

# Employment-Attributable Mortality and “Deaths of Despair”

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# Motivation

- ▶ Deaths due to drugs, suicide, and alcohol-related causes (DSA) have contributed to increase in midlife mortality and decline in US life expectancy<sup>1</sup>
- ▶ Between 1999-2017: fatal drug overdose ↑ 387%, suicides ↑ 38%, and alcoholic liver disease mortality ↑ 41% among US adults (Woolf and Schoomaker, 2019)
- ▶ Educational gradient ⇒ widespread social, economic and psychological “despair” *in part* due to deteriorating labor market conditions for lower-skilled workers (Case and Deaton, 2015, 2017, 2020)
- ▶ Yet “despair” narrative suggests common set of root causes for distinct COD and has been critiqued in literature<sup>2</sup>

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<sup>1</sup>For a comprehensive review, see the 2021 NASEM report on *High and Risking Mortality Rates among Working-Age Adults*: <https://doi.org/10.17226/25976>

<sup>2</sup>For common critiques in the literature, see Diez Roux (2017); Geronimus et al. (2019); Masters et al. (2017); Ruhm (2021); Shanahan et al. (2019); Tilstra et al. (2021)

# Motivation: role of economic factors

- ▶ Causal evidence linking *aggregate economic factors* to increases in DSA is mixed<sup>3</sup>
- ▶ Historically procyclical variation in mortality ([Ruhm, 2000, 2005, 2015](#)), but relationship as weakened/reversed largely due to drug-related mortality
- ▶ Post-Great Recession evidence suggests economic contraction contributed to adverse mental and behavioral health outcomes ([Burgard et al., 2013](#); [Catalano et al., 2011](#); [Modrek et al., 2013](#))
- ▶ Emerging evidence that labor market conditions affect DSA ([Charles et al., 2019](#); [Hollingsworth et al., 2017](#); [Pierce and Schott, 2020](#); [Venkataramani et al., 2020](#)) although magnitudes unlikely to drive overall mortality trends
  - E.g., [Ruhm \(2019\)](#): Economic factors account for *at most* 10% of the increase in opioid-related mortality

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<sup>3</sup>See [Currie and Schwandt \(2020\)](#); [Maclean et al. \(2020\)](#); [Ruhm \(2021\)](#) for reviews

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2. **How do these effects vary across age-by-sex subgroups?**
  - Increases in the *aggregate* county-level employment rate decreases suicide **only among men** and increase drug overdose among older men and younger women
  - Evidence that changes in *group-specific* employment have own-group (e.g., direct) and cross-group (e.g., indirect) effects on mortality
  - Most age-sex specific estimates sensitive to correcting for multiple hypothesis testing

# Empirical approach - overview

- ▶ Construct county-year panel from 2003-2017 using restricted-access mortality data from NCHS and employment counts from the Quarterly Workforce Indicators (QWI)
- ▶ Estimate series of instrumented two-way fixed effects models that leverage within variation in aggregate and subgroup-specific employment rates at the county-level
- ▶ Attempt to identify causal effects using a shift-share (Bartik) instrument to isolate *demand-side* variation in employment
- ▶ Extensions: simple simulation to contextualize effect sizes and timing, correct for multiple hypothesis testing, re-estimate over various sample periods, lag structures



# Data & Notation:

- ▶ All data cover the 2003-2017 period; unit of analysis is at the county-year or county-year-demographic group level
- ▶ Demographic groups indexed by  $i$ : F/M ages 19-44, F/M ages 45-64
- ▶  $Y_{ct}$  (or  $Y_{ict}$ ): four, cause-specific mortality rates per 100,000 working-age adults (or in demographic group  $i$ ): all alcohol-related, drug non-suicide, non-drug suicide, and drug-suicide <sup>4</sup>
- ▶  $EPOP_{ct}$  (or  $EPOP_{ict}$ ): share of the employed population relative to the total working-age population (or in demographic group  $i$ )
- ▶ Denominators and county-level demographic controls ( $\mathbf{X}_{ct}$ ) from SEER

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<sup>4</sup>Specific ICD-10 codes include: **drug non-suicide** (Y10-Y14, X40-X44), **non-drug suicide** (X66-X84, Y870), **drug suicide** (X40-X64), and **alcohol-related** causes (X45, X65, Y15, K70, K73-K74).

# Empirical approach - baseline econometric model

- ▶ Goal is to estimate contemporaneous effects of aggregate (or demographic group-specific) employment rates on mortality:

$$Y_{ct} = \theta_c + \theta_t + \theta_{st} + \beta_1 EPOP_{ct} + \gamma \mathbf{X}_{ct} + \varepsilon_{ct} \quad (1)$$

- ▶ Likely that  $cov(EPOP_{ct}, \varepsilon_{ct}) \neq 0$ , and estimating with OLS will yield biased estimate of  $\beta^5$
- ▶ Follow [Currie et al. \(2019\)](#) and [Metcalf and Wang \(2019\)](#) to instrument for  $EPOP_{ct}$  with  $Z_{ct}$ , a *predicted employment rate* for each county-year (or county-year-dem. group)

$$Z_{ct} = \sum_j \left( emp_{cj(2002)} \times \frac{\sum_{c' \in \{C \setminus c\}} emp_{jc't}}{\sum_{c' \in \{C \setminus c\}} emp_{jc'(2002)}} \right) \quad (2)$$

- ▶ Key identifying assumption:  $cov(Z_{ct}, \varepsilon_{ct}) = 0$

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<sup>5</sup> Main endogeneity concern is that local employment is co-determined by labor supply, which is likely correlated with mortality

# Aggregate effects model

What is the effect of one percentage point increase in **aggregate** EPOP on **aggregate** mortality rates?

