Family Health Behaviors

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Motivation

- Health behaviors, broadly defined as any action or consumption choice that can affect health and mortality risk, are a key input in the production of individuals' health
  - Including habits such as smoking and drinking, take up of preventive care, and drug abuse

- Long tradition of economic research has theoretically and empirically identified the importance of family interactions in determining individual behavior
  - Particularly, in the context of the sharing of financial resources for the consumption of goods and of labor supply choices

- Similarly, there is a potentially significant role for the family in forming health behaviors over the life-cycle
  - Through a variety of channels such as information, beliefs, awareness, and norms

Motivation

- Yet, while strong correlations in health and health-related behaviors have been documented across family members, identifying causal relationships of family spillovers that can affect health behaviors has been proven difficult
  - Estimation impeded by the likelihood of correlated unobservables across and within generations of the family
  - Requires large data sets on health and health-care use that link across family members

Overview

- In this paper, we study how health behaviors are shaped through family spillovers both within and across generations
- Estimate the causal effects of health shocks to individuals on their family members' consumption of preventive-care and utilization indicative of health-related behaviors
- Identification strategy relies on the timing of shocks
  - By constructing counterfactuals to affected households using households that experience the same shock but a few years in the future
  - Leveraging administrative health-care data
- Detailed data allow us to investigate potential mechanisms that may underlie the estimated effects
  - Information (biological/environmental risk); Salience

Main Findings

- We identify intra- and inter-generational family spillovers as a prevalent causal channel through which health behaviors evolve
  - Spouses and adult children immediately increase their health investments and improve their health behaviors in response to shocks
  - Effects are both significant and persistent for at least several years

- While a variety of mechanisms seem to be at play, the evidence points to salience as a major operative explanation
  - Mainly with respect to the specific nature of the shock, but also with respect to overall increased awareness of health

- Implications for models of health behaviors (effect/mechanisms)
  - Potentially informative for policies that aim to improve health and reduce disparities

Related Literature

- **Correlations in family health behaviors:**
  Christakis and Fowler (2007); Cohen-Cole and Fletcher (2008a,b); Rosenquist et al. (2010)
- **Work on health behaviors associated with bereavement:**
  Jin and Christakis (2009); Shah et al. (2013); Simeonova (2013); Stahl and Schulz (2014)
- **Peer effects in health behaviors:** Lundborg (2006); Clark and Loheac (2007); Argys and Rees (2008); Trogdon et al. (2008); Carrell et al. (2011)
- **More general work on factors that shape health behaviors** (Cawley and Ruhm 2011)
  - **Financial incentives and commitment mechanisms:**
    Finkelstein et al. (2007) Volpp et al. (2008); Vlopp et al. (2009); Charness and Gneezy (2009); Gine et al. (2010); John et al. (2011); Just and Price (2013); Acland and Levy (2015); Royer et al. (2015); Choudhry et al. (2011); Cabral and Cullen (2016)
  - **Advertisements and the media:**
    Cram et al. (2003); Avery et al. (2007); Desai and Jena (2016)
  - **Medical information, diseases outbreaks, doctors:**
    Oster et al. (2013a,b); Oster (2015, 2016); Koulayev et al. (2016)

Outline

- Institutional background and data
- Part I: Effects of heart attacks and strokes on family members' consumption of preventive medication that reduces cardiovascular risk
  - Spouses and children
- Part II: Effects of general fatal shocks on family members
  - Overall changes in health-care indicative of behaviors and awareness
  - Cause-specific preventive-care by variation in cause of death
- Implications and conclusion

Setting

- The Danish setting provides us with a particularly well-suited environment for identifying family spillovers in health behaviors in the context of developed economies

- Data: Long panel of detailed administrative health-care records for linked family members
  - Exact codes allow identifying health investments and behavior proxies
  - Large scale provides statistical power for studying different utilization outcomes

- Institutions: near-complete universal health-care coverage
  - Allows identifying effects that are not confounded by availability of health insurance (similar to the Medicare population)

Data

- Combine several administrative Danish registers (on health and demographics) with family linkages from 1980-2012
- All families of married and cohabiting couples and their children's households
- Datasets include:
  - Death records with specific cause of death
  - Hospital discharge records (outpatient and detailed codes from 1994)
  - Purchases of prescription drugs (1995-2012)
  - Non-hospital visits to primary-care physicians and medical specialists (1985-2012)

