Scorching Circumstances: The Role of Extreme Heat in Disability Among Older Workers in Heat Sensitive Jobs

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Aging workforce in a hotter world

- **Rising heat**: frequency and severity of heat waves will increase to the point of becoming a "new normal" *(Su et al, 2023; Stillman, 2019).*

- **Aging workforce**: Over the past two decades, the proportion of workers aged 60+ in the labor force has doubled, with nearly one-in-five Americans over age 65 now in the workforce *(NAS, 2022; Fry and Braga 2023)*

Occupational heat exposure

- **Occupational exposure to extreme heat**: Exposure to extreme heat is associated with higher mortality rates, adverse health outcomes, job injuries and reduced work productivity, especially among older and disadvantaged groups *(O'Neill and Ebi, 2009; Berberian et al, 2022; Limaye et al, 2018; Balk et al, 2021; Parsons et al, 2021; Ioannou et al, 2022; Cheveldayoff et al, 2023; Flouris et al, 2018)*

- **Uneven occupational heat exposure:** Some occupations, notably outdoor jobs (e.g., agriculture and construction) and indoor jobs without cooling, bear a disproportionate impact from extreme heat. Bureau of Labor Statistics (BLS) Occupational Requirement Survey (ORS) shows 33% of civilian workers are engaged in occupations requiring outdoor exposure.

Evidence gap:
Heat-sensitive jobs + medium- and long-term exposure

- **Existing research focuses on immediate health outcomes**: Research on heat exposure at work primarily focuses on immediate outcomes, such as emergency room visits for heat stroke in industrial settings *(Spector et al, 2019)*.

- **Medium- and long-term perspectives missing:** Much less is known about the link between occupational heat exposure over the life course *(Mazzei, 2024 in NYT)*

- Understanding the medium- and long-term implications of employment in heat-sensitive jobs is an important public health objective *(Ebi et al, 2021; Spector et al, 2019)*.

- Our research explores whether and to what extent such heat-sensitive work before and during midlife is correlated with patterns of health and work disability status in older adulthood (after age 51).

