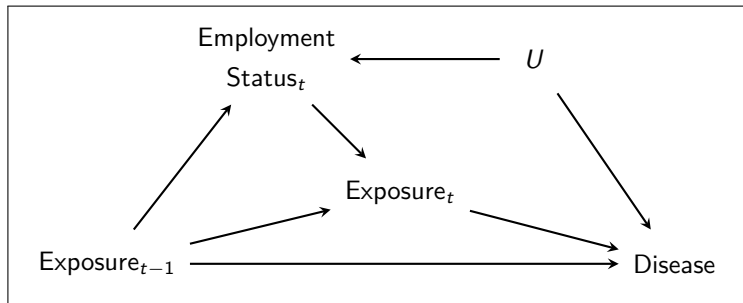# HWSE path analysis

Cancer incidence

May 12, 2021

# From Erika Garcia's paper[1]

The presence of the healthy worker survivor effect (HWSE) implies the presence of the following three conditions:

1. Leaving work predicts (future) exposure
2. Leaving work is associated with the disease
3. Prior exposure predicts predicts leaving work

Analytic population

- Cancer incidence follow-up
  - Starting in 1973 in plants 1 and 2; 1985 in plant 3
  - Ending in 2015
- Employment records in in 1994; individuals still at work in 1995 were censored

2. Leaving work and cancer incidence
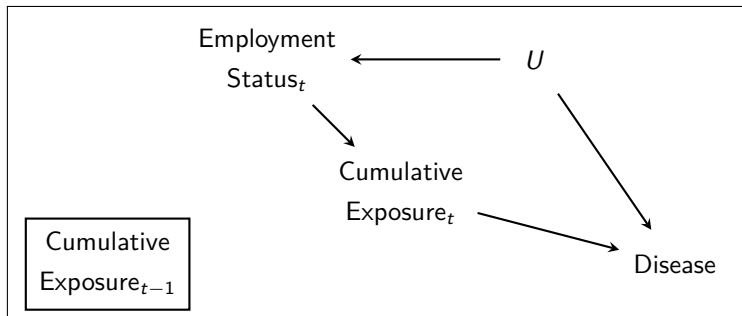
- Exposure: Employment status (binary)
- Conditioning set:
    - Age (index time for Cox model)
    - Cumulative MWF exposure (lagged 1 year)
    - Year of hire
    - Race (MI)
    - Plant
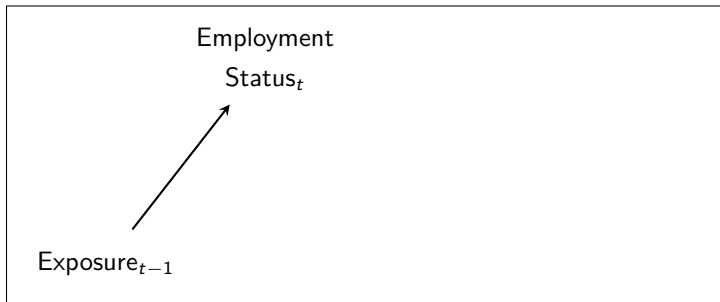   - Sex

2. Leaving work at age 60 and cancer incidence

$$\log h(t \mid a, \ x) = \log h_0(t)$$
$$+ a \cdot \mathbb{1}\left[t < 60\right] \cdot \beta_1 + a \cdot \mathbb{1}\left[t \geq 60\right] \cdot \beta_2$$
$$+ x \begin{pmatrix} \beta_3 & \cdots & \beta_p \end{pmatrix}^{\top}$$

where a is the indicator of having left work, t is age, and x is a vector of covariates

- Coefficients β_1 and β_2 may be thought of as interaction effects of employment status and age

3. Prior exposure and leaving work

- Exposure: Cumulative exposure lagged 1 year
- Conditioning set:
  - Age (index time for Cox model)
  - Year of hire
  - Race (MI)
  - Plant
  - Sex

Citations

1. Garcia E, Picciotto S, Costello S, Bradshaw PT, Eisen EA. Assessment of the healthy worker survivor effect in cancer studies of the united autoworkers-general motors cohort. *Occupational and environmental medicine*. 2017;74(4):294-300.