Medicaid and Mortality:

New Evidence from Linked Survey and Administrative Data

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This paper is released to inform interested parties of research and to encourage discussion. Any views expressed on statistical, methodological, technical, or operational issues are those of the authors and do not necessarily represent the views of the U.S. Census Bureau; the National Heart, Lung, and Blood Institute; the National Institutes of Health; or the U.S. Department of Health and Human Services. These results have been reviewed by the Census Bureau’s Disclosure Review Board (DRB) to ensure that no confidential information is disclosed. The DRB release numbers are: CBDRB-FY19-310 and CBDRB-FY19-400.
High degree of inequality in health outcomes by income

- Adults 55-64 with incomes below 138% FPL have annual mortality rate 4x greater than those with incomes 400% FPL or higher (rates: 1.7% vs. 0.4%)

- 787% higher chance of dying from diabetes, 552% higher for cardiovascular disease, 813% higher for respiratory disease

Correlation between income and health higher in the US than other wealthy countries (Semyonov et al. 2013)
Medicaid and Mortality

Can any program effectively reduce high mortality rates for the poor?

- Medicaid: largest health insurance provider for low-income individuals
- Covers 72 million enrollees at over $500 billion in annual spending (CMS 2019a,b)
- Inconclusive evidence on whether affects health/mortality

GOP congressman: "Nobody dies because they don't have access to health care"
Medicaid and Mortality

Can any program effectively reduce high mortality rates for the poor?

- Large literature demonstrating Medicaid substantially increases use of care, including care generally believed to be effective

- Increase in Rx drugs: large and significant increases in drugs for diabetes, cardiovascular disease, and treatments for HIV and Hepatitis C (Ghosh, Simon and Sommers 2017)

- More cancer screening (Finkelstein et al. 2012, Sabik et al. 2018) and earlier detection (Soni et al. 2018) and treatment (Eguia et al. 2018)

- Increase in hospitalizations and ED visits considered “non-deferrable” (Duggan, Gupta and Jackson 2019, Taubman et al. 2014, Finkelstein et al. 2012)
The Affordable Care Act (ACA) Medicaid expansions present a promising setting in which to investigate this:

- ACA originally intended to expand Medicaid eligibility to all individuals in households with incomes \( \leq 138\% \) FPL.
- Supreme Court decision made this expansion optional, with roughly half of the states expanding.
- Still represented historic expansion in coverage (13.6 million adults compared to 19 million under Medicare).

Can use a quasi-experimental difference-in-differences design to estimate causal impact of expanded Medicaid on health outcomes.
However, there are some empirical challenges:

- Difficult to assess health programs like Medicaid in current data because death records have very little information about socioeconomic status of the decedent
- Have to look over broad groups, like states or counties
- Has made mortality effects difficult to uncover (Black et al. 2019)
Medicaid and Mortality

Our contribution: “new” data for an old question

- Use data on SSA death records from Census Numident file linked to the American Community Survey (ACS)

- ACS is a large survey (4 to 4.5 million respondents per year), detailed info on individual characteristics

- Identify group most likely to gain Medicaid eligibility based on income and household characteristics

We find mortality rate among this high impact group falls about 0.123 percentage points (about 9.4% relative to sample mean)
Background
Medicaid Background

Medicaid is a large public insurance program

- Historically, Medicaid only covered certain low-income groups (elderly, persons with disabilities, and cash welfare participants)
- Due to mandatory changes in the 1980s-2000s, the program has generous eligibility criteria for pregnant women and children
- Optional state expansions for low-income parents in 1990s-2000s
- Most low-income, non-disabled adults did NOT qualify for Medicaid prior to ACA
Median Medicaid/CHIP Eligibility Thresholds, January 2013

Minimum Medicaid Eligibility under Health Reform - 138% FPL ($24,344 for a family of 3 in 2012)

- Children: 235%
- Pregnant Women: 185%
- Working Parents: 61%
- Jobless Parents: 37%
- Childless Adults: 0%

SOURCE: Based on the results of a national survey conducted by the Kaiser Commission on Medicaid and the Uninsured and the Georgetown University Center for Children and Families, 2013.
After 2012 Supreme Court decision, expansions became optional

- 26 states and DC implemented the expansions in 2014, with 10 additional states adopting in the last 5 years
Medicaid Background

Source: Kaiser Family Foundation, status as of November 11, 2019
Other papers have looked at the impact of these expansions on access to and use of health care services and financial outcomes