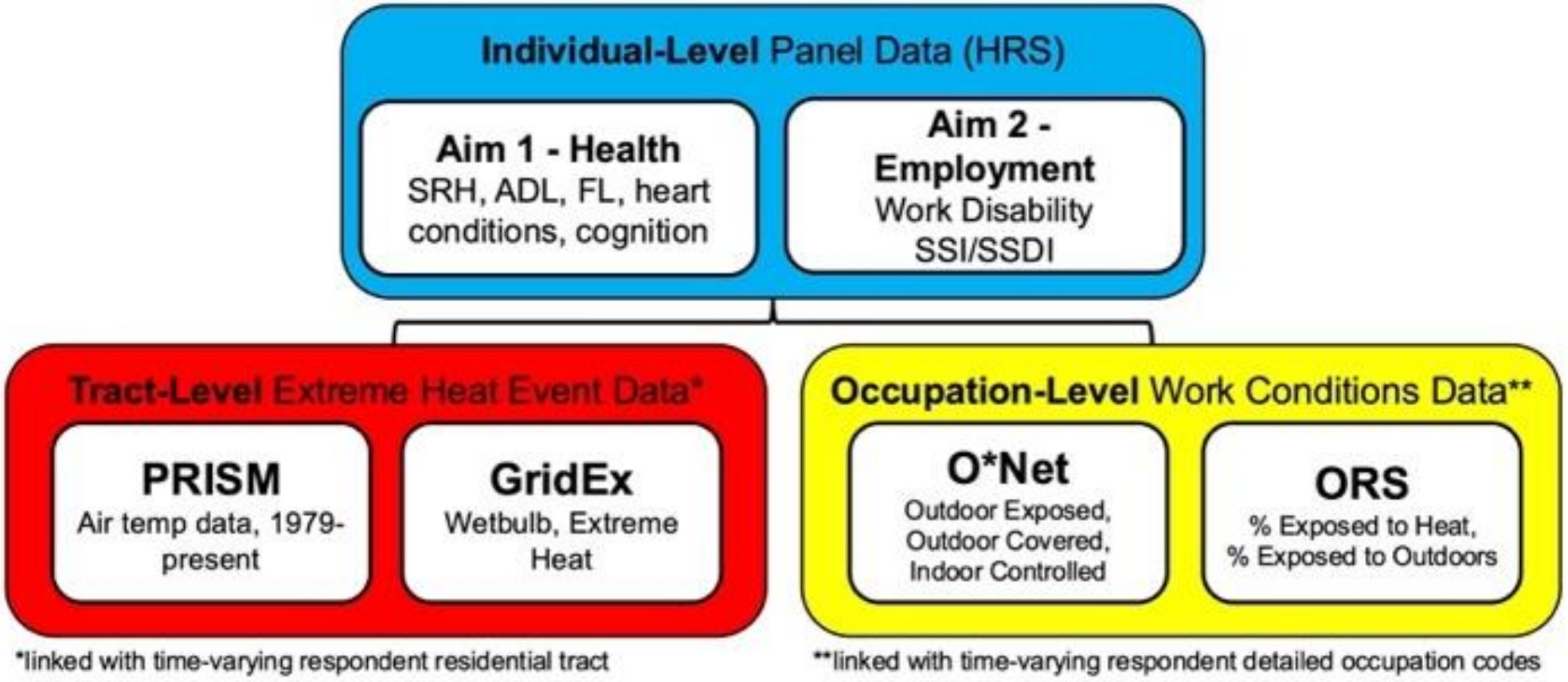
Approach

- **Unique data integration**: We link two sources of tract-level data on temperatures or extreme heat (GridEx and Prism) and two sources of data on occupational characteristics (O*NET and ORS), to individual-level panel data from the Health and Retirement Study (HRS).

- **Panel data analyses**: We use linear mixed-effects (e.g. growth curve) models and panel data modeling to address selection bias and reverse causality, accounting for a robust set of confounders.

