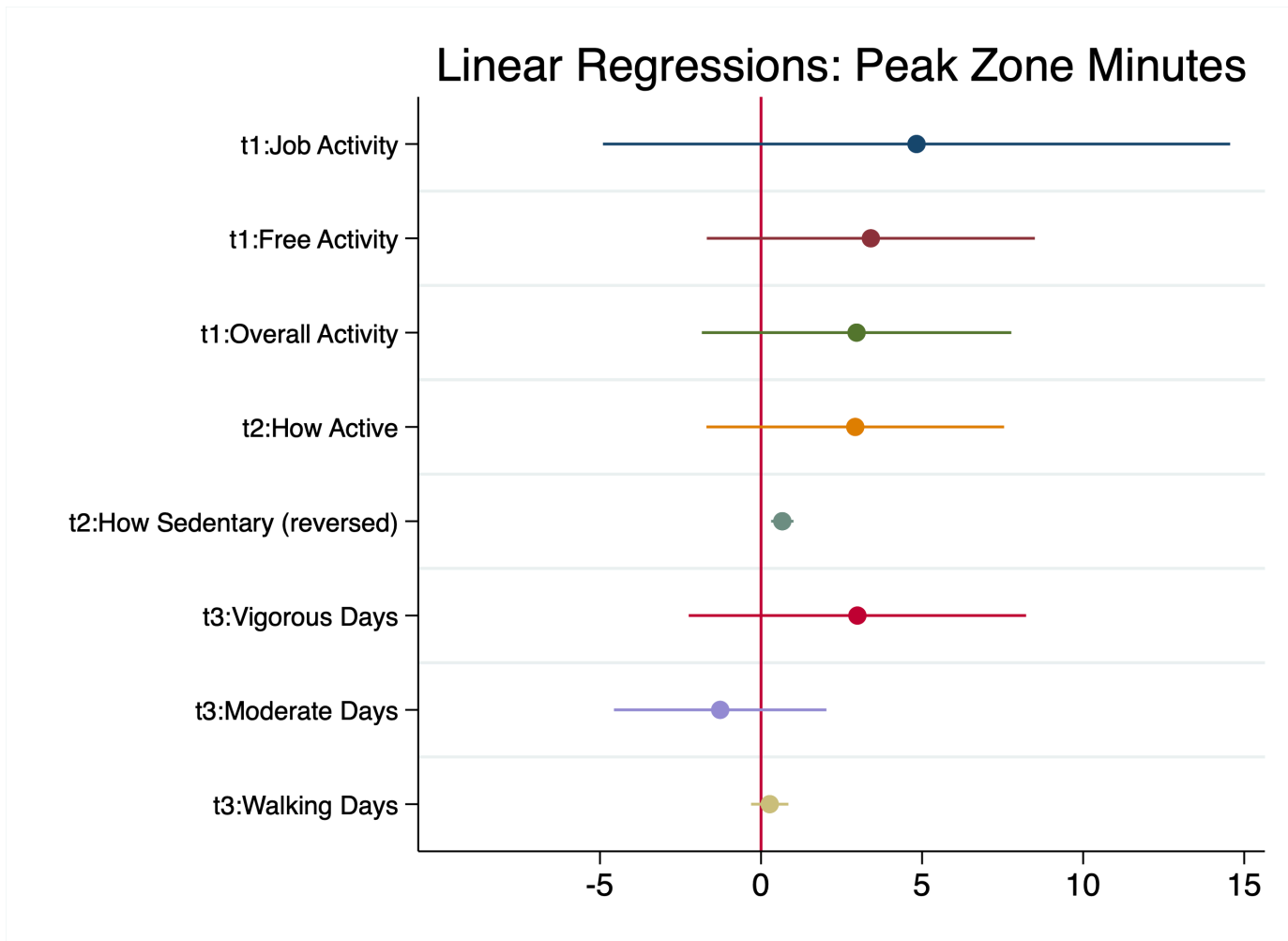
Results: Activity & Activity Zone Minutes (Annual)