- Credit report data shows large reductions in unpaid bills and improvements in financial stress (Hu et al. 2017; Brevoort et al. 2019; Miller et al. 2019)

- Large increases in use of prescription drugs (Ghosh, Simon and Sommers 2017), cancer screening and earlier treatment and detection of cancer (Soni et al. 2018), and other preventive care (Cawley, Soni and Simon 2018)

- Improvements in self-reported ability to access care (Miller and Wherry 2017; Sommers et al. 2015)
Analysis of the impact on health challenging due to data limitations:

- Most studies rely on self-reported health from surveys
  - Large/modest improvements (Cawley et al. 2018; Simon et al. 2017; Sommers et al. 2016, 2017)
  - No effects (Courtemanche et al. 2018a, 2018b; Wherry and Miller 2016)
  - Or even small negative effects (Miller and Wherry 2017)
- May not accurately measure changes in physical health
Analysis of the impact on health challenging due to data limitations:

- Population-level studies of mortality reach different conclusions (Black et al. 2019; Borgschulte and Vogler 2019)
  - Black et al. 2019 NBER WP: “it will be extremely challenging for a study [on the ACA Medicaid expansions] to reliably detect effects of insurance coverage on mortality unless these data can be linked at the individual level to large-sample panel data.”

- Indication there were effects for vulnerable subgroups - reductions in mortality for patients with ESRD (Swaminathan et al. 2019)
Previous analysis of Oregon Health Insurance Experiment found small and not statistically significant effect of Medicaid on mortality (Finkelstein et al. 2012)

- Sample size was small (about 10k people gaining coverage)
- Sample was young (more than 70% under the age of 50)

The ACA expansions affected a much larger number of people (13.6 million); also, we focus on the near-elderly who have much higher rates of mortality (1.4% vs. 0.4%)
Data
Use 2008-2013 waves of the restricted version of the American Community Survey

- Restrictions: age 55-64 in 2014, citizens, not receiving SSI, and either (a) household income $\leq 138\%$ FPL or (b) less than HS degree

- Merge with death records from SSA via the Census Numident file; observe deaths 2008-2017, or 4 years after the expansion

We have about 566,000 individuals meeting this inclusion criteria, or about 4 million individual by year observations
Strengths of data:

- Connect information that determines eligibility to death records, identify high impact sample as well as “placebo” samples (elderly, high income, etc.)

- High quality administrative data on mortality (closely tracks NCHS death certificates)
Data

Weaknesses of data:

- **No information on cause of death**: we supplement our analysis with 2008 ACS which has been linked to death records for 2008-2015 (“MDAC”)

- Observe status at time of ACS, which could change over time: mismeasurement
Approach

For everyone alive at the beginning of the year, what is the probability they are dead by the end of the year?

\[ \text{Died}_{isjt} = \text{Expansion}_s \times \sum_{y=-6}^{3} \beta_y I(t - t^*_s = y) + \beta_t + \beta_s + \beta_j + \gamma I(j = t) + \epsilon_{isjt} \]

Individual \(i\) whose mortality status is observed in year \(t\) and responded to the \(j\) wave of the ACS, who lived in state \(s\) at the time of the ACS.

Note adding controls for race, gender, single year of age does not affect estimates.
Approach

For everyone alive at the beginning of the year, what is the probability they are dead by the end of the year?

\[ Died_{isjt} = Expansion_s \times Post_t + \beta_t + \beta_s + \beta_j + \gamma I(j = t) + \epsilon_{isjt} \]

Replace event time indicators with a single “post” indicator (“difference in differences” coefficient)
Key assumption: in the absence of the expansions, mortality would have evolved similarly in expansion and non-expansion states

Fundamentally not testable, but some analysis can bolster our case:

- Did mortality evolve similarly across expansion and non-expansion states prior to the ACA, and diverge only after the expansions were implemented?

- Do we observe effects on the elderly, who were already covered through the Medicare program, or on high income groups?