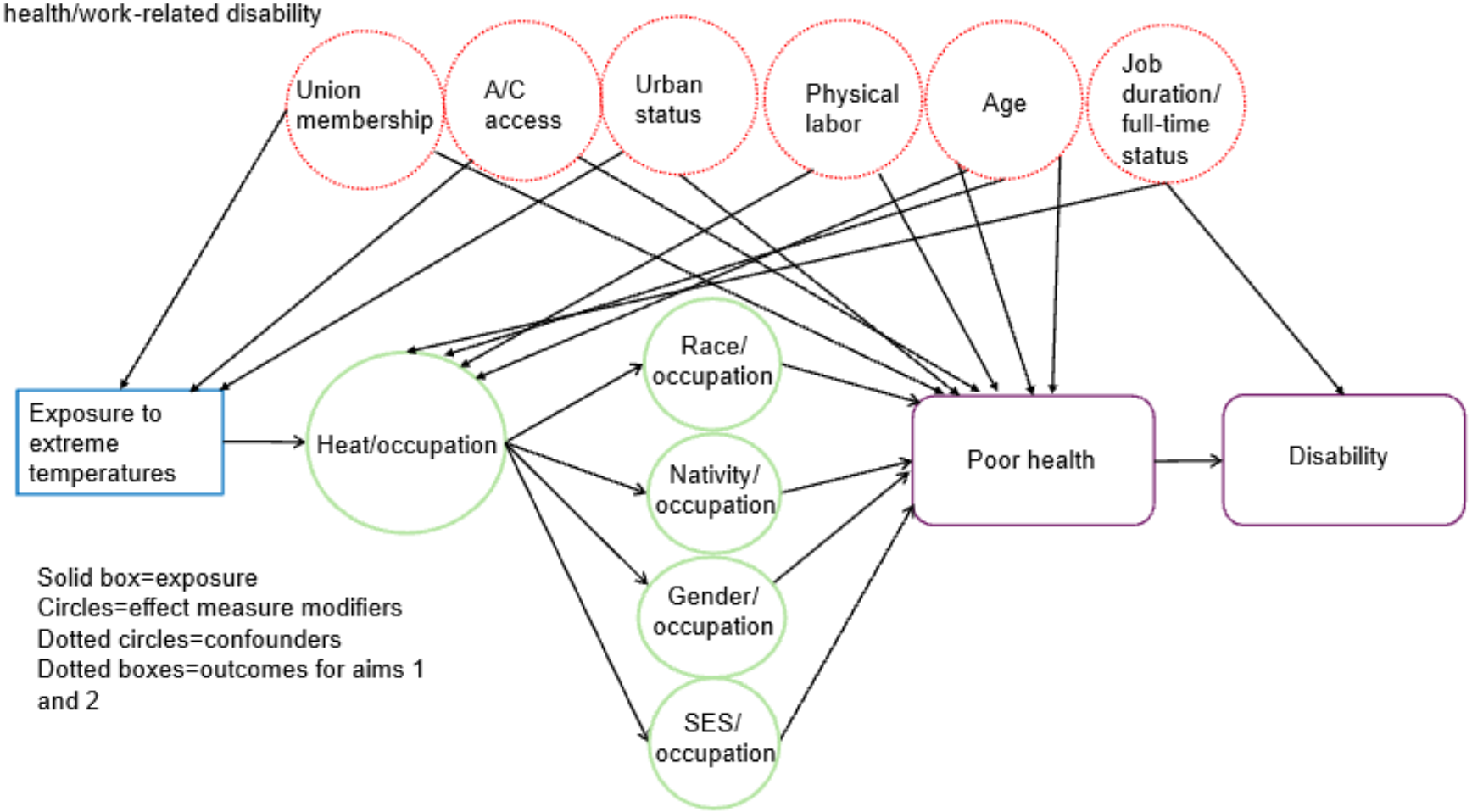
Innovative data integration

Figure 2. Integration of HRS with Occupational and Heat Data



Effect measure modifiers

Figure 1. Directed acyclic graph (DAG) demonstrating the relationship between exposure to extreme temperatures and poor health/work-related disability



