

Heterogeneity in Damages from a Pandemic

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NBER Racial and Ethnic Health Disparities, Spring 2023

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- In the US, the economic and health impacts of COVID-19 varied substantially across different groups. [large literature, see paper]
- Two broad classes of explanations:
 - ① differences in exposure to virus or economic contractions
 - ② differences in health and human capital that affect impact conditional on exposure
- We ask the following questions:
 - How much did the economic and health damages relate across different groups, in the first two years of the pandemic?
 - How much can observable differences in exposure explain the gaps in both economic and health damages?

- Examine disparities across racial/ethnic groups and education groups (with vs. without a BA)
- Findings:
 - ① Adverse impacts on mortality and employment concentrated in the same groups: non-White individuals, those without a college degree, and those with lower incomes
 - ② Mortality gaps by race/ethnicity declined throughout the pandemic, while other gaps changed less.
 - ③ Observable differences in exposure typically explain 25-45% of differences in mortality and employment effects.

- Mortality: Linked administrative and survey data
 - SSA administrative mortality file (Numident)
 - Includes information about race/ethnicity and date of birth
 - Link Numident to American Community Survey (ACS) for additional (lagged) covariates (education, industry, occupation, income, housing, transportation, disability, etc.)
- Employment: Current Population Survey (CPS)
 - Includes a range of covariates similar to those from the ACS

Summary Statistics

Measuring Health and Economic Well-Being

- Health: **all-cause mortality** (vs. recorded COVID deaths)

$$\frac{N \text{ died in group in given period}}{\text{Total } N \text{ in group at beginning of period}}$$

- Use death records from January 2011 to February 2022 for individuals aged 11-99
- Economic well-being: **employment-to-population ratio** (EP Ratio)

$$\frac{N \text{ in group working (part-time or full-time) week before survey}}{N \text{ people surveyed in group in month}}$$

- Use CPS data from 2011 to 2022 for individuals aged 25-64
- Annual employment measure defined as average across months

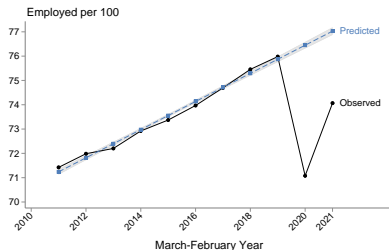
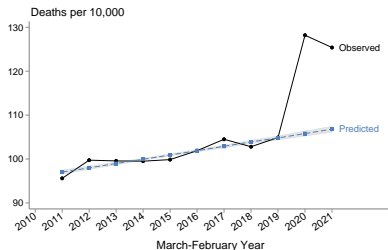
Econometric Framework: Measuring Damages

- Linear probability model on data from Jan. 2011 to Feb. 2022:

$$y_{imt} = \gamma_m + \delta \times t + \sum_{\mu=1}^{26} \phi_{\mu} \mathbf{1}_{\{mt - Dec2019 = \mu\}} + \epsilon_{imt}$$

- y_{imt} : indicator variable for individual i 's status (employment or death) in month m of year t
- Includes month indicators and common linear annual trend
- ϕ : coefficient of interest for Jan. 2020 - Feb. 2022 of **excess** all-cause mortality or **missing** EP Ratio, defined as deviations from trend
- Analogous variables and equation for annual analyses, defining years as March-February years

Annual All-Cause Mortality and Employment

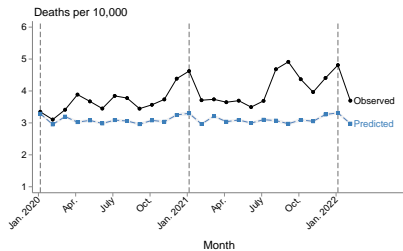


(a) Annual Mortality, Ages 11-99

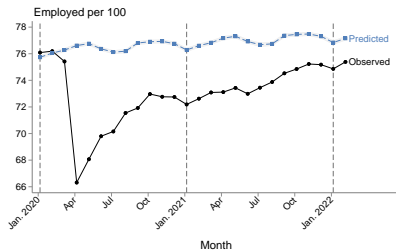
(b) Annual EP Ratio, Ages 25-64

- 22.3 excess deaths (from any cause) per 10,000 people ages 11-99 during the first year and 18.6 per 10,000 during the second year
- Average monthly employment displacement of 5.4 per 100 people ages 25-64 in year 1 and 3.0 per 100 in year 2

Annual effects mask substantial monthly volatility in overall damages.