- If we conducted this analysis on a different set of years where there wasn’t a coverage expansion, do we find effects?
Results
First Stage

Estimate model but with repeated cross sections since no linked survey-administrative data on Medicaid enrollment is available

- Well known issues with undercount of Medicaid in surveys

- May be worse in ACS because no state-specific Medicaid names
  - Also estimate first stage using the National Health Interview Survey (NHIS) and find much larger effects

- Use linked NHIS-admin data to estimate underreporting; suggests about 31.4% of Medicaid enrollment not reported on survey (consistent with, e.g., Boudreaux et al. 2019)
We will use these estimates to scale our estimates for mortality to give implied treatment effect for new enrollees

- Measures only contemporaneous impact of Medicaid on mortality

- Eligibles may only sign up when an health event occurs – i.e. “conditional coverage” – made more likely by some policy changes in the ACA
Change in Medicaid Eligibility

Figure 1: Medicaid Eligibility

About 43% of sample gained Medicaid eligibility in expansion states relative to non-expansion states.
On average 10.1pp increase in enrollment, or
\[
\frac{10.1}{1-0.314} = 14.7\text{pp increase}
\]
taking into account likely undercount
Change in Uninsurance

Figure 3: Uninsured

On average, 4.4pp decrease in 
uninsurance, although this 
may be subject to 
measurement error as well
Analysis shows that a substantial fraction of this group gained Medicaid eligibility and that a large number enrolled as a result, with take-up on the order of 34%
Mortality Effects

**Figure 4:** Annual Mortality Rate

About a 0.089pp reduction in mortality in first year, effects growing over time.
## Mortality Effects (per 100K)

### Difference-in-Differences Model:
Expansion × Post

\[-132.0 (49.70)\]**

### Event Study Model:

<table>
<thead>
<tr>
<th>Year</th>
<th>Effect (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 0</td>
<td>-88.8 (36.00)**</td>
</tr>
<tr>
<td>Year 1</td>
<td>-119.0 (44.49)**</td>
</tr>
<tr>
<td>Year 2</td>
<td>-130.6 (56.06)**</td>
</tr>
<tr>
<td>Year 3</td>
<td>-208.2 (82.84)**</td>
</tr>
<tr>
<td>Year -1 (Omitted)</td>
<td>0</td>
</tr>
<tr>
<td>Year -2</td>
<td>15.02 (47.35)</td>
</tr>
<tr>
<td>Year -3</td>
<td>-28.85 (53.06)</td>
</tr>
<tr>
<td>Year -4</td>
<td>11.34 (69.15)</td>
</tr>
<tr>
<td>Year -5</td>
<td>91.19 (69.01)</td>
</tr>
<tr>
<td>Year -6</td>
<td>-21.32 (70.31)</td>
</tr>
</tbody>
</table>

Average effect of **-0.132** percentage points during the post period
This corresponds to a treatment effect of enrolling in Medicaid of about $\frac{0.132}{14.7} \approx 0.898$ pp reduction in the probability of mortality using the ACS first stage

- What is the baseline mean among those who enroll in expansion states but would not be able to in non-expansion states? (i.e. “compliers”)

- About 1.4 percent mortality rate overall, but Medicaid enrollees die at higher rate (about 2.3 percent for those enrolled in 2014 in this group)

- So about a 39% reduction compared to mean mortality of enrollees, but higher (64%) compared to overall mean
Oregon Health Insurance Experiment (OHIE) for 55-64 year olds:

**Table 1**: Results from the OHIE for participants age 55-64 in 2008

<table>
<thead>
<tr>
<th>Alive</th>
<th>Control Group Mean</th>
<th>Reduced Form</th>
<th>2SLS</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>6550 (C)</td>
<td>4240 (T)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alive</td>
<td>0.977</td>
<td>0.00422</td>
<td>0.0165</td>
<td>0.128</td>
</tr>
</tbody>
</table>

Mortality reduction of $\approx 71.7$ percent. This is a 16-month mortality rate; scaling down to a 12-month mortality rate, the treatment effect is 1.24pp. So our results are in line with (but smaller than) this point estimate.
# How Big of an Effect Should We Expect?

