Did Medicare Decrease Diabetics’ Insulin Usage Until the Advent of Part D?

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Can moral hazard effects be averted with an appropriately targeted subsidy?
Motivation

Estimated 12-14% of US population has Type I or Type II diabetes (Menke et al., JAMA 2015)

Moreover, it is the fastest-growing non-communicable disease in low-to-middle-income countries

Source: International Diabetes Foundation (2009)
Motivation

- Health outcomes in this group are sensitive to their usage of preventive care
- Covering treatment and not prevention may decrease incentives to use prevention (moral hazard)
- In 2006 Part D began to subsidise insulin and diabetic medication
- Paying for prevention should offset moral hazard effects - but by how much?
Motivation

- Previous evidence that some diabetics forgo insulin to lose weight, for example (Rydall et al., NEJM 1997)

- Generally poor adherence to insulin - 59-77% (Weinger & Beverley 2010)

- Insulin complex to administer - most regimes require constant vigilance
Motivation

- Broader context: consensus that coverage generally improves health outcomes

“Insurance coverage increases access to care and improves a wide range of health outcomes. Arguing that health insurance coverage doesn’t improve health is simply inconsistent with the evidence”

- Sommers, Gawande & Baicker (JAMA, 2017)
What I Do

- Use a regression-discontinuity design with Medicare eligibility age (65) as the cutoff
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- Examine whether there are significant differences above and below the cutoff in
  - Insulin usage
  - Dieting
  - Exercise
  - Medication adherence

Follow up individuals who were <65 in 1998 to see if the effect persists in later years
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- This effect is reversed in 2006, the year when Medicare Part D is made available
Related Literature

- Card et al. (2008 AER, 2009 QJE) - Medicare as an RDD
- Cawley et al. (2017) - Impact of coverage on prevention
Data

- Health and Retirement Study - 3,043 individuals reporting diabetes in 1998

Key Result: Insulin Usage Decreases at Age 65 in 1998
Robustness Checks I

- Result remains even after
  - Excluding smokers and those who have had cancer (interacts with physiological response)
  - Excluding those on SSDI (only 10 individuals)

- No similar results found

- When using a placebo cutoff of 64 or 66
  - For other behaviours (diet, exercise, other medication use)
Robustness Checks II: Retirement

No similar discontinuity in proportion of individuals who are retired at 65, in line with Card et al. (2008 AER, 2009 QJE)
Following Up the Untreated Individuals

- Since I have panel data, I can see what happens to under-65s in 2000-2006

- In most years, the proportion who stop reporting insulin after turning 65 is larger than those who begin to report usage at that age:

<table>
<thead>
<tr>
<th>Year</th>
<th>% Ceased Using Insulin at 65</th>
<th>% Started Using Insulin at 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>12.50</td>
<td>4.31</td>
</tr>
<tr>
<td>2002</td>
<td>17.07</td>
<td>6.25</td>
</tr>
<tr>
<td>2004</td>
<td>11.90</td>
<td>9.00</td>
</tr>
<tr>
<td>2006</td>
<td>1.99</td>
<td>13.58</td>
</tr>
</tbody>
</table>
Following Up the Untreated Individuals

- Problem: any test of difference in means will lack power due to the small number of individuals either side of the cutoff

- Solution: pool years and estimate the equation:

\[ l_{it} = \alpha l_{it-1} + \beta [\text{age} \in [63, 67]] + \gamma [t = 2006] + \delta [\text{age} \in [63, 67]] \cdot [t = 2006] + \eta_i + \xi_{it} \]
Random-Effects Probit Specification

- $l_{it-1}$ is endogenous - contains $\eta_i$ - so estimator for $\alpha$ biased

- $\eta_i$ would be responsible for a statistically significant $\delta$ :: cohort effects (early childhood, Levemir)
Random-Effects Probit Specification

- If we condition on $l_{i0}$ and assume (Wooldridge, 2005)

\[ \eta_i = \phi_0 + \phi_1 l_{i0} + \epsilon_i \]
\[ \epsilon_i | l_{i0} \sim N(0, \sigma_\epsilon^2) \]

Can estimate $\alpha$ and $\sigma_\epsilon^2$ separately; restrict $\alpha$ to examine effect on $\delta$
### Random-Effects Probit Results