(a) Monthly Mortality, Ages 25-64



(b) Monthly EP Ratio, Ages 25-64

- By the end of the pandemic's second year, neither health nor economic damages have recovered.

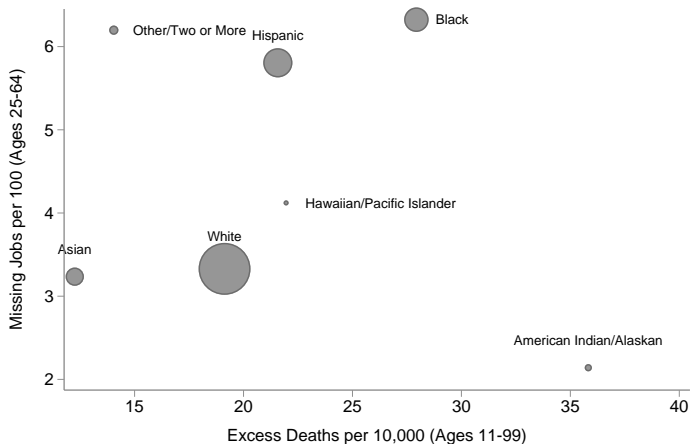
Econometric Framework: Measuring and Decomposing Disparities

- **Measuring Disparities:** Annual analysis, allowing all slopes and intercepts to be group-specific (with groups ρ):

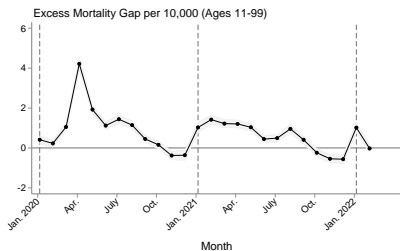
$$y_{it} = \alpha_{\rho} + \beta_{\rho} * t + \theta_{\rho 1} * \mathbf{1}_{\{t=2020\}} + \theta_{\rho 2} * \mathbf{1}_{\{t=2021\}} + f(a, X) + \epsilon_{it}$$

- Coefficients of interest are $\theta_{\rho 1}$ and $\theta_{\rho 2}$, which we then aggregate
- In baseline specification, $f(a, X) = 0$
- **Decomposing Disparities:** Interested in how much adding $f(a, X)$ changes the point estimates of $\theta_{\rho 1}$ and $\theta_{\rho 2}$
 - $f(a, X)$ adjusts for differences in the age distribution (a) as well as in other covariates (X)
 - We allow all elements of f to have differential effects during pandemic vs. prior to the pandemic

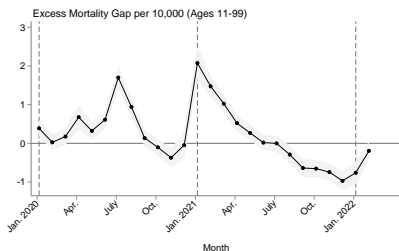
Both economic and health damages tend to be higher among Black and Hispanic individuals.



Gaps in excess mortality by race/ethnicity declined during the pandemic's second year.



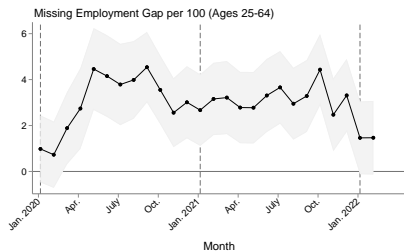
(a) Black-White Gap (Ages 11-99)



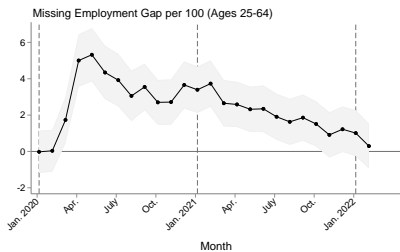
(b) Hispanic-White Gap (Ages 11-99)

Age-Adjusted

Gaps in economic damage by race/ethnicity persisted through most of the pandemic's first two years.

