UAW-GM Cohort Study

Online-only Content

# eAppendix: The full cohort and other sensitivity analyses

## Cohort description and exploratory analyses

A directed acyclic graph (DAG) showing our working hypothetical causal structure is presented in eFigure 1. Under our working assumptions, reducing the risk of worker exit prior to retirement would reduce the risk of suicide and fatal overdose. Note that underlying depression was unmeasured. By conditioning on calendar time and plant, the causal parents of plant closure, we reduced the magnitude of confounding bias through that path.1

eFigures 4a and 4b show the person-time contribution of suicide and fatal overdose cases, respectively, arranged by date of worker exit. There does not appear to be clear temporal clustering of termination dates among cases. Worker exit became more frequent over calendar time, and there was significantly more follow-up time before worker exit than after.

## Sensitivity analyses

Employment status was determined using termination dates from company job records. If a case occurred after worker exit, their exit date should precede their date of death. If a case occurred while employed, their exit date should equal their death date. However, we expect the termination dates to be imperfectly recorded, given the administrative nature of the data. We attempted to characterize the extent of possible misclassification by examining the distribution of difference between the dates of death and termination.

The right-side panel of eFigure 3 presents a histogram of the difference between death and termination dates for suicide cases. The distribution had a strong right-skew and a striking mode in the third bin representing cases whose death date was later than their exit date and less than or equal to one year after exit. Among cases that occurred within a year of job exit, the distribution still showed a strong right skew, but with two local modes centered approximately around 0 and 33 days. The observed times centered around 0 were roughly bounded by a radius of 14 days.

In the main analysis, we assumed that cases occurred while employed if the death date preceded or equaled the termination date. In the sensitivity analysis we assumed that a case occurred while employed if the death date was within a week of the termination date. That is, we assumed that all the cases whose exit dates preceded their death dates by no more than one week were misclassified as not employed at death when they were in fact employed (see eTable 1).

Sensitivity analyses in which follow-up was restricted to five years after worker exit are presented in eTable 2. The point estimates and overall shape of the associations remained approximately the same. Table 4 presented hazard ratio estimates for the combined outcome of suicide and fatal overdose in the sub-cohort. In the sensitivity analysis presented in eTable 3, we estimated hazard ratios for the combined outcome in the full cohort. The shape of the exposure-outcome relationship remained approximately the same.

To better understand the shape of the exposure-outcome relationship, we fitted models which included a restricted penalized spline function (*df*=4) of continuous age at termination.2 To fit these splines and compute hazard ratio estimates, we assumed that the log-hazard associated with age at termination was constant for those who left work at 55 or older, conditioning on all other covariates. To complement the analyses for categorical age at termination presented in the main body, we fitted these models for suicide and for the combined outcome of suicide and fatal overdose (eFigure 5).

## Competing risks

A competing risks analysis of age at leaving work on suicide was performed to account for the increasing risk of mortality due to other causes in an aging cohort. As in the categorical models presented in the main body, subjects entered follow-up upon leaving work and were followed until they experienced the event of interest (suicide; n = 158), the competing risk (mortality due to cancer, n = 3,101), censoring by another mortality event (n = 7,805), or the end of/loss to follow-up (n = 8,214). The exposure of interest was age at worker exit.

Using both parametric and non-parametric methods of analysis,3,4 cumulative incidence of suicide was estimated at four different points during follow-up: 1 year, 2 years, 5 years, and 10 years post-worker exit. The difference in cumulative incidence functions between the exposure groups served as the parameter of interest. For each of the follow-up times and across all estimators, employees who left work before the age of 55 had higher cumulative incidence of suicide than employees who left work after the age of 55. This difference did not change meaningfully when cause-specific or sub-distribution hazards were the basis of estimation. Further, the difference did not diminish when accounting for baseline factors such as sex, type of work (assembly, grinding or machining), the total amount of time spent away from work during employment, or the location of the worker within the three plants. A targeted maximum likelihood analysis utilizing bounds to account for the rare event of interest produced slightly diminished, though concordant estimates.

**References**

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