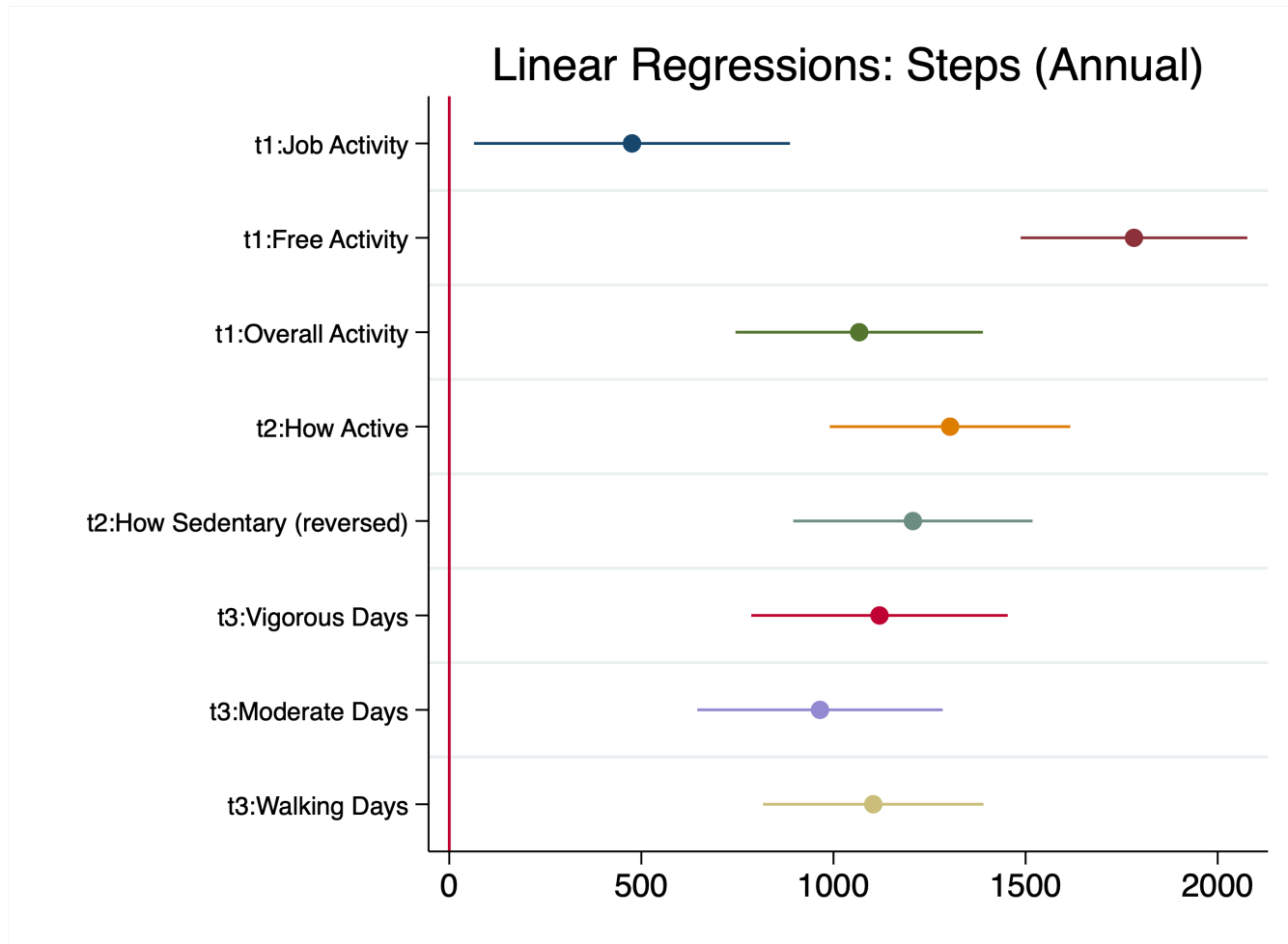
Results: Activity & Activity Zone Minutes (Annual)