Institutional Background: Health Insurance

- Near-complete universal health-care coverage
- Visits to General Practitioners (GPs) and public hospitals are fully covered
- GPs act as gatekeepers with respect to referring patients to hospitals and specialists; reimbursement according to a fee-for-service schedule
- Public hospitals reimbursed by fee-for-service or Diagnosis-Related Groups (DRG) (based on average resources used to treat patients in each DRG)
- Private hospitals account for only 2.5%; covered if public hospitals have no availability; out-of-pocket on a fee-for-service basis otherwise, but mostly covered by supplementary employer-based private insurance
- Patients pay out-of-pocket for part of the cost of services provided by dentists, physiotherapists, psychologists, and chiropractors, as well as prescription drug co-insurance payments

Institutional Background: Health Insurance

- Prescription drugs co-insurance:

- Before March 2000 –
  - Patients pay 50%
  - Pay 25% for drugs treating life-threatening/chronic conditions

- After March 2000 (2012 cutoffs) –
  - For annual expenses up to DKK 865 pay full amount
  - Decreasing marginal co-insurance rates for additional expenses: 50% in the range of DKK 865-1,410; 25% in the range of DKK 1,410-3,045; and 15% for expenses over DKK 3,045

- Annual caps for chronically ill (e.g., in 2012 full reimbursement for expenses above DKK 3,555); retirees can apply for means-tested reimbursements from the municipality

Primary Research Design

- Main target of empirical analysis:
  - The dynamic causal effect of health shocks on family members' consumption of preventive care and health-related behavioral changes

- Ideal experiment: randomly assign shocks to families and track responses in health behaviors over time
  - Need to compare affected households to ex-ante similar unaffected households
  - Comparable expectations over future paths, but different realizations

- Quasi-experiment: use long panel of administrative data to mimic the ideal experiment
  - Within a short period the timing of shocks may be as good as random
  - Identify treatment effects from timing

Primary Research Design

- Look only at affected households and combine event studies of two experimental groups:
  - Treatment group: family members in households that experience a shock in year t
  - Control group: matched family members from the same cohorts in households that experience the same shock but in year $t + \Delta$
- Trade-off in the choice of Δ: comparability versus horizon (Δ=5)
- Estimator: dynamic differences-in-differences
  - Identifying assumption: **Parallel Trends**
  - Track the two groups back to four years before the shock to validate the design

Primary Research Design

- Estimating dynamic differences-in-differences equation:

$$y_{i,t} = \alpha + \beta treat_i + \sum_{r \neq -1; r=-4}^{4} \gamma_r \times I_r + \sum_{r \neq -1; r=-4}^{4} \delta_r \times I_r \times treat_i + \lambda X_{i,t} + \varepsilon_{i,t}$$

where $I_r = 1(t = r)$

  - Parameter vector of interest: δ_r

- For mean effects estimate basic DD:

$$y_{i,t} = \alpha + \beta treat_i + \gamma post_{i,t} + \delta treat_i \times post_{i,t} + \lambda X_{i,t} + \varepsilon_{i,t}$$

Heterogeneity

- For heterogeneity in treatment effects we estimate an augmented differences-in-differences equation of the form:

$$y_{i,t} = \alpha + \beta treat_i + \gamma post_{i,t} + \delta_i treat_i \times post_{i,t} + \lambda X_{i,t} + \varepsilon_{i,t}$$

where:

$$\delta_i = \delta_0 + \delta_1 z_i$$

  - z_i is the household characteristic of interest

Heterogeneity

- For parts of the analysis we exploit variation within the treatment group
  - Dynamic:

$$y_{i,t} = \alpha + \beta z_i + \sum_{r \neq -1; r=-4}^{4} \gamma_r \times I_r + \sum_{r \neq -1; r=-4}^{4} \delta_r \times I_r \times z_i + \lambda X_{i,t} + \varepsilon_{i,t}$$

  - Mean:

$$y_{i,t} = \alpha + \beta z_i + \gamma post_{i,t} + \delta \times z_i \times post_{i,t} + \lambda X_{i,t} + \varepsilon_{i,t}$$