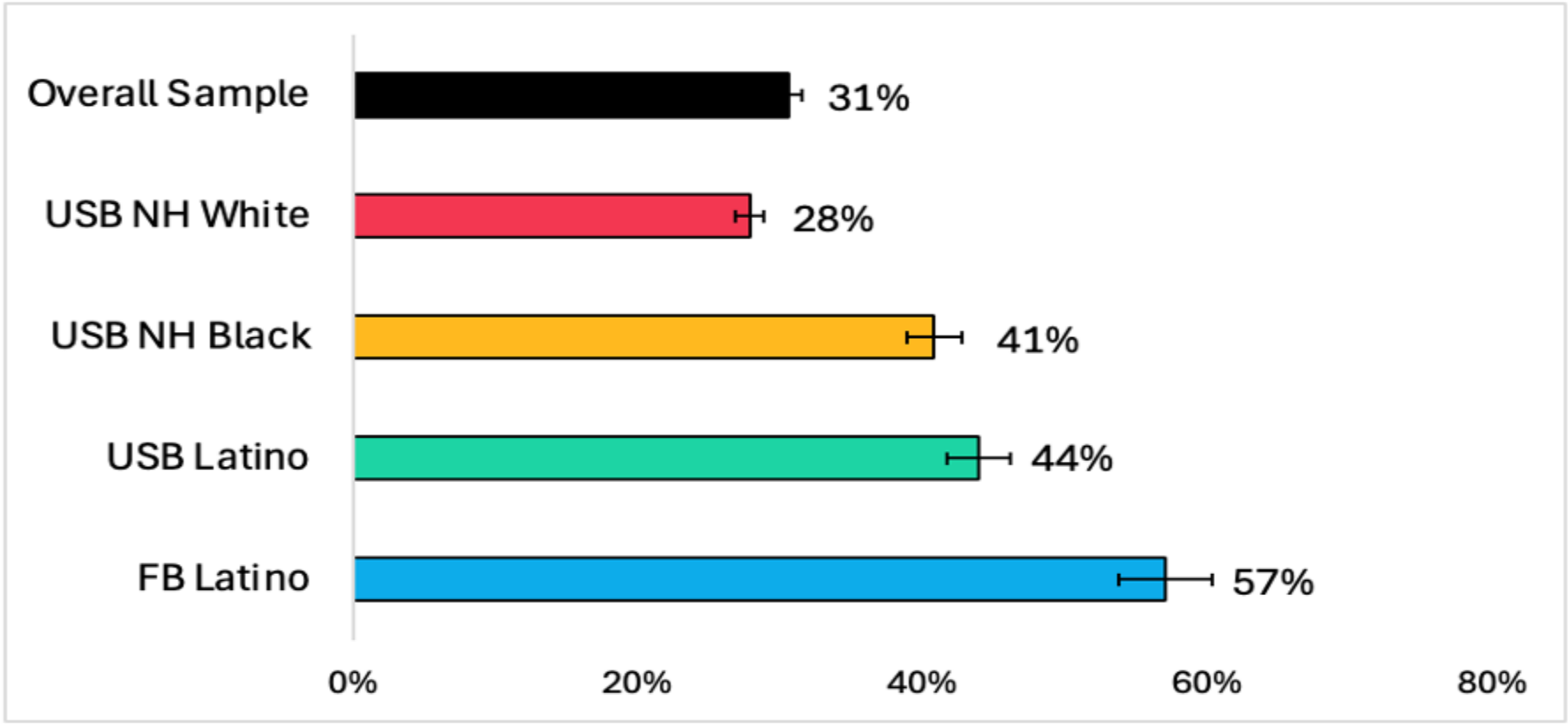
Heat-sensitive occupations

Table 1. Classification of Heat-Sensitive Occupations at the Broad Occupation Category Level

HSO Occupations	non-HSO Occupations
Protective Service	Management
Building and Grounds Cleaning and Maintenance	Business and Financial Operations
Farming, Fishing, and Forestry	Computer and Mathematical
Construction and Extraction	Architecture and Engineering
Installation, Maintenance, and Repair	Life, Physical, and Social Science
Production	Community and Social Service
Transportation and Material Moving	Legal
	Education, Training, and Library
	Arts, Design, Entertainment, Sports, and Media
	Healthcare Practitioners and Technical
	Healthcare Support
	Food Preparation and Serving Related
	Personal Care and Service
	Sales and Related
	Office and Administrative Support

Unequal representation in heat-sensitive jobs

Figure 2. Percent Working in Heat Sensitive Occupations in Midlife by Race, Ethnicity, & Nativity (84.3% CI)



Note: FB = foreign-born; USB = US-born; 84.3% confidence intervals recommended for visual comparison of two independent estimates to assess statistical significance at the 0.05 level (Cumming 2009).

Heat-sensitive jobs and disability risk

Figure 3. Adjusted Probability of Disability by Heat Sensitive Occupational Classification (84.3% CI)

