Does Insurance for Treatment Crowd Out Prevention?
Evidence from Diabetics’ Insulin Usage

Daniel Kaliski\textsuperscript{1}

\textsuperscript{1}Birkbeck, University of London

Allied Social Science Association Meetings, 4\textsuperscript{th} Jan. 2020
Motivation: Prevention

- *Ex ante* moral hazard: decrease efforts to avoid bad state if insured

- *Question:* how much does investment in health decrease if only treatment is covered?

- This paper: Evidence that insurance for treatment alone has large negative effects on prevention
Motivation: Setting

- Pre-2006:
  - U. S. over-65s covered for physicians and hospitals, but not medications

- Post-2006:
  - Medications covered for over-65s (“Medicare Part D”)

- Diabetics: 12-15% of the U.S. population & fastest growing chronic illness globally

- High costs of care - $850 billion, ~1% of global GDP (Bommer et al., 2017, Lancet)
This Paper

1. Regression discontinuity design: insurance for treatment alone

2. Difference-in-discontinuities design: allow effect to differ post-2006 - coverage for prevention added

3. Use life-cycle model to

   Reconcile results with literature and

   Derive results’ relationship to compensated elasticity

   Key simplification: no cumulative effects of human capital investment
Preview of Findings

1. Pre-2006: Insulin usage falls by -8 pp from 26% to 18% at age 65

2. Post-2006: subsidies for insulin offset this more than one-for-one

   Post-2006 effect is a net increase of +7 pp

3. Model shows that compensated elasticity $\geq$ measured elasticity
Contribution

1. First evidence of large moral hazard effects in health behaviors due to provision of health insurance (cf. Card et al. 2008, AER; Finkelstein et al., 2012, QJE)
   - Consonant with literature on provision of treatment for AIDS & opioid overdoses (Goldman, Lakdawalla & Sood, 2006, QJE; Doleac & Mukherjee, 2019)
   Policy implication: underestimating extent of measures necessary to encourage prevention

2. First use of different life-cycle elasticities to analyse differences across studies of prevention (cf. Keane 2010, JEL, Ried 1998 JHE)
Structure of this Talk

▶ Background & Data
▶ Empirical Strategy
▶ Results
▶ Theoretical Framework
▶ Conclusion
Background: Diabetes (I)

- 10% of diabetics are Type I - will not survive long without insulin
Background: Diabetes (I)

- 10% of diabetics are Type I - will not survive long without insulin
- Majority are Type II - developed in older adulthood
Background: Diabetes (I)

- 10% of diabetics are Type I - will not survive long without insulin
- Majority are Type II - developed in older adulthood
- Early on, can use diet and oral medication (Metformin)
Background: Diabetes (I)

- 10% of diabetics are Type I - will not survive long without insulin
- Majority are Type II - developed in older adulthood
- Early on, can use diet and oral medication (Metformin)
- Insulin is typically used once disease worsens
Background: Diabetes (I)

- 10% of diabetics are Type I - will not survive long without insulin
- Majority are Type II - developed in older adulthood
- Early on, can use diet and oral medication (Metformin)
- Insulin is typically used once disease worsens
  - Usage can decline by 20% over a two-year period from initiation (Brown et al., 1999)
Costs of Insulin in the United States Pre-2006

- Non-monetary: Insulin complicated to use
Costs of Insulin in the United States Pre-2006

- Non-monetary: Insulin complicated to use
- Expensive:

  - No generic version
  - Coinsurance rates high (~50%)
  - $60 per vial in 2018 dollars in 1998 × 54 vials a year = $3240 a year
  - 200% of the federal poverty line in 1998 in 2018 dollars is $33500
  - Nearly 10% of household income without insurance
Costs of Insulin in the United States Pre-2006

- Non-monetary: Insulin complicated to use
- Expensive:
  - No generic version

- Coinsurance rates high (∼50%)
- $60 per vial in 2018 dollars in 1998 × 54 vials a year = $3,240 p. a.
- 200% of the federal poverty line in 1998 in 2018 dollars is $33,500:
  - Nearly 10% of household income without insurance
Costs of Insulin in the United States Pre-2006

- Non-monetary: Insulin complicated to use

- Expensive:
  - No generic version
  - Coinsurance rates high (∼50%)
Costs of Insulin in the United States Pre-2006

- Non-monetary: Insulin complicated to use

- Expensive:
  - No generic version
  - Coinsurance rates high (~50%)
Costs of Insulin in the United States Pre-2006

- Non-monetary: Insulin complicated to use

- Expensive:
  - No generic version
  - Coinsurance rates high (∼50%)
  - $60 per vial in 2018 dollars in 1998 × 54 vials p.a. = $3 240 p. a.