## Table 2: Implied Annual Mortality Effects on New Enrollees

<table>
<thead>
<tr>
<th>Study</th>
<th>Methodology</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-ACA Medicaid Expansions</td>
<td>Finkelstein et al. 2012</td>
<td>16.3% reduction for ages 20-64</td>
</tr>
<tr>
<td></td>
<td></td>
<td>71.7% reduction for ages 55-64</td>
</tr>
<tr>
<td></td>
<td>Sommers 2017*</td>
<td>21.4% for ages 20-64</td>
</tr>
<tr>
<td>MA Health Care Reform</td>
<td>Sommers, Sharon and Baicker 2014*</td>
<td>29.2% reduction for ages 20-64</td>
</tr>
<tr>
<td>ACA Medicaid Expansions</td>
<td>Our estimates</td>
<td>22.6% for ages 19-64, low-income</td>
</tr>
<tr>
<td></td>
<td></td>
<td>64.0% for ages 55-64, low-income</td>
</tr>
<tr>
<td></td>
<td>Black et al. 2019</td>
<td>6.8% reduction for ages 55-64</td>
</tr>
<tr>
<td></td>
<td>Borgschulte and Vogler 2019*</td>
<td>23.5% reduction for ages 20-64</td>
</tr>
<tr>
<td></td>
<td>Swaminathan et al. 2018</td>
<td>82.8% reduction among ESRD patients</td>
</tr>
</tbody>
</table>

*Applies adjustment suggested in Sommers (2017)
How Big of an Effect Should We Expect?

Goldin, Lurie, and McClubbin (2020): Randomized controlled trial with 3.9 million participants sending out letters to the uninsured 45-64 year olds

- Each MONTH of coverage resulted in 11.4% reduction in mortality
- Approximately 1pp reduction in mortality for 6 months of enrollment
Figure 5: Age 65+ in 2014

(a) Medicaid Coverage

(b) Annual Mortality
Figure 6: Pre-ACA Years

(a) Medicaid Coverage

(b) Annual Mortality
Placebo Tests: Higher Income (400 FPL+)

Figure 7: Higher Income (400 FPL+)

(a) Medicaid Coverage

(b) Annual Mortality
Also explore additional subsamples of ACS:

- Age 19-64: smaller effect sizes (close to OHIE); only statistically significant for 1 of the 4 post-ACA years

- Main sample but report being uninsured at time of survey: somewhat larger effects (15% of sample mean vs. 9% in main sample) but also a bit noisier (180,000 individuals vs 566,000)
Similar pattern among those age 19-64 as in older ages, but only one “post-ACA” coefficient is significant.
If we subset to just those who reported being uninsured at the time of the ACS (180k individuals), we see somewhat larger estimates (15% reduction vs. 9%) but they are also noisier.
Additional Results: Cause of Death

Main results do not contain cause of death information; we supplement this by conducting exploratory analysis using the MDAC data

- Smaller sample (one year of ACS)
- Shorter follow-up period

We hope these exploratory analysis can help inform future research if/when better data become available.
Reductions in mortality of about 0.2pp per year in deaths from internal causes, although only significant at the 10% level.
No negative effect on external mortality (perhaps slight upward trend)
Negative but not significant effect on deaths with underlying cause of death classified as “health care amenable”
## Results by Type of Death

<table>
<thead>
<tr>
<th></th>
<th>Deaths from Internal Causes</th>
<th>Deaths from Health Care Amenable Causes</th>
<th>Deaths from External Causes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Difference-in-Differences:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Expansion × Post</td>
<td>-235.1 (675.4)**</td>
<td>-99.07 (50.43)*</td>
<td>38.31 (19.98)*</td>
</tr>
<tr>
<td><strong>Event Study:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year 1</td>
<td>-220.7 (126.2)*</td>
<td>-41.0 (81.7)</td>
<td>9.54 (39.47)</td>
</tr>
<tr>
<td>Year 0</td>
<td>-209 (108.1)*</td>
<td>-102.9 (74.8)</td>
<td>25.01 (31.54)</td>
</tr>
<tr>
<td>Year -1 (Omitted)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Year -2</td>
<td>-53.4 (82.72)</td>
<td>65.3 (53.1)</td>
<td>-6.58 (33.8)</td>
</tr>
<tr>
<td>Year -3</td>
<td>87.72 (103.8)</td>
<td>13.87 (71.71)</td>
<td>-6.58 (44.0)</td>
</tr>
<tr>
<td>Year -4</td>
<td>-44.16 (111.8)</td>
<td>-7.97 (81.95)</td>
<td>-31.9 (38.44)</td>
</tr>
<tr>
<td>Year -5</td>
<td>74.9 (94.9)</td>
<td>47.41 (73.9)</td>
<td>-21.9 (36.96)</td>
</tr>
<tr>
<td>Year -6</td>
<td>70.98 (106.2)</td>
<td>23.33 (61.64)</td>
<td>-60.14 (34.89)</td>
</tr>
<tr>
<td>N (Individuals x Year)</td>
<td>683000</td>
<td>683000</td>
<td>683000</td>
</tr>
<tr>
<td>Number of individuals</td>
<td>88500</td>
<td>88500</td>
<td>88500</td>
</tr>
</tbody>
</table>