Figure 3a. Functional Limitations

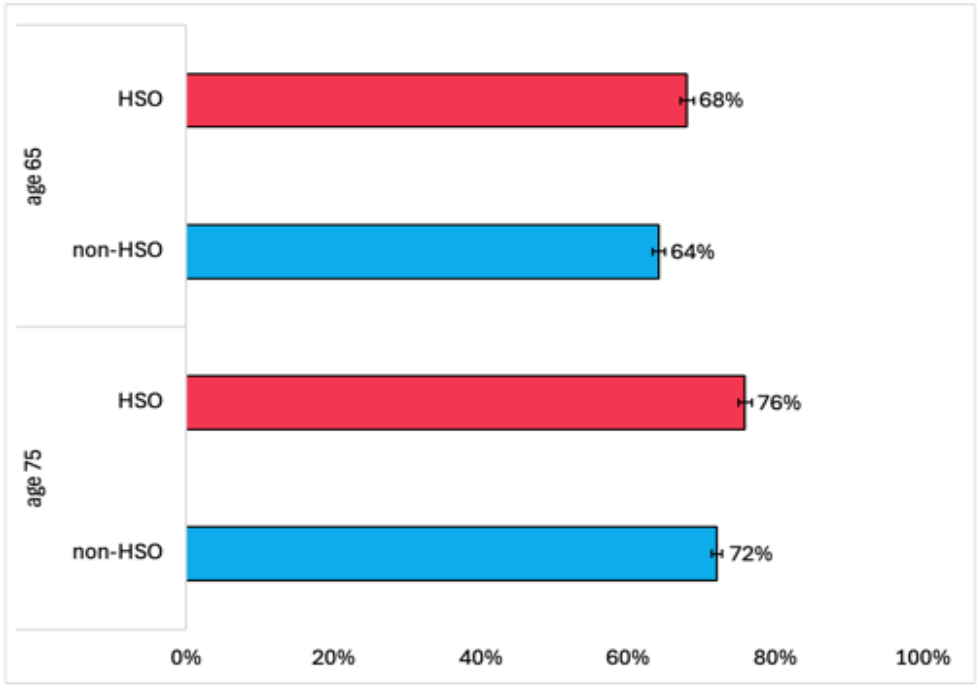
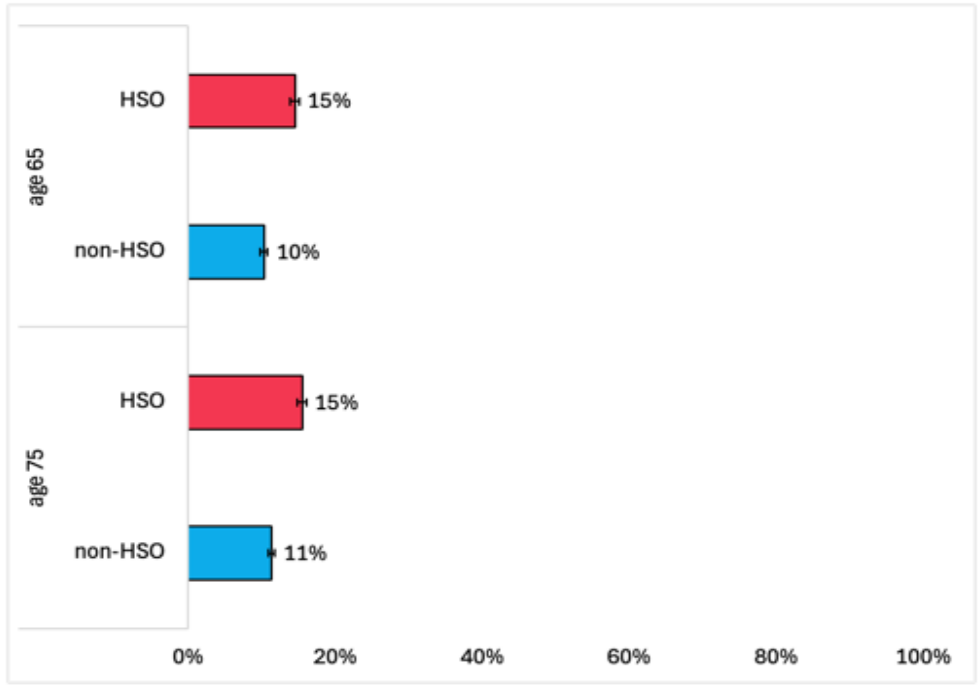


Figure 3b. Activities of Daily Living



Note: Adjusted for age, age-square, race/ethnicity, nativity, gender, educational attainment, census region, urbanicity, died over observation, currently working, current job requires physical work, years at longest held job. 84.3% confidence intervals recommended for visual comparison of two independent estimates to assess statistical significance at the 0.05 level (Cumming 2009).

Generations Journal | Transformative Approaches to Social Security Benefits

Burn Out Reimagined: Extreme Heat, Work Disability, and Sociodemographic Disparities in America