- 200% of the federal poverty line in 1998 in 2018 dollars is $33 500:
Costs of Insulin in the United States Pre-2006

- Non-monetary: Insulin complicated to use

- Expensive:
  - No generic version
  - Coinsurance rates high (≈50%)

- 200% of the federal poverty line in 1998 in 2018 dollars is $33,500:
  - Nearly 10% of household income without insurance
Regression Discontinuity Design

- RDD, if individual $i$’s age in months $R_{it}$ exceeds eligibility threshold $\bar{R}$, $D_{it} = 1$ if person $i$ is covered in period $t$, instrument for $D_{it}$ with eligibility rule $1[R_{it} \geq \bar{R}]$,

$$Y_{it} = \beta_0 + \beta_1 D_{it} + \gamma_0 R_{it} + \gamma_1 1[R_{it} \geq \bar{R}] \times R_{it} + \delta X_{it} + \zeta t + \eta_i + \nu_{it} \text{ for } |R_{it} - \bar{R}| < h;$$

- Identifying assumption: no other discontinuities at cutoff
“Crowding Out” Pre-2006 & “Crowding In” Post-2006

▶ Intuition: behavior at the cutoff in 2006 different $\implies$ policy changes net effect on behavior

$$Y_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 1[t \geq 2006] + \beta_3 D_{it} \times 1[t \geq 2006] + \gamma_0 R_{it} + \gamma_1 1[R_{it} \geq \bar{R}] \times R_{it} + \delta X_{it} + \zeta t + \eta_i + \nu_{it}$$

▶ Assumption to id $\beta_3$: no other important differences at 65 between 2006 and previous years (i.e. cohort effects, simultaneous policy changes):
<table>
<thead>
<tr>
<th></th>
<th>(1) Employed</th>
<th>(2) Retired</th>
<th>(3) Partly Retired</th>
<th>(4) Hours</th>
<th>(5) Earnings</th>
<th>(6) Social Security</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.03</td>
<td>-0.03</td>
<td>0.09</td>
<td>-0.31</td>
<td>731.71</td>
<td>-0.00</td>
</tr>
<tr>
<td></td>
<td>(0.76)</td>
<td>(-0.72)</td>
<td>(1.01)</td>
<td>(-0.13)</td>
<td>(0.87)</td>
<td>(-0.11)</td>
</tr>
</tbody>
</table>

*t* statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
### Other Health Outcomes, Diabetic Women, 1998-2004

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Hospital Stay Nights in Hospital</td>
<td>-0.04</td>
<td>3.09</td>
<td>0.14*</td>
<td>2.34</td>
</tr>
<tr>
<td>Any Doctor Visit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. Doctor Visits</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kidney Problems</td>
<td>0.25</td>
<td>-0.09</td>
<td>-0.02</td>
<td>3.80</td>
</tr>
<tr>
<td>Poor Health</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $t$ statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
## Difference-in-Discontinuities 1998-2008: Other Outcomes

<table>
<thead>
<tr>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.08</td>
<td>-0.03</td>
<td>-0.00</td>
<td>-0.04</td>
</tr>
<tr>
<td>(1.37)</td>
<td>(-1.27)</td>
<td>(-0.00)</td>
<td>(-1.16)</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.10</td>
<td>-0.03</td>
<td>0.06*</td>
<td>-0.06</td>
</tr>
<tr>
<td>(1.56)</td>
<td>(-1.12)</td>
<td>(2.24)</td>
<td>(-1.79)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hours</th>
<th>Earnings</th>
<th>Soc. Sec.</th>
<th>Diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.11</td>
<td>-574.21</td>
<td>0.05***</td>
<td>0.05**</td>
</tr>
<tr>
<td>(-0.11)</td>
<td>(-0.63)</td>
<td>(4.54)</td>
<td>(2.69)</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-0.31</td>
<td>-2252.86</td>
<td>0.05***</td>
<td>0.05**</td>
</tr>
<tr>
<td>(-0.27)</td>
<td>(-1.24)</td>
<td>(4.60)</td>
<td>(2.69)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Absence of Credit Constraints</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\hat{D}_{it}$</td>
<td>-0.08*</td>
<td>-0.08**</td>
<td>-0.08**</td>
</tr>
<tr>
<td></td>
<td>(-2.50)</td>
<td>(-2.62)</td>
<td>(-2.62)</td>
</tr>
<tr>
<td>$1[t \geq 2006]$</td>
<td>-0.14*</td>
<td>-0.14*</td>
<td>-0.12*</td>
</tr>
<tr>
<td></td>
<td>(-2.53)</td>
<td>(-2.53)</td>
<td>(-2.38)</td>
</tr>
<tr>
<td>$D_{it} \times 1[t \geq 2006]$</td>
<td>0.15*</td>
<td>0.15*</td>
<td>0.13*</td>
</tr>
<tr>
<td></td>
<td>(2.41)</td>
<td>(2.42)</td>
<td>(2.28)</td>
</tr>
</tbody>
</table>

- By contrast, no effects on: oral medication use, exercise, or diet
Which Elasticity is Being Measured?

I estimate the intertemporal substitution (Frisch) effect of a lower price for treatment, since the price change is anticipated:

\[ \varepsilon_{F}^{\phi_2, P^M} \equiv \left( \frac{P^M}{\phi_2} \right) \left( \frac{\partial \phi_2}{\partial P^M} \right) \left| \frac{\partial \mu}{\partial P^M} = 0 \right. \]

\[ = - \left( \frac{P^M}{\phi_2} \right) \left( \frac{V_{\phi M} \left( \frac{\partial M_2}{\partial P^M} \right)}{V_{\phi \phi}} \right) > 0, \]

Compensated elasticity at least as large

Motivation: disparity between literatures on (i) specific interventions and (ii) health insurance expansions

- Latter often include income effects that can offset \textit{ex ante} moral hazard

Abstracts from cumulative effects & dynamic effects of lifespan extension
Conclusion

- In 1998-2004, Medicare coverage decreased the proportion of female diabetics who use insulin by 8 pp

- Post-2006, this is cancelled out by coverage for insulin

- Theoretical model reconciles with the literature:
  - Income effects likely larger than believed
  - Estimates here are lower bounds for the compensated effects