	Contemporaneous EPOP		One year lag EPOP	
	OLS	SSIV	OLS	SSIV
<b>Alcohol</b> (mean = 12.29)	-0.00296 (0.0121)	-0.0846 (0.0522)	-0.00139 (0.0123)	-0.0543 (0.0558)
<b>Drug non-suicide</b> (mean = 18.56)	0.0000786 (0.0374)	0.258* (0.105)	-0.0220 (0.0353)	0.260* (0.106)
<b>Non-drug suicide</b> (mean = 14.07)	0.0123 (0.0104)	-0.209*** (0.0579)	0.0145 (0.0107)	-0.220*** (0.0578)
<b>Drug suicide</b> (mean = 2.29)	-0.00318 (0.00424)	-0.0172 (0.0180)	-0.00101 (0.00433)	-0.0278 (0.0193)
First stage F-stat.		166.3		155.2
Observations	46,646	46,473	43,549	43,375

Significance: \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001 (all tables)

- 1 percentage point increase in **aggregate** EPOP  $\Rightarrow$

1.4% increase in drug non-suicide (DNS) rate

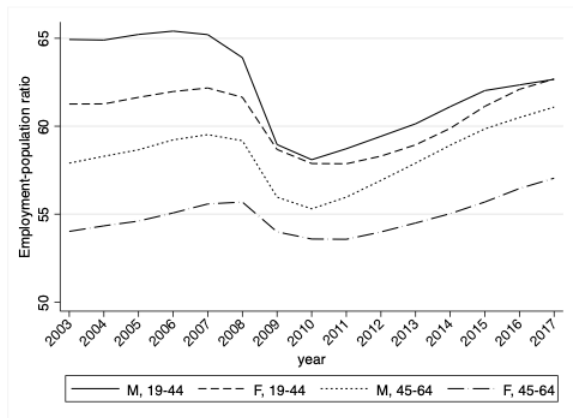
1.5% decrease in non-drug suicide (NDS) rate

# Heterogeneous effects of aggregate employment changes

	Age 19–44		Age 45–64	
	Male	Female	Male	Female
Alcohol	0.0135 (0.0550)	0.0520 (0.0422)	-0.226 (0.170)	-0.142 (0.117)
Drug non-suicide	0.391* (0.186)	0.269** (0.102)	0.385* (0.187)	-0.0551 (0.123)
Non-drug suicide	-0.278* (0.125)	-0.0788 (0.0600)	-0.420** (0.158)	-0.0229 (0.0615)
Drug suicide	0.00579 (0.0303)	-0.00678 (0.0323)	-0.0879* (0.0372)	0.0104 (0.0428)
First stage F-stat.	140.8	173.0	166.2	185.7
Observations	46648	46648	46648	46648

- **DNS:** 1.6% ↑ among M19-44, 2.4% ↑ among F19-44, and 1.7% ↑ among M45-64
- **NDS:** 1.3% ↓ among M19-44, 1.7% ↓ among M45-64
- **DS:** 3.1% ↓ among M45-64

# Subgroup-specific employment rates



- ▶ Groups experienced different trends in employment rates during the 2003-2017 period (e.g., 2007-2009 "man-cession")
- ▶ Leverage detailed demographic information in QWI data to estimate effects of subgroup-specific employment shocks

## Own-group employment effects (direct effects)

*What is the effect of a one percentage point increase in EPOP among subgroup  $i$  on mortality rates for group  $i$ ? (i.e., own-group effects)*

- Estimates generally consistent with model using aggregate EPOP with one key exception: no own-group effect among older males

	Age 19–44		Age 45–64	
	Male	Female	Male	Female
Alcohol	0.0183 (0.0479)	0.0316 (0.0455)	-0.0807 (0.0834)	0.0216 (0.0567)
Drug non-suicide	0.439* (0.191)	0.206* (0.102)	-0.0441 (0.0845)	0.0524 (0.0556)
Non-drug suicide	-0.376** (0.117)	0.0505 (0.0537)	-0.109 (0.0670)	0.0283 (0.0344)
Drug suicide	0.0530 (0.0294)	-0.00188 (0.0271)	-0.0118 (0.0207)	0.0376 (0.0243)
First stage F-stat.	92.45	81.79	315.1	286.0
Observations	46494	46432	46417	44837

