The impact of midlife job loss on self-injury mortality in a cohort of autoworkers; application of a novel causal approach

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MOTIVATION

Since 2000, rates of fatal drug overdose and suicide have increased dramatically for midlife adults, particularly for those with a high school education or less. A complex web of causes has been hypothesized including over-prescription of opioids and economic distress due to the decline in domestic manufacturing.

OBJECTIVES

1. Determine if suicide and overdose mortality have increased during the 2000s in the United Autoworkers-General Motors (UAW-GM) cohort.
2. Estimate the impact of job loss on risk of self-injury in the UAW-GM cohort over the past 75 years.

METHODS

Study Population

The UAW-GM cohort includes 39,000 autoworkers at three Michigan plants followed for mortality from 1941. For this cohort, we examined historic trends in suicide and fatal drug overdose. The cohort was then restricted to 22,000 autoworkers ever employed between ages 35 and 64, for whom complete work histories were available, in order to perform the incremental propensity score (IPS) analysis to examine the impact of job loss.

Incremental Propensity Score Method

Using the IPS method, we apply a stochastic dynamic intervention that shifts the odds of leaving work within a given year of employment by a multiplicative factor δ. This approach allows us to qualitatively assess the impact of leaving employment on mid-life suicide and overdose deaths while relying solely on the assumptions of consistency and exchangeability.

To implement IPS, requires taking the following steps for each δ across each time t:

1. Estimate an individual's propensity to leave work in a given year based on their observed covariate history.
2. Intervene to *shift* their observed propensity score.
3. Use the observed data to build an outcome model relating leaving work and fatal drug or suicide mortality.
4. Use the shifted propensity scores to estimate what would have happened to the cumulative incidence of drug and suicide mortality under the intervention of interest.

A fast implementation of random forests (`ranger`) was used for both the propensity and outcome models. To estimate the propensity scores, the **treatment model** accounted for age, cumulative years of employment, plant, cumulative days spent off work, year of birth, year of hire, race, sex, and the proportion of the past year spent in skilled, unskilled, and off work. The **outcome model** accounted for age, calendar year, race, and sex.

The function `ipsi` from the `npcausal` package was used to apply and estimate the effects of the intervention.

RESULTS

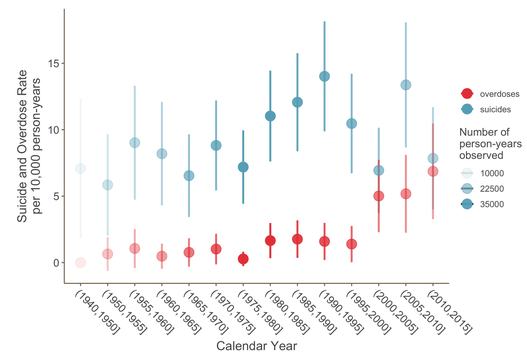

Figure 1: The estimated incidence rates of overdose and suicide by calendar time in the full UAW-GM cohort.

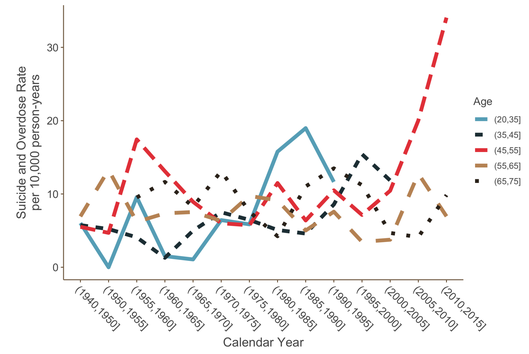

Figure 2: The estimated combined incidence rates of overdose and suicide by calendar time and age in the full UAW-GM cohort.

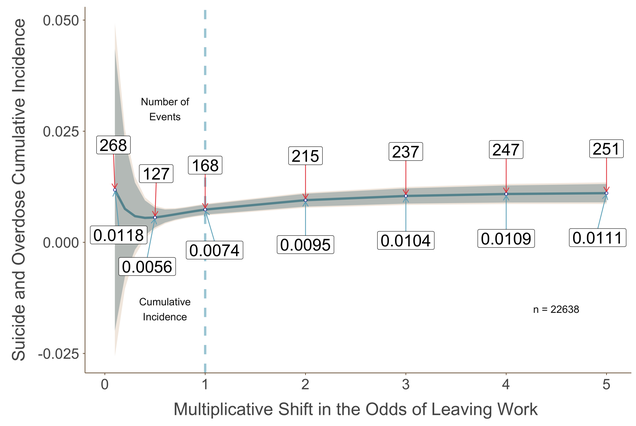

Figure 3: The estimated cumulative incidence of overdose and suicide mortality over a range of multiplicative changes in the odds of leaving work.

Testing the null hypothesis of no incremental effect of leaving work on suicide and overdose cumulative incidence returns a p-value of 0.06.

There is evidence that changing the odds of leaving work for middle aged employees has an effect on suicide and overdose mortality in this cohort.

CONCLUSIONS & NEXT STEPS

This analysis provides evidence that the **combined overdose and suicide mortality rates have increased since 2000 in this manufacturing population**, with the overdose rate catching up to suicide. The increase was particular striking for 45-55 year old autoworkers. Moreover, **this risk appears to be related to job loss.**

Limitations

Our employment data ends in 1994 and we do not know who was still employed in the early 2000s - and at risk of losing their jobs - when 2 of the 3 plants closed down.

Strengths

- UAW-GM cohort ties extensive work histories to death records for decades of American manufacturing employees.
- IPS analysis does not rely on positivity assumptions.

Next Steps: 1) investigate period specific effects, 2) extend work records, 3) renew cohort

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