Education Gradients in Mortality Trends by Race and Gender

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Motivation

- Interest in social disparities & health for many years
  - Positive relationship between education & health (“SES gradient”)
  - Changes in group-specific mortality rates as indicators of social progress

- Reversals in progress reducing mortality rates
  - U.S. life expectancy, 2014-2017 \( \downarrow \) from 78.9 to 78.6
  - 1\textsuperscript{st} 3-year decline in a century

- “Deaths of Despair” (Case & Deaton 2015, 2017, 2020)
  - Focus on 45-54 or 50-54 non-Hispanic whites (“Whites”)
  - Mortality \( \uparrow \) concentrated among non-college educated
  - Taken as evidence of economic/social breakdown in society
Empirical Challenge: Negative Selection

• Most research measures education in discrete categories: < high school, high school, some college, college+

• Disparities could reflect rising educational attainment over time (Preston and Elo 1995, Dowd & Hamoudi 2014; Bound et al. 2015)
  - Less educated groups become more negatively selected
  - Some people who failed to complete high school in previous cohort now graduate high school
  - “Will Rogers Phenomenon”: all groups have lower quality

• Recent efforts to adjust for changes in education levels over time
  - Different methods, data, time periods, and results
This Project

- Estimate $\Delta$’s in mortality trends by education quartile
  - Construct quartiles by sex, race, 5-year age group (25-64 year olds)
  - Combine administrative + survey data from 2001-2018

- Race & gender patterns for specific causes of death
Patterns of absolute mortality rate $\Delta$’s often taken to indicate size of health shocks to different groups

Not true if initial differences in stock of health capital

Equal size $\Delta$ in health capital
  - larger mortality $\Delta$ for less educated
  - but possibly smaller absolute $\Delta$

Examine logs and levels of mortality rates
Death Rates

\[
mort_{arit} = \frac{deaths_{arit}}{pop_{arit}}
\]

- age group \( a \)
- race/ethnicity \( r \)
- education quartile \( i \)
- year \( t \)

- calculate rates for 5-year age groups, from 25-64
- stratified by sex
Data

- Deaths: CDC *Multiple Cause of Death Files (MCOD)*
  - Available 1999-2018

- Population: *Surveillance Epidemiology & End Results (SEER)* database
  - Age, sex & race-specific populations

- Educational Share: *American Community Survey (ACS)*
  - Starts in 2001

- Analysis Period: 2001-2018
Complicating Factors

- Education on death certificates switches from continuous to categorical
- Education-Specific Populations
  - SEER Population $\times$ ACS Education Share
  - ACS education switches from categorical to continuous
- A single year of education may span quartiles
Causes of Death

- Total mortality
- Specific causes
  - 10 highest causes for each age subgroup (cardiovascular disease, cancer etc.) plus
  - non-drug accidental deaths
  - non-intentional drug deaths
  - suicide
  - residual category
- “Major” vs. “Minor” causes
Total Mortality trends by race: males

- Age-standardized trends: 25-64 year olds
- Larger declines (but higher levels) for Blacks than whites
Total Mortality trends by race: females

- Lower overall rates but similar trends to males
Regression Specification

\[ \text{mort}_{ari} = \sum_{a \in A} \sum_{r \in R} \sum_{i=1}^{4} \beta_{ari} [\text{age}_a \times \text{race}_r \times Q_i] + \sum_{r \in R} \pi_r [\text{trend} \times \text{race}_r] \]

\[ + \sum_{r \in R} \sum_{i \neq 4} \pi_{ri} [\text{trend} \times \text{race}_r \times Q_i] + \epsilon_{ari} \]

- \( Q_i \): education quartile (\( Q_4 \) reference group)
- \( \text{age}_a \): 5-year age group
- \( \text{race}_r \): race/ethnicity \( \text{trend} \): year
- \( \beta_{ari} \): group fixed-effect
- \( \pi_r \): race-specific trend for reference quartile (\( Q_4 \))
- \( \pi_{ri} \): race-specific trend difference vs. \( Q_4 \)
• monotonic trends for whites only
Quartile-specific total mortality trends: females

• similar to males
Quartile-specific log mortality trends: males

- 4th quartile does best
- Little difference for Q1 - Q3
Quartile-specific log mortality trends: females

- more monotonic in education than for males
Cardiovascular mortality: males

- no education pattern for whites
- biggest ↓ for less educated Blacks (possibly Hispanic & other)
Major causes: males

- drugs monotonic; biggest ↑
- CVD, cancer, sometimes HIV; biggest ↓, especially Q1/Q2 Blacks
All major causes: males

(a) Major causes
Minor causes: males

- minor causes: trend coefficient <0.8 (absolute value)
- liver disease a minor cause for most groups
- residual fairly important for less educated whites
Cardiovascular mortality: females

- very different for Black females vs males
- no general education gradient
Major causes: females

- drugs monotonic; biggest ↑
- females: cancer ↓ for Q3/4 whites; Q2-Q4 Blacks; CVD for Q3/4 Blacks
- few clear education patterns
All major causes: females

(a) Major causes

![Graph showing mortality rates for different causes across various populations.](image-url)
• similar to males
Log mortality rates: males

- Largest % increases (decreases) for drugs (HIV)
- Sometimes more favorable ∆ for Q4
• Largest % increases (decreases) for drugs (HIV)
• More monotonic in education
Review of Key Results

- Drug Deaths: most important source of mortality ↑
  - particularly for whites

- Cardiovascular disease, cancer, HIV most important for mortality ↓

- Other mortality trends also important
  - Q1/2 white females: limited CVD/cancer ↓
  - Blacks: exceptional HIV, CVD, cancer ↓
    - Q1/Q2 males; Q2/Q4 females
  - smaller drug ↑ for Blacks than whites

- Hispanic/other nonwhite trends have small magnitude
  - hard to evaluate
What We Have Learned

Unidimensional explanations unlikely to explain mortality trends
Must explain tremendous heterogeneity in $\Delta'$s by sex, race & age

- Total mortality $\Delta'$s mix effects of different causes
- Mortality ↑ dominated by drugs
- Liver disease a “minor” cause (e.g. larger effect of respiratory)
- Mortality ↓ by Cancer, CVD, sometimes HIV
- Large differences by sex, race & education

Need to focus on specific causes of death
THANK YOU
Complicating Factors

Education on death certificates often categorical

- After 2002: some states report categories
  - ≤8th grade, 9-12 no diploma, high school grad, some college, bachelor’s degree, master’s degree, doctorate/professional degree
  - Calculate single years of education (where provided) for broader categories (e.g. ≤8, 9-11 grade)
  - Regress these % on trend, age, sex, race/ethnicity (& interactions)
  - Predict probability of single years of education for categories
Complicating Factors (cont.)

Education-Specific Populations

- \textit{SEER Population} \times \textit{ACS Education Share}
- After 2007: ACS reports single education years: 1-12
- Before 2008: 0-4, 5-6, 7-8 grades combined, split based on 2008-2017 distribution
- H.S. grad = 12
- College: No Degree/ Associates Degree = 14
- College Degree = 16
- Beyond College = 17