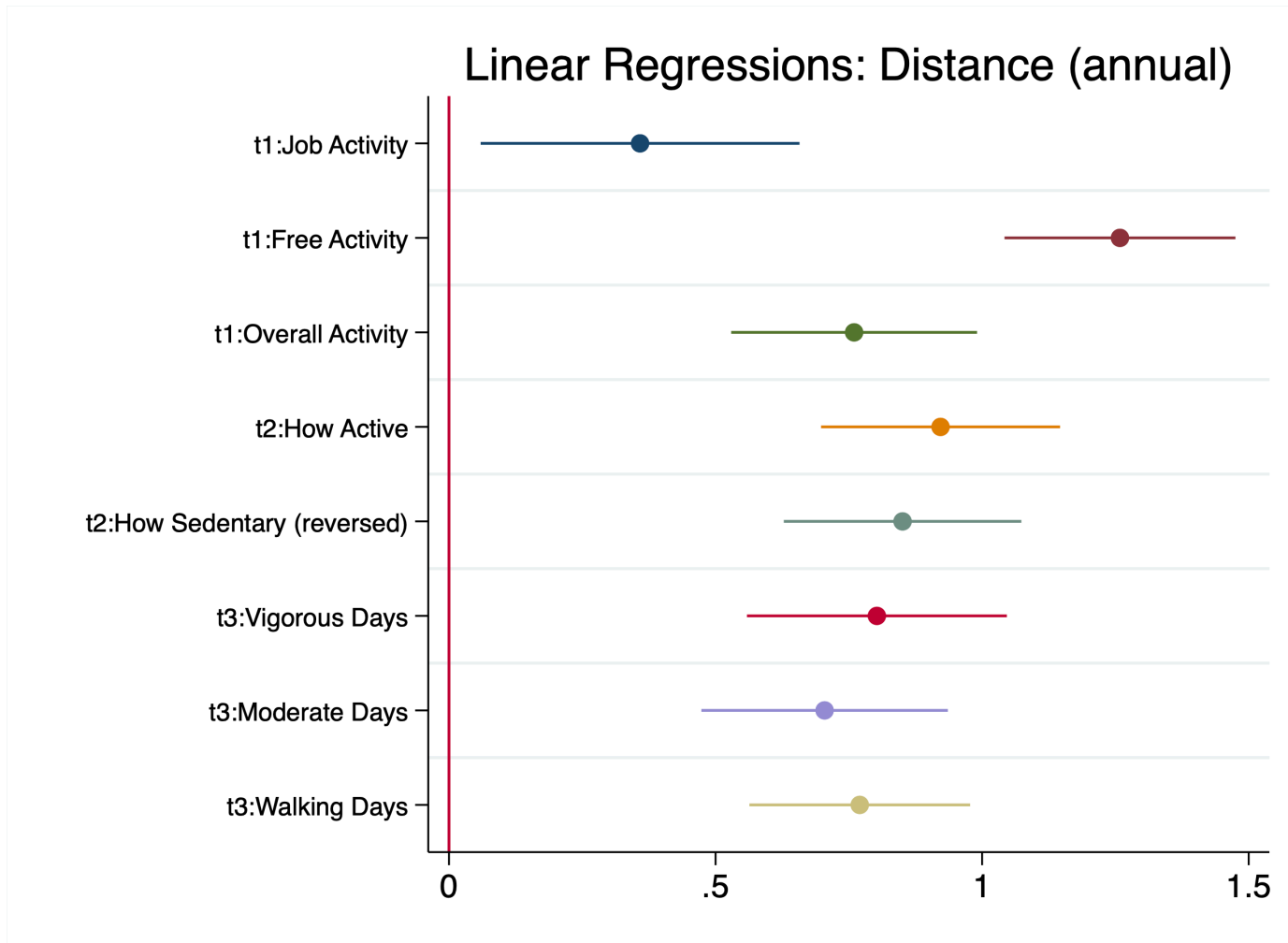
Results: Activity & Activity Zone Minutes (Annual)



Results: Activity & Steps (Annual)



Results: Activity & Distance (Annual)



Conclusions

- Self-reports of physical activity are related to measures of physical activity from wearables.
 - Measures do poorly measuring higher-intensity activity.
- Differences between measures are not large.
 - Larger differences when looking at annual data.
- Relationship with activity is still modest (correlations $\sim .23 - .34$.)
- Caveats
 - Differences between the ALiR and survey sample.
 - Have not added controls to the analysis.
- Future plans
 - Add controls
 - Sub-group differences
 - Health outcomes

Thank you!

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