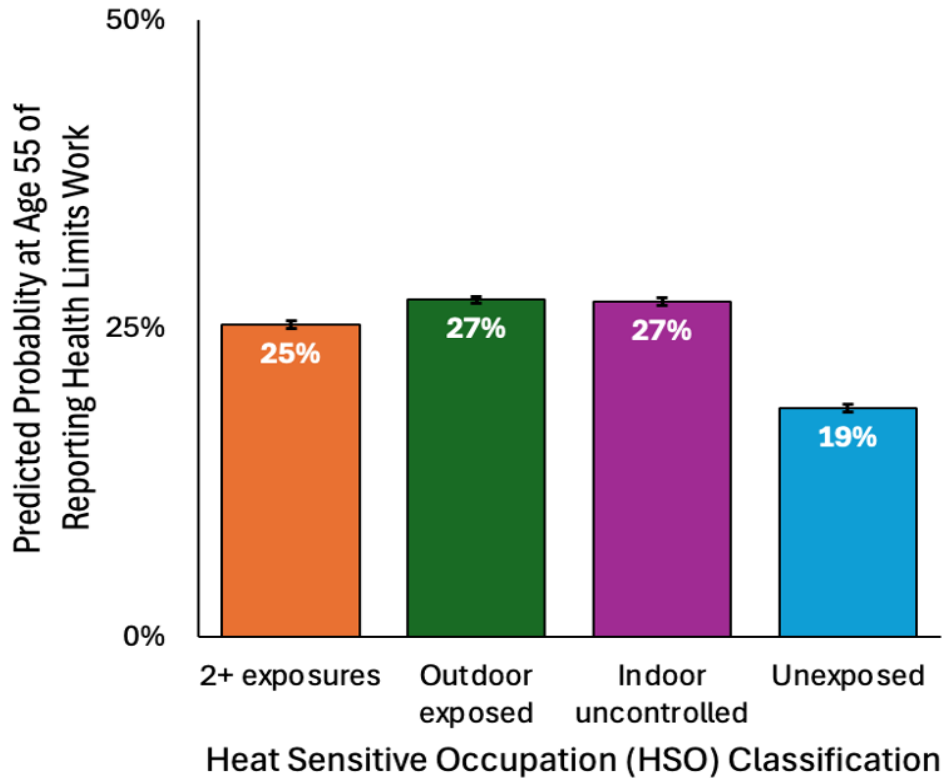
October 22, 2025

As temperatures rise and our labor force ages, protecting workers from extreme heat on the job becomes crucial.

By Mara Getz Sheftel, Jennifer Brite, Na Yin, and Deborah Balk

Heat-sensitive jobs and work disability risk

Figure 2. Is there an Association between Working in Heat-Sensitive Occupations and Health Limiting Work? Predicted Probabilities of Reporting that Health Limits Work by Heat Sensitive Occupation (HSO) Classification of Longest Held Job at Baseline at Age 55



Note: Data: Health and Retirement Study (HRS) 1992-2020; linear probability models estimated with robust standard errors to account for multiple observations per respondent, models control for age, sex, race/ethnicity, nativity and education; post-regression predicted probabilities estimated at age 55 (covariates held at observed values), 95% Confidence Intervals

Additional analyses underway

- *Variation in exposure within broad occupational categories*
- Disability administrative records linkage
- *Addition of spatially linked heat data*: Restricted access HRS linked to the National Neighborhood Data Archive (NaNDA). We hope to learn more about NaNDA at this workshop and from colleagues.

Send comments and questions to

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Additional slides

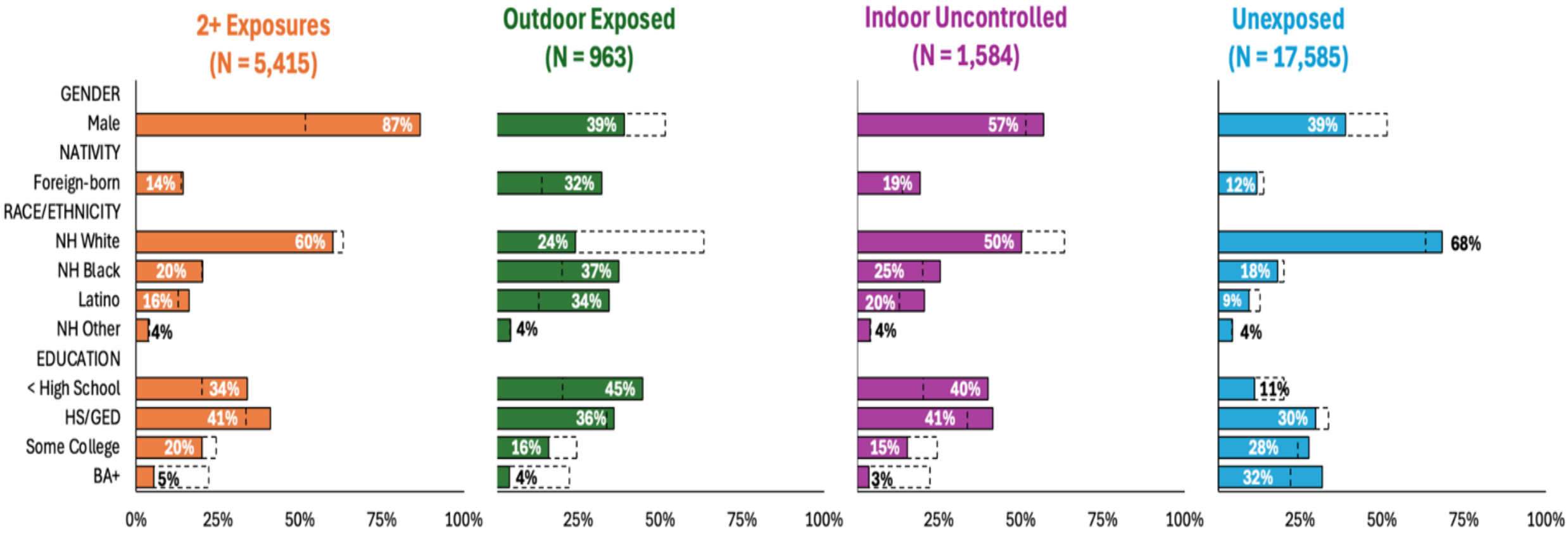
Table 2. Linear Probability Models Predicting Disability (Robust SE)