# Cross-group employment effects (indirect effects)

*What is the effect of a one percentage point increase in EPOP among subgroup  $i$  on mortality rates for group  $j$ ? (i.e., cross-group effects)*

- ▶ 1 ppt increase in EPOP among **males 19-44**  $\Rightarrow$  0.48 per 100K decrease in NDS among **males 45-64** (2% reduction)
  - Theoretically plausible in context of intergenerational model in which adult children are key sources of economic support for parents
  - Evidence of increased “doubling-up” post-Great Recession supports this hypothesis ([Mykyta and Macartney, 2012](#); [Wiemers, 2014](#))
- ▶ Procyclical pattern among younger males and females and among older males could reflect the combined effect of changes in EPOP among other demographic groups
- ▶ Indirect effects of changes in employment conditions that may operate via intrahousehold mechanisms or other pathways ([Brand, 2015](#); [Burgard et al., 2009](#))

# Contextualizing effect sizes: non-drug suicide (males)

How do the estimated effects compare to underlying trends?

Exercise: compare actual with “employment-attributable” trends – i.e., what would trends in non-drug suicide look like if *only* determined by changes in EPOP relative to 2002?

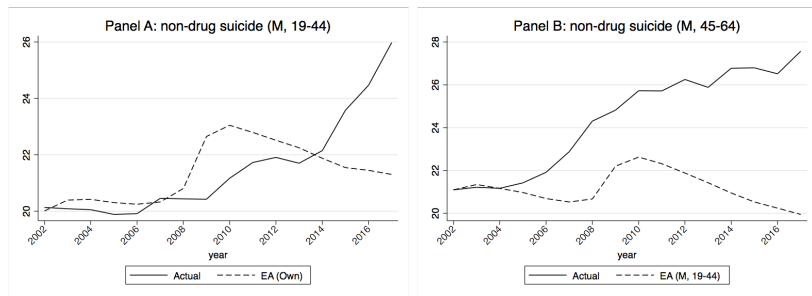


Figure shows population-weighted trends in rates of mortality for non-drug suicide among males 19-44 (left) and males 45-64 (right) between 2003-2017. The solid line denotes actual mortality rates, while the dashed lines present estimated “employment-attributable” rate.



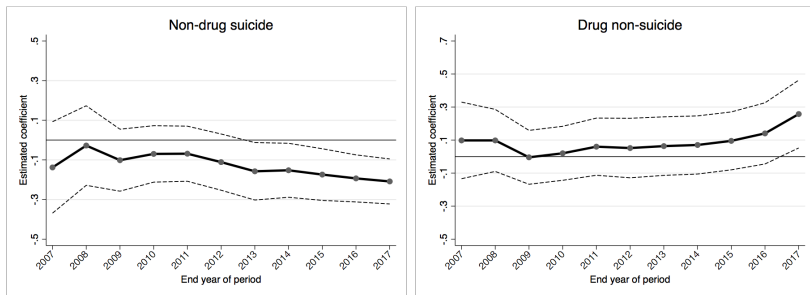
# Key findings from sensitivity analyses (1)

- ▶ Calculate Westfall-Young adjusted p-values to correct for multiple hypothesis testing:
  - Key parameter estimates from **aggregate** model remain statistically significant at 5%-level, but not group-specific estimates<sup>6</sup>
- ▶ Main estimate of drug non-suicide ( $\beta = 0.26$ , 95% : 0.05, 0.46) not robust to alternate aggregate model specifications:
  - Addition of area-level economic controls such as housing price index ([Brown and Wehby, 2019](#))
  - Control for one-year lead term
  - Modeling inverse hyperbolic sine of the count of deaths in each cell
- ▶ No estimates are robust to inclusion of county linear time trends
- ▶ As expected, estimated effects larger at CZ-level ([Lindo, 2015](#)) and alcohol mortality also significantly countercyclical

<sup>6</sup>The one exception is the estimated effect of younger male EPOP on older male non-drug suicide, which remains statistically significant at 5%-level after adjusting for 64 simultaneous hypotheses.

## Key findings from sensitivity analyses (2)

- Estimates sensitive to panel period (Ruhm, 2015; Shover et al., 2019):



- Actual shift in causal relationship over time vs. temporal changes in confounding factors?
- Similar findings when estimating models across start years or equivalent 10-year windows within 2003-2017 interval

# Policy implications

- ▶ Unique causes of death respond differentially to short-term economic shocks, suggesting potential policy trade-offs
- ▶ Connecting job-seekers with immediate employment opportunities (e.g., active labor market programs) could significantly reduce suicide ([Stuckler et al., 2009](#))
  - Potential adverse effect on drug overdose is small in magnitude and likely result of other non-economic (e.g., drug supply) factors
- ▶ Important to disentangle mechanisms as procyclical pattern in overdose may be the result of:
  - Strong income effect
  - More jobs  $\neq$  better jobs (higher rates of workplace injury)
  - Increased job-related stress and coping behaviors
- ▶ Policies may mitigate (e.g., UI, Medicaid expansion, minimum wage) adverse effect of structural changes in the labor market ([O'Brien et al., 2022](#))

Thank you!

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