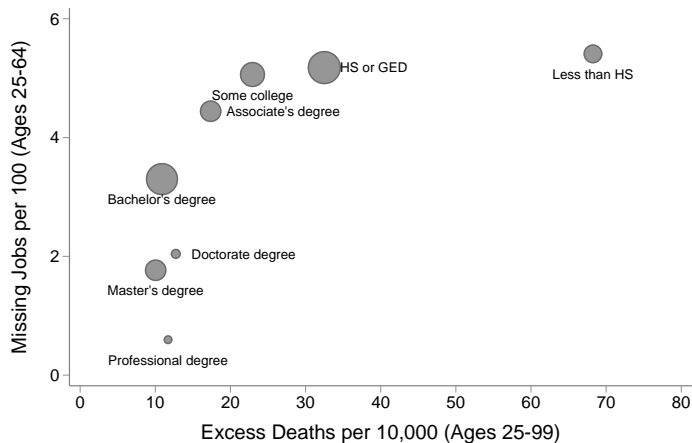


(a) Black-White Gap (Ages 11-99)

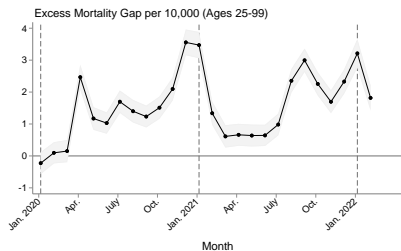


(b) Hispanic-White Gap (Ages 11-99)

Economic and health damages were lower for individuals with higher education.



Individuals without a BA had consistently higher health and economic damages each month.



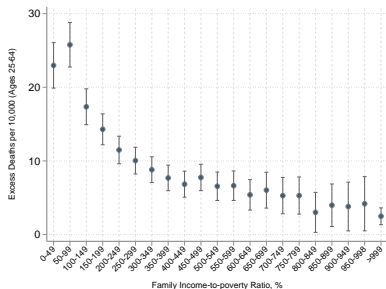
(a) Excess Deaths/10,000 (Ages 25-64)



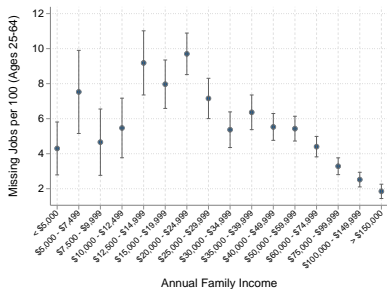
(b) Missing Jobs/100 (Ages 25-64)

Age-Adjusted Mortality

Annual Health and Economic Damages by Income



(a) Excess Deaths/10,000 (Ages 25-64)



(b) Missing Jobs/100 (Ages 25-64)

Age-Adjusted Mortality

- Excess mortality and economic damages also correlated across industries and occupations

Industry/Occupation Results

Decomposing Gaps in Damage

- Were groups that experienced higher damages more **exposed** to the virus/economic contractions, or are all differences attributable to differences in response conditional on exposure?
- We test how much variation in damages we can explain with observables that likely capture differences in **exposure**.
- Two groups of **exposure variables**: [Table](#)
 - Living arrangements – capture the ability to isolate from others who are contagious (e.g., state, type of housing, transportation to work)
 - Nature of work – affects on-the-job exposure to the virus and exposure to changes in labor demand (e.g., industry, occupation)
 - There are large differences by race/ethnicity and education in baseline levels of these variables. [Summary Statistics](#)
- We also consider the role of **pre-existing health/human capital** (e.g. health insurance, disability status, income), but our data are not as rich in these measures.

Decomposition of Gaps Between Black and White Individuals: Role of Exposure (Ages 25-64)

Specification	Excess Deaths per 10,000			Missing Jobs per 100		
	Gap	(SE)	Reduction	Gap	(SE)	Reduction
			A: Baseline			
Unadjusted	19.30	(1.95)	5.3%	3.00	(0.36)	-2.4%
Age-Adjusted	20.37	(1.95)	baseline	2.93	(0.35)	baseline
			B: Covariates			
Living Arrangements	16.70	(1.98)	18.0%	3.04	(0.36)	-3.8%
Nature of Work	18.08	(1.96)	11.2%	1.97	(0.19)	32.8%
Living and Work	15.28	(2.00)	25.0%	1.99	(0.20)	32.1%
All Variables	12.20	(2.01)	40.1%	1.11	(0.16)	62.1%

- During the first two years, Black individuals had 19.3 more excess deaths per 10,000 total than White individuals and 3.00 more missing jobs per 100 on average each month.