DRB Approval # CBDRB-FY19-310
Table 3: Impact of the ACA Expansions on Mortality: Impact by ICD Grouping

<table>
<thead>
<tr>
<th>Expansion × Post</th>
<th>Infectious Disease</th>
<th>Neoplasms</th>
<th>Diseases of the blood and blood-forming organs</th>
<th>Endocrine, nutritional and metabolic diseases</th>
<th>Mental/Behavioral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>-6.71 (1.273)</td>
<td>-5.512 (45.56)</td>
<td>3.37 (3.45)</td>
<td>-43.14 (22.77)*</td>
<td>-4.65 (11.00)</td>
</tr>
<tr>
<td>Mean</td>
<td>412.1</td>
<td>2718.0</td>
<td>26.75</td>
<td>527.9</td>
<td>167.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expansion × Post</th>
<th>Nervous System</th>
<th>Circulatory System</th>
<th>Respiratory</th>
<th>Digestive</th>
<th>Skin and Subcutaneous Tissue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>-1.31 (11.62)</td>
<td>-88.61 (48.04)*</td>
<td>-38.01 (27.58)</td>
<td>-0.46 (24.30)</td>
<td>-2.550 (1.19)**</td>
</tr>
<tr>
<td>Mean</td>
<td>239.2</td>
<td>2504.0</td>
<td>822.3</td>
<td>658.9</td>
<td>8.866</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expansion × Post</th>
<th>Musculoskeletal system</th>
<th>Genitourinary system</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>11.48 (7.06)</td>
<td>-12.97 (11.01)</td>
<td>31.75 (19.10)</td>
</tr>
<tr>
<td>Mean</td>
<td>44.95</td>
<td>209.4</td>
<td>700.60</td>
</tr>
</tbody>
</table>
Conclusion

We use linked survey and administrative mortality data to examine the impact of the Medicaid expansions on a sample likely to be affected

- We find mortality falls by 9.4% in this most affected group

- About 3.7 million individuals who meet our sample criteria live in expansion states, implies about 4,800 fewer deaths occurred per year among this population, or roughly 19,200 fewer deaths over the first four years alone

- About 3 million who meet our criteria in non-expansion states, indicating about 15,600 excessive deaths occurring over this 4 year period
Thank you!
How Much Are We Under-Estimating?

Using the same sample group in the 2008 to 2012 NHIS linked survey-admin data we see 15.7% report being on Medicaid in the survey, but 22.9% were enrolled in the admin data—about 31.4% undercount.

Table 4: Undercount Estimates from the NHIS-CMS Linked Feasibility Files

| % Reported Enrolled in Survey          | 0.157 (0.007) |
| % Reported Enrolled in Administrative Data | 0.229 (0.008) |

- Boudreaux et al. 2019 estimate a 40% undercount for effects of ACA on Medicaid coverage in ACS compared to administrative data.
## Table 5: Comparison of Medicaid Coverage Estimates: CMS vs. ACS

<table>
<thead>
<tr>
<th></th>
<th>All Ages and States, 2013-2017</th>
<th>Age 44-64, 17 States, 2012-2014</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Enrollment Based on CMS Reports</td>
<td>Enrollment Based on ACS Data</td>
</tr>
<tr>
<td>Expansion x Post</td>
<td>0.0382*** (0.0093)</td>
<td>0.0862*** (0.0248)</td>
</tr>
<tr>
<td></td>
<td>0.0309*** (0.0049)</td>
<td>0.0258*** (0.0065)</td>
</tr>
<tr>
<td>Baseline Mean in Expansion States</td>
<td>0.197</td>
<td>0.120</td>
</tr>
<tr>
<td></td>
<td>0.172</td>
<td>0.108</td>
</tr>
<tr>
<td>Number of Observations</td>
<td>2,103</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>14,323,891</td>
<td>2,423,253</td>
</tr>
</tbody>
</table>
First stage with NHIS

Using NHIS data, first stage is a 13.6pp, or $\frac{13.6}{1-0.35} = 21$pp increase in enrollment taking into account a likely undercount.
First stage with NHIS

Figure 14: Uninsurance

NHIS first stage; about 6pp average decrease in post-period