	Functional Limitations		Activities of Daily Living	
	Model 1	Model 2	Model 1	Model 2
Heat Sensitive Occupation (HSO)	0.02**	0.03***	0.01*	0.01**
	(0.01)	(0.01)	(0.01)	(0.01)
Race, Ethnicity, Nativity (ref: USB NH White)				
USB NH Black	0.02*	0.04***	0.06***	0.05***
	(0.01)	(0.01)	(0.01)	(0.01)
USB Latino	0.02	0.03	0.04**	0.03
	(0.02)	(0.02)	(0.01)	(0.02)
FB Latino	0.01	0.02	0.10***	0.10***
	(0.01)	(0.02)	(0.02)	(0.02)
Race, Ethnicity, Nativity X HSO (ref: USB NH White, non-HSO)				
USB NH Black X HSO		-0.05***		-0.04*
		(0.02)		(0.02)
USB Latino X HSO		-0.02		0.02
		(0.03)		(0.02)
FB Latino X HSO		-0.03		-0.01
		(0.02)		(0.02)
Age	0.01*	0.01*	-0.06***	-0.06***
	(0.01)	(0.01)	(0.00)	(0.00)
Age squared	0.00	0.00	0.00***	0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Female	0.09***	0.09***	0.01**	0.01**
	(0.01)	(0.01)	(0.00)	(0.00)
Education (ref: less than HS)				
HS graduate	-0.02**	-0.02**	-0.05***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)
Some college	-0.04***	-0.05***	-0.05***	-0.05***
	(0.01)	(0.01)	(0.01)	(0.01)
College or more	-0.11***	-0.11***	-0.07***	-0.07***
	(0.01)	(0.01)	(0.01)	(0.01)
Census region (ref: South)				
Northeast	-0.02***	-0.03***	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Midwest	-0.02*	-0.02*	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
West	-0.03***	-0.03***	0.00	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Urbanicity (ref: urban)				
Suburban	0.02*	0.02*	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Ex urban	0.02**	0.02**	0.01	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Died over observation	0.09***	0.09***	0.10***	0.10***
	(0.01)	(0.01)	(0.00)	(0.00)
Tenure at longest held job	-0.00***	-0.00***	-0.00***	-0.00***
	(0.00)	(0.00)	(0.00)	(0.00)
Currently working	-0.10***	-0.10***	-0.07***	-0.07***
	(0.01)	(0.01)	(0.01)	(0.01)
Current job requires lots of physical activity some/most	0.02	0.02	-0.01	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Constant	0.08	0.08	2.36***	2.36***
	(0.19)	(0.19)	(0.16)	(0.16)
Observations	268,693	268,693	268,703	268,703
R-squared	0.09	0.09	0.08	0.08