Decomposition of Gaps Between Black and White Individuals: Role of Exposure (Ages 25-64)

Specification	Excess Deaths per 10,000			Missing Jobs per 100		
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- Adjusting for age slightly increases the age-adjusted mortality gap; we use the age-adjusted gaps as the baseline throughout.

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- Adjusting for observable exposure measures reduces the excess mortality gap by 25% and the missing jobs gap by 32%.

Decomposition of Gaps Between Black and White Individuals: Role of Exposure (Ages 25-64)

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All Variables	12.20	(2.01)	40.1%	1.11	(0.16)	62.1%

- Adjusting for all observable variables increases the shares explained to 40% for mortality and 62% for missing jobs.

Decomposition of Gaps Between Hispanic and Non-Hispanic White Individuals: Role of Exposure

Specification	Excess Deaths per 10,000			Missing Jobs per 100		
	Gap	(SE)	Reduction	Gap	(SE)	Reduction
	A: Baseline					
Unadjusted	9.93	(1.41)	12.4%	2.48	(0.29)	-12.2%
Age-Adjusted	11.34	(1.41)	baseline	2.21	(0.29)	baseline
	B: Covariates					
Living Arrangements	10.88	(1.50)	4.1%	1.89	(0.30)	14.5%
Nature of Work	8.17	(1.43)	28.0%	1.94	(0.15)	12.2%
Living and Work	8.37	(1.51)	26.2%	1.72	(0.16)	22.2%
All Variables	4.52	(1.53)	60.1%	1.52	(0.19)	31.2%

2020 Only Results

Decomposition of Gaps Between Individuals with and Without a BA: Role of Exposure

Specification	Excess Deaths per 10,000			Missing Jobs per 100		
	Gap	(SE)	Reduction	Gap	(SE)	Reduction
			A: Baseline			
Unadjusted	19.16	(0.91)	3.8%	2.36	(0.20)	9.2%
Age-Adjusted	19.91	(0.92)	baseline	2.60	(0.20)	baseline
			B: Covariates			
Living Arrangements	15.11	(0.93)	24.1%	2.72	(0.20)	-4.6%
Nature of Work	13.93	(1.01)	30.0%	2.39	(0.12)	8.1%
Living and Work	11.23	(1.02)	43.6%	2.48	(0.12)	4.6%
All Variables	6.05	(1.05)	69.6%	1.72	(0.12)	33.8%

2020 Only Results

- In the pandemic's first two years, adverse impacts on employment and on mortality were concentrated in the same groups: Non-White individuals and those without a college degree.
- Differences in observed exposure (e.g., living arrangements, industry, occupation) generally explain 25-45% of these disparities.
 - Remaining role for differences in health / human capital or unobserved exposure

Supplementary Slides

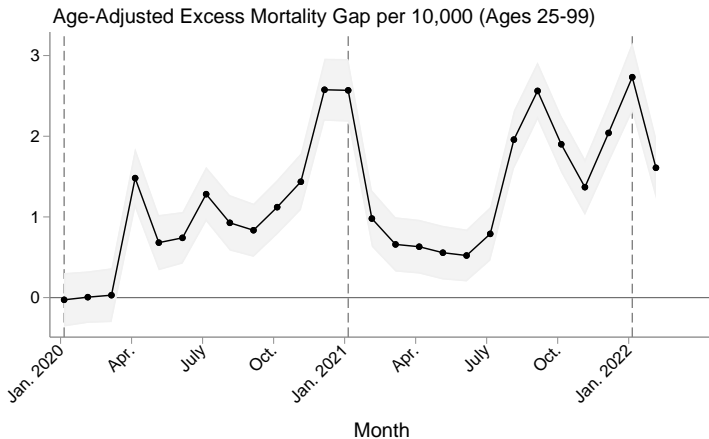
Summary Statistics, March 2020 - February 2021

Table: Ages 25-64 Summary Statistics, Pandemic Year 1 (Mar. 2020 - Feb. 2021)

