Life Course Predictors of Midlife Mortality

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A Key Challenge for Studying Midlife Mortality

• Not many people die in midlife (40-64)
• 2015 life table: 85% of Americans die at ages 65+ (82% in 1999; HMD)
• MIDUS cohort (aged 25-74 in 1995-96):
  – 16% of SAQ sample died within ~18 years
  – Only 285 (<5%) deaths at ages 40-64
• Need a HUGE sample to study midlife mortality at the individual-level.
Sparse Literature on Midlife Mortality

• Few individual-level studies focus on **midlife** mortality.

• Predictors of midlife mortality not necessarily the same as the predictors of **changes over time** in midlife mortality.

• Increases in “deaths of despair”: difficult to study at individual-level because it is so rare (among the few deaths in midlife, <20% result from these causes).
Life Course Predictors of Midlife Mortality

**LIFE STAGES**

- **Birth**
- **Early Childhood** (Ages < 12)
- **Adolescence** (Ages 13-19)
- **Young Adulthood** (Ages 20-39)
- **Midlife** (ages 40-64)

**Predictors of Midlife Mortality**

- **Sex**
- **Race/Ethnicity**
- **Genetic factors**
- **Prenatal Exposures**

**Life Course Stages**

- **Childhood SES**
- **Educational Attainment**

**Midlife Outcomes**

- **Physical Health**
- **Psychological Health/Well-Being**
- **Social Well-Being**

**Career Development**

- **Labor Force Entry**
- **Marriage**
- **Parenthood**

**Penultimate Outcomes**

- **Marital disruption**
- **Empty Nest**

**Ultimate Outcome**

- **Midlife Mortality**
What is the evidence regarding life course predictors of midlife mortality?
Childhood SES

• Associated with mortality [Montez & Hayward, 2014; Chapman et al., 2009; Hayward & Gorman, 2004; Pudrovska & Anikputa, 2013; Galobardes et al. 2004]

• Stronger effect in midlife? [Turrell et al., 2007]

• Operates primarily via adult SES [Pudrovska & Anikputa, 2013; Montez & Hayward, 2014]
  – Not clear if also true for midlife mortality

• Fundamental cause: linked with cluster of associated exposures (e.g., adverse childhood experiences) & related factors
Employment/Career Trajectory

- Aggregate (county-level) analyses
  - Economic opportunity $\rightarrow$ lower mortality (esp. at working ages) [Venkataramani et al., 2016]
  - Economic mobility (county) $\rightarrow$ smaller increases midlife mortality [O’Brien et al., 2017]

- Individual-level factors associated with lower mortality in men [Hayward & Gorman, 2004]
  - Substantive complexity of job
  - Total family income
  - Net assets
Marriage & Family Transitions

- Compared with always single or formerly married, those who were consistently married → lower midlife mortality (among college students followed to age 62) [Siegler et al., 2013]

- **Men**: Married/never married lower mortality than widowed/divorced [Hayward & Gorman, 2004]

- **Women**: Mortality lowest for married with children later in life; highest for those with spells of single motherhood [Sabbath et al., 2015]
Midlife Mortality Based on MIDUS

- Completed SAQ in 1995-96 (n=6325)
  - Dropped missing data for age (n=2), vital status (n=7), or other predictors (n=1081)
- Mortality follow-up through May 2013 (mean=17.9, range=16.7-18.3 years)
- Split exposure into age ranges:
  - Early (age 20-39): n=1794, 12 (<1%) died
  - Midlife (age 40-64): n=4701, 217 (<5%) died
  - Later (age 65-92): n=2222, 493 (22%) died
- Cox model, age as “clock”, sex-adjusted
Life Course Predictors of Midlife Mortality

LIFE STAGES

- Birth
- Early Childhood (Ages < 12)
- Adolescence (Ages 13-19)
- Young Adulthood (Ages 20-39)
- Midlife (ages 40-64)

Factors:
- Sex
- Race/Ethnicity
- Genetic factors
- Prenatal Exposures

Life Stages:
- Childhood SES
- Educational Attainment
- Labor Force Entry
- Marriage
- Parenthood
- Career Development
- Marital disruption
- Empty Nest
- Physical Health
- Psychological Health/Well-Being
- Social Well-Being

Ultimate Outcome: Midlife Mortality
Age is a Better Predictor of Mortality in Later Life than in Midlife

Discrimination (AUC)

Baseline Model (Age only)

Coin Toss

Perfect Prediction

Midlife (40-64): 0.69
Later life (65-92): 0.82

Baseline Model (Age only)
**Added Value of Sex and Race/Ethnicity**

Ref=Female
- Male: HR=1.38 ($p \sim 0.02$)
- HR=1.17 (NS)

Ref=NH White
- NH Black: HR=2.00 ($p \sim 0.01$)
- Latino: HR=1.17 (NS)
- HR=1.39 ($p < 0.001$)
- HR=1.09 (NS)
- HR=0.62 (NS)

Discrimination (AUC)
- Midlife (40-64): 0.013
- Later life (65-92): 0.004

Legend:
- Baseline Model (Age only)
- Sex & Race/Ethnicity
Added Value of Childhood SES

Effect size per SD of Childhood SES (varies by age)

HR=0.59 (at age 40)  
\( p \approx 0.01 \)

HR=0.89 (at age 65)  
\( p \approx 0.02 \)