Robust standard errors in parentheses

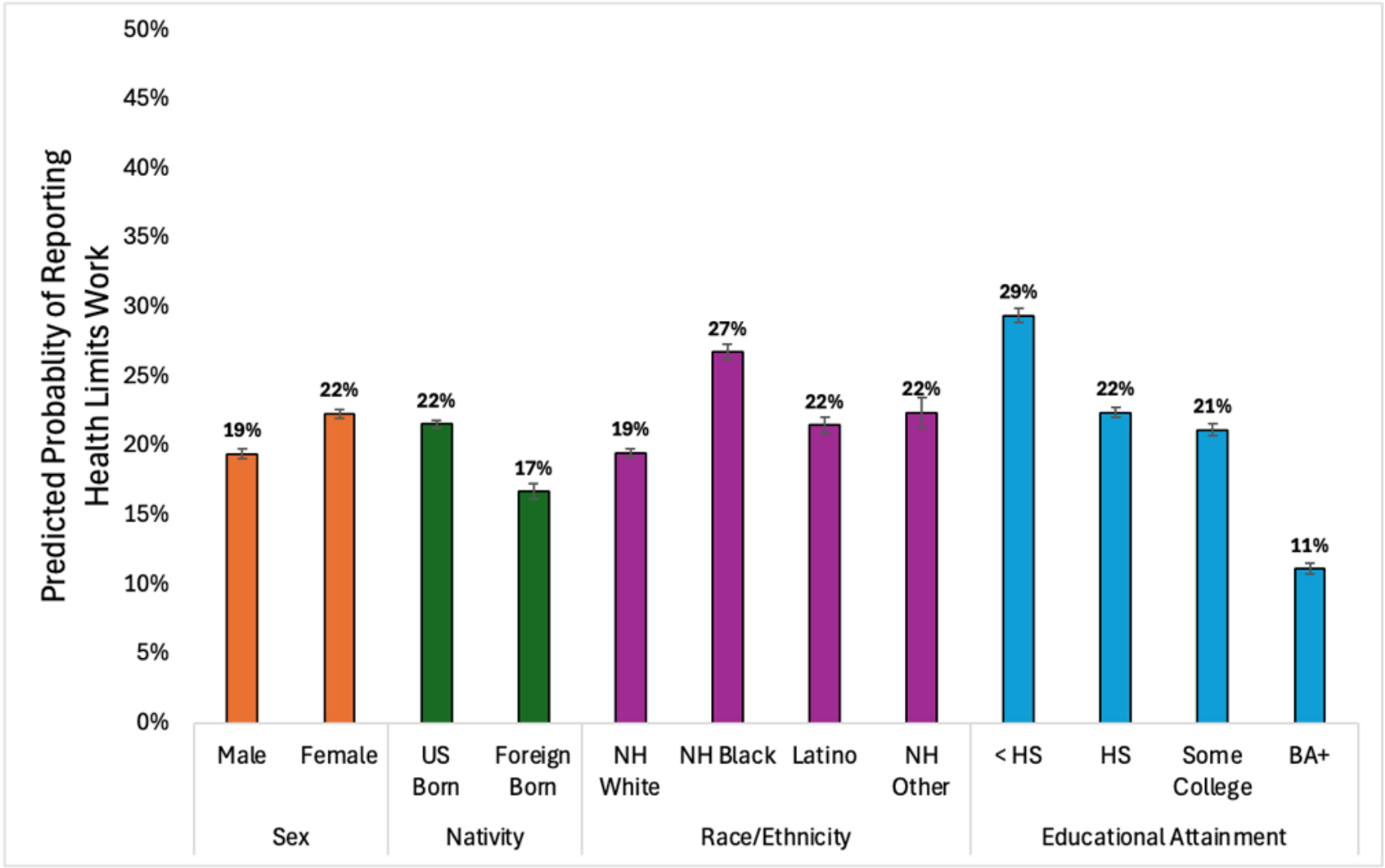
*** p<0.001, ** p<0.01, * p<0.05

Figure 3. Who is Exposed to Heat Sensitive Occupations (HSO)? Sociodemographic Characteristics by Heat Sensitive Occupation Classification



Note: Data: Health and Retirement Study (HRS) 1992-2020; distribution of sociodemographic characteristics of workers (1 observation per respondent) within each HSO category. Dotted lines indicate the overall distribution for the entire sample for comparison.

Figure 4. Who is Most Likely to Report that Health Conditions Limit their Work? Predicted Probabilities of Health Conditions Limiting Work by Sociodemographic Characteristic at Age 55



Note: Data: Health and Retirement Study (HRS) 1992-2020; linear probability models estimated with robust standard errors to account for multiple observations per respondent, models control for age, sex, race/ethnicity, nativity and education; post-regression predicted probabilities estimated at age 55 (covariates held at observed values), 95% Confidence Intervals