	Numident	ACS-Numident	CPS
People (Unweighted)	142,900,000	12,100,000	216,356
% Died	0.46	0.44	.
% Employed	.	.	71.08
Average Age	44.50	44.75	43.77
Male %	49.38	49.00	49.13
Hispanic %	14.40	14.27	18.84
Non-Hispanic White	65.25	66.25	58.62
Non-Hispanic Black	13.16	12.47	13.24
BA or Higher %	.	33.91	38.44

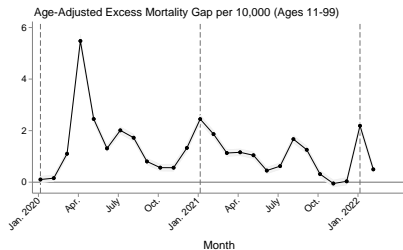
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Age-Adjusted Non-BA/BA Excess Mortality Gaps

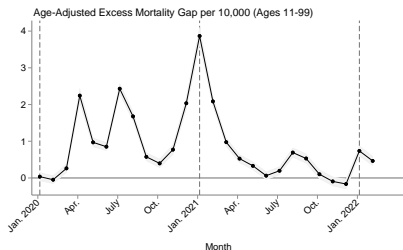


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Age-Adjusted Race/Ethnicity Excess Mortality Gaps



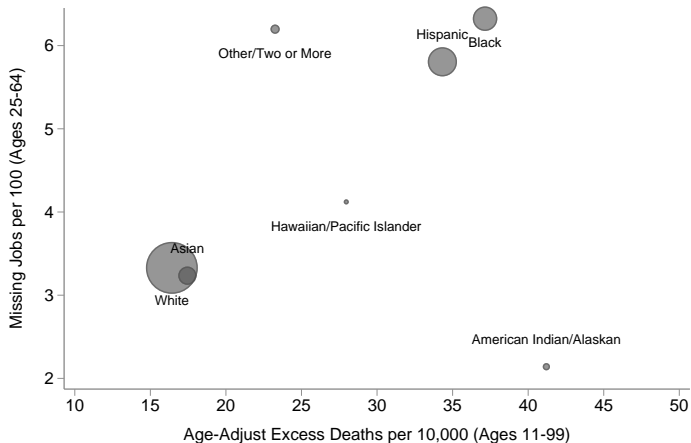
(a) Black-White Gap (Ages 11-99)



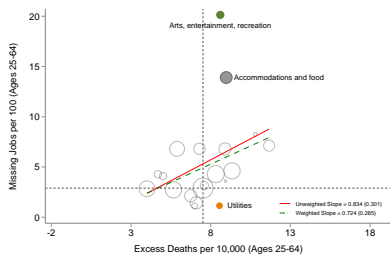
(b) Hispanic-White Gap (Ages 11-99)

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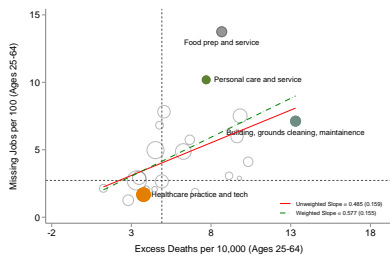
Both economic and health damages tend to be higher among Black and Hispanic individuals.



Age-Adjusted Industry and Occupation Scatterplots



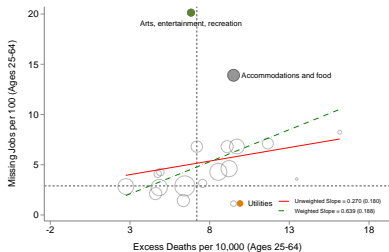
(a) Industry



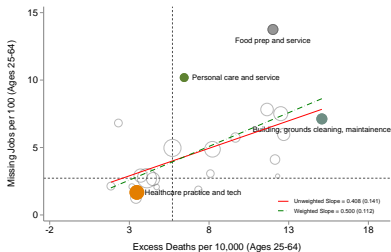
(b) Occupation

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Across industries and occupations, economic and mortality damages were positively correlated.