**Dep. Var.: Using Insulin**

<table>
<thead>
<tr>
<th>Coefficient</th>
<th>Constant</th>
<th>Insulin Used Two Years Prior</th>
<th>Insulin Used in 1998</th>
<th>Aged 63-67</th>
<th>2006</th>
<th>2006*Aged 63-67</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( \hat{\alpha}_u )</td>
<td>( \hat{\alpha} = 0 )</td>
<td>( \hat{\alpha} = 0.1 \hat{\alpha}_u )</td>
<td>( \alpha = 0.5 \hat{\alpha}_u )</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>(t-stat)</strong></td>
<td>(-21.52)</td>
<td>(-25.82)</td>
<td>(-24.88)</td>
<td>(-24.04)</td>
<td>(-2.28)</td>
<td>(-2.00)</td>
</tr>
<tr>
<td><strong>Constant</strong></td>
<td>-1.724***</td>
<td>-2.703***</td>
<td>-2.576***</td>
<td>-2.150***</td>
<td>1.939***</td>
<td>0</td>
</tr>
<tr>
<td><strong>(t-stat)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(17.08)</td>
<td>(.)</td>
</tr>
<tr>
<td><strong>Insulin Used Two Years Prior</strong></td>
<td>1.939***</td>
<td>0</td>
<td>0.194</td>
<td>0.970</td>
<td>1.497***</td>
<td>5.230***</td>
</tr>
<tr>
<td><strong>(t-stat)</strong></td>
<td>(17.08)</td>
<td>(.)</td>
<td>(.)</td>
<td>(.)</td>
<td>(6.45)</td>
<td>(26.56)</td>
</tr>
<tr>
<td><strong>Insulin Used in 1998</strong></td>
<td>-0.171*</td>
<td>-0.202*</td>
<td>-0.201*</td>
<td>-0.194*</td>
<td>-0.171*</td>
<td>-0.202*</td>
</tr>
<tr>
<td><strong>(t-stat)</strong></td>
<td>(-2.28)</td>
<td>(-2.00)</td>
<td>(-2.03)</td>
<td>(-2.17)</td>
<td>(-2.28)</td>
<td>(-2.00)</td>
</tr>
<tr>
<td><strong>2006</strong></td>
<td>0.318***</td>
<td>0.764***</td>
<td>0.713***</td>
<td>0.527***</td>
<td>0.318***</td>
<td>0.764***</td>
</tr>
<tr>
<td><strong>(t-stat)</strong></td>
<td>(4.27)</td>
<td>(9.06)</td>
<td>(8.55)</td>
<td>(6.68)</td>
<td>(4.27)</td>
<td>(9.06)</td>
</tr>
<tr>
<td><strong>2006*Aged 63-67</strong></td>
<td>0.362*</td>
<td>0.375</td>
<td>0.378*</td>
<td>0.384*</td>
<td>0.362*</td>
<td>0.375</td>
</tr>
<tr>
<td><strong>(t-stat)</strong></td>
<td>(2.36)</td>
<td>(1.95)</td>
<td>(2.00)</td>
<td>(2.18)</td>
<td>(2.36)</td>
<td>(1.95)</td>
</tr>
</tbody>
</table>
Why Shouldn’t $\alpha = 0$?

- A priori: should be *some* state dependence in insulin usage

- Otherwise need to attribute lots of explanatory power to unobserved heterogeneity ($\delta = \alpha = 0$!)

- Statistical: OLS is biased upwards for $\alpha$, FE biased downwards (Nickell, 1981)

- The interval for consistent estimators produced by these estimates does not contain 0
Summary

- In 1998, Medicare eligibility decreases the proportion of diabetics using insulin

- In 2006, this effect is offset by the availability of subsidies for insulin and diabetic medication

- These effects are difficult to explain via changes in retirement status, availability of long-acting insulin, or cohort effects
What Should Universal Health Care Pay For?

- If individuals don’t bear the costs of treatment, but do bear the costs of prevention, less reason for them to pay for the latter:

- Double moral hazard effect where penalised for actions that avoid costly outcomes

- Preventive care is currently under-utilised by the less educated, poorer, and more vulnerable

- Future work: optimal mix of subsidies for prevention (self-insurance) and coverage to minimise financial risk and/or adverse health outcomes