Midlife (40-64)
Later life (65-92)
Added Value of Own Education

Graduate degree vs. No HS degree/GED

HR=0.32
p~0.001

HR=0.65
p~0.03
Add Marriage, Parenthood, & Current Occupation

Ref = Never Married

1st Married @Age 23+
- HR = 0.50 ($p \approx 0.002$)
- HR = 0.68 ($p \approx 0.04$)

Div/Sep
- HR = 1.71 ($p \approx 0.002$)
- HR = 1.53 ($p \approx 0.01$)

Marriage: Age at first marriage; whether divorced/separated by MIDUS 1
Parenthood: Age at first birth; whether first birth after marriage [$\Delta$AUC < 0.001]
Occupation: SEI score of current occupation; not currently employed
Added Value: Subjective Measures of Work and Financial Situation

Subjective Measures: Rating of expected work situation 10 years in the future; Perceived financial situation compared with parents at same age
Added Value: Mental Well-Being and Other Health-Related Measures

Discrimination (AUC)

<table>
<thead>
<tr>
<th>Midlife (40-64)</th>
<th>Later life (65-92)</th>
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<tbody>
<tr>
<td>0.002</td>
<td>0.001</td>
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<tr>
<td>0.051</td>
<td>0.023</td>
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</tbody>
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Mental Well-Being: Purpose in life index; Negative affect index
Other Health-Related Measures (self-reported): Smoking status; overall health status; physical limitations; diabetes; hypertension
Biomarkers: Predict Midlife Mortality?

Notable predictive ability ($\Delta AUC \geq 0.01$)*:
- C-Reactive protein
- Homocysteine

Poor discrimination ($\Delta AUC < 0.01$)*:
- Body mass index
- Waist circumference
- Blood pressure (SBP, DBP)
- Lipids (TC, HDL, ratio TC/HDL)
- Leukocyte telomere length

* Compared with age and sex only.

Sources: Goldman et al. (forthcoming); Glei et al. (2016)
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<tr>
<th><strong>Advantages</strong></th>
<th><strong>Disadvantages</strong></th>
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| • Extensive measures of:  
  – Childhood adversity  
  – Psychological health  
  – Personality traits  
  – Hardship related to Great Depression  
• Cohort aged 25-74 (in ~1995)  
• 18+ years of follow-up  
• Refresher cohort (aged 25-74 in ~2013) | • Limited power  
• Few minorities  
• Sparse information about labor force entry & career development  
• Geocoding?  
• ≈10 years between follow-up waves  
• Retrospective info regarding childhood |
Other Datasets

- **HRS**: Sample limited to age 50+
- **WLS**: Only HS graduates, represents Wisconsin only, cohort now aged ~78
- **NLSY79**: Cohort now aged 53-60; first interviewed in young adulthood
  - No mortality follow-up (yet); may add it?
- **National Longitudinal Mortality Study (NLMS)**: State and urban/rural/SMSA identifiers, but limited information regarding life course history?
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EXTRA SLIDES
What kinds of policy interventions might be effective for addressing life-course effects on midlife mortality?
Intervene At What Point in Life?

- Evidence of irreversible damage?
  - Need to intervene in early childhood?
- Target in young adulthood?
  - But early enough to influence trajectory of education → labor force entry
  - Case & Deaton (2017): Labor market entry as the trigger → marriage prospects, etc.
Symptoms versus Causes

• Opioid epidemic: Cause or symptom?
  – Need to get at the root causes; may require more than cutting off the supply of opioids
    • Macro-level influences, educational & labor market opportunities, etc.

• Prognosis identifies those at high risk
  – BUT, does not tell you what are the causal, modifiable factors (selection vs. causation)

• Identifying the vulnerable (or resilient) pathways: necessary starting place?
Critical research gaps in our understanding of life course predictors of midlife mortality and possible interventions?
Future Research

• Specific pathways leading to high risk of midlife mortality?
  – Which social chains are highest risk?
  – Constellation of factors related to low SES that really matter?
  – AND pathways to resilience?
• Additive models may not be adequate
  – Clustering of exposures and interactions between them
• Why is the U.S. different? (comparative)
Parting Thoughts

• Midlife mortality: Just the tip of the iceberg?
  – High levels of “despair” in US (misery that doesn’t end in death)?
  – More power to study health than mortality
  – Broader view of disparities in well-being

• Need to consider differences in both levels (at a given time) and change (over time)
  – Mortality improved more for blacks than for whites, but blacks still have higher mortality!

• Numerator-denominator bias in calculation of mortality rates by ethnicity?
Mortality Among the MIDUS Cohort: Effect of Predictor Varies by Age?

- Stronger association at younger ages for:
  - Race/ethnicity
  - Childhood socioeconomic status*
  - Own Education
  - Age at first marriage (or never married)
  - Age at first birth (or childless)
  - Psych well-being subscale: Purpose in Life
  - Overall self-assessed health status
  - Self-reported physical limitations
  - Self-reported hypertension†
  - Self-reported diabetes*

* Also within midlife  † Also within later life mortality
What theories might explain these patterns?
Life Course Theories

• Critical (Sensitive) Period
  – Biological imprinting; irreversible damage

• Accumulation of Risks
  – Additive and/or interactive effects

• Pathway Model
  – Early life shapes life-course trajectory

• Social Mobility Model
  – Circumstances later in life modify effects of early life exposures/factors

Sources: Pudrovksa & Anikputa (2013)