(a) Industry

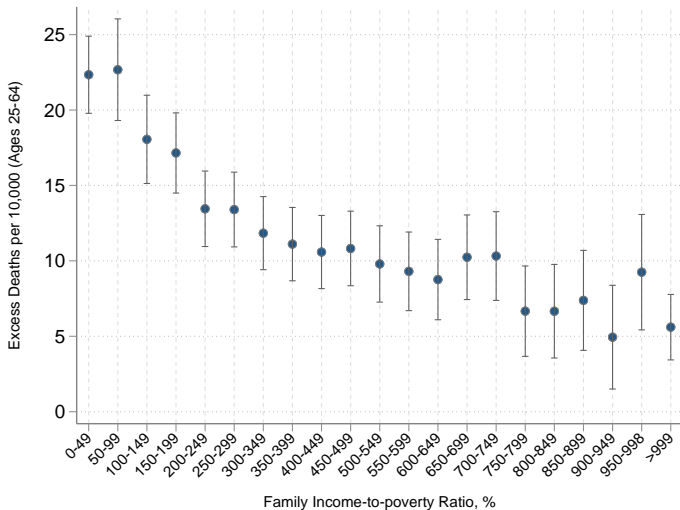


(b) Occupation

- Note: Results are shown for ages 25-64 and are not age-adjusted.
- Results are similar when adjusting mortality by the age distribution across industry and occupation. [Age-Adjusted Scatterplots](#)

[Return](#)

Age-Adjusted Excess Mortality by Income



Variables Included in Decompositions

Decomposition Variables		
Variable Group	Mortality	Employment
Living Arrangements	State People per Room Housing Type Group Quarters Mode of Transportation	State
Nature of Work	Industry Occupation Essential Worker Work from Home	Industry Occupation Essential Worker Work from Home
Additional Variables	Disability Sex Health Insurance Income Education	Disability Sex Young Child Income Education

Decomposition of Gaps Between Black and White Individuals: Role of Exposure – Year 1

Specification	Excess Deaths per 10,000			Missing Jobs per 100		
	Gap	(SE)	Reduction	Gap	(SE)	Reduction
			A: Baseline			
Unadjusted	10.65	(1.16)	4.8%	3.38	(0.43)	-0.46%
Age-Adjusted	11.19	(1.16)	baseline	3.23	(0.42)	baseline
			B: Covariates			
Living Arrangements	9.17	(1.19)	18.1%	3.35	(0.43)	-3.8%
Nature of Work	10.25	(1.17)	8.4%	1.91	(0.24)	40.7%
Living and Work	8.64	(1.20)	22.8%	1.98	(0.24)	38.5%
All Variables	7.46	(1.21)	33.3%	1.76	(0.24)	45.5%

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Decomposition of Gaps Between Hispanic and Non-Hispanic White Individuals: Role of Exposure – Year 1

Specification	Excess Deaths per 10,000			Missing Jobs per 100		
	Gap	(SE)	Reduction	Gap	(SE)	Reduction
	A: Baseline					
Unadjusted	9.10	(0.85)	7.52%	3.33	(0.35)	-9.8%
Age-Adjusted	9.84	(0.86)	baseline	3.03	(0.35)	baseline
	B: Covariates					
Living Arrangements	9.31	(0.92)	5.37%	2.53	(0.37)	16.5%
Nature of Work	8.64	(0.87)	12.15%	2.20	(0.19)	27.5%
Living and Work	8.35	(0.93)	15.20%	1.94	(0.20)	36.2%
All Variables	6.55	(0.94)	33.41%	1.67	(0.21)	44.9%

Decomposition of Gaps Between Individuals with and Without a BA: Role of Exposure – Year 1

Specification	Excess Deaths per 10,000			Missing Jobs per 100		
	Gap	(SE)	Reduction	Gap	(SE)	Reduction
	A: Baseline					
Unadjusted	7.49	(0.54)	1.1%	2.56	(0.24)	7.5%
Age-Adjusted	7.57	(0.54)	baseline	2.76	(0.24)	baseline
	B: Covariates					
Living Arrangements	5.65	(0.55)	25.4%	3.01	(0.24)	-6.8%
Nature of Work	5.18	(0.61)	31.6%	1.58	(0.15)	43.9%
Living and Work	4.16	(0.63)	45.1%	1.70	(0.15)	39.5%
All Variables	1.66	(0.65)	78.1%	1.17	(0.15)	58.6%

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