Part 1: Heart Attacks and Strokes

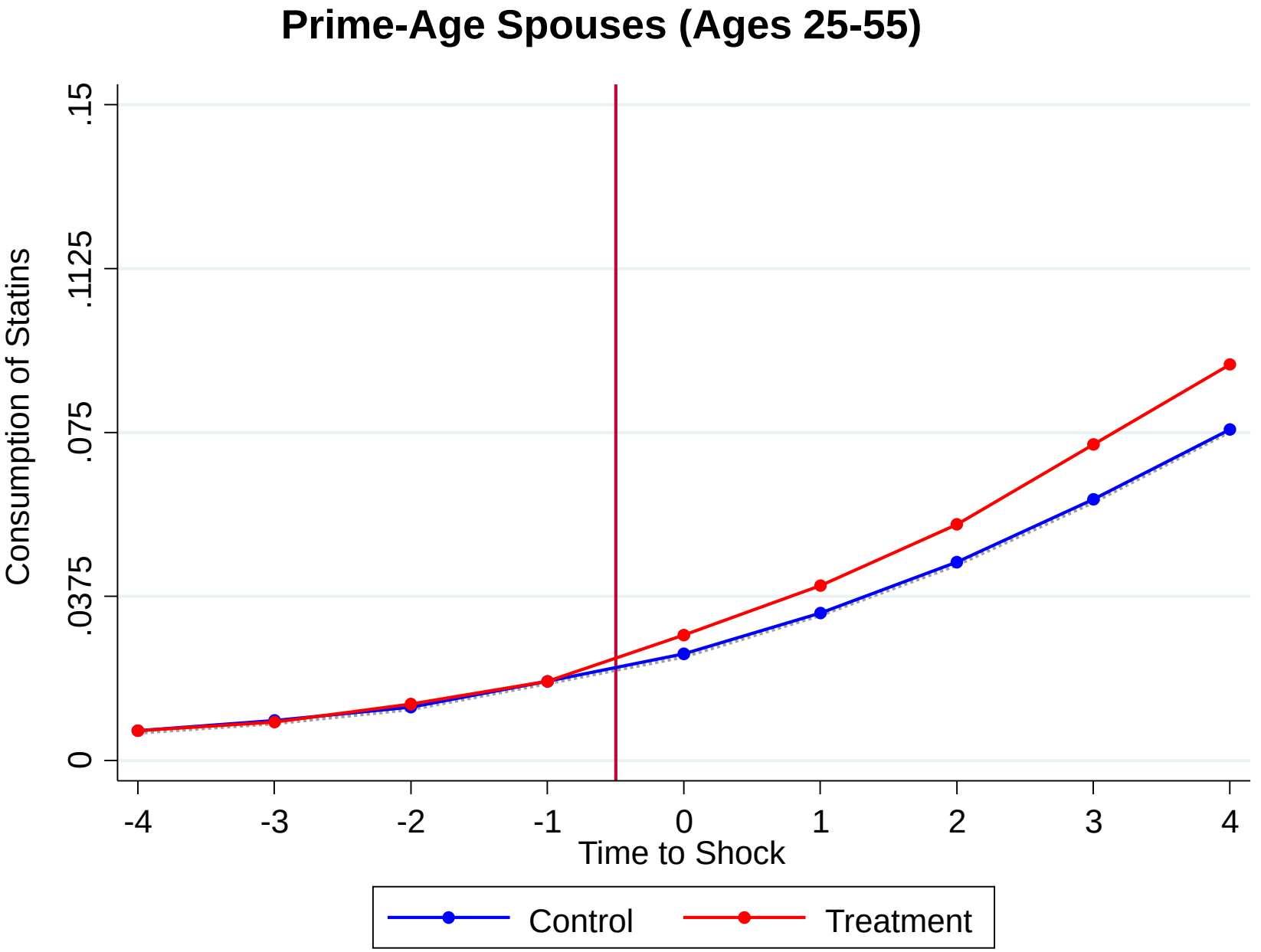
Family Effects of Health Shocks

- Study how health shocks spillover to family members' health behaviors by focusing on heart attacks and strokes for several reasons
  - **Scope:** Among leading causes of morbidity and mortality in the developed world (WHO 2014); account for 1 in every 3 deaths among adults in U.S. (800,000 annually); estimated costs $316 billion
  - **Identification:** Sudden and severe shocks (Chandra and Staiger 2007; Doyle 2011)
  - **Suitability:** Directly tied to a disease-specific risk-reducing medication
    - Statins: prescription medications taken to lower cholesterol that are widely used to prevent cardiovascular disease
  - **Outcome relevance:** Major class of preventive-care and among the best-selling drugs in the U.S. (Lipitor $7 billion in 2010)
    - CDC (2015) estimates that 37% of U.S. adults above 20 (78 million) are on or eligible for cholesterol treatment

Family Effects of Cardiovascular Shocks

- Analyze how individuals' cardiovascular shocks affect their family members' consumption of statins
- We begin with an intra-generational analysis of spouses
  - Identify family spillovers that are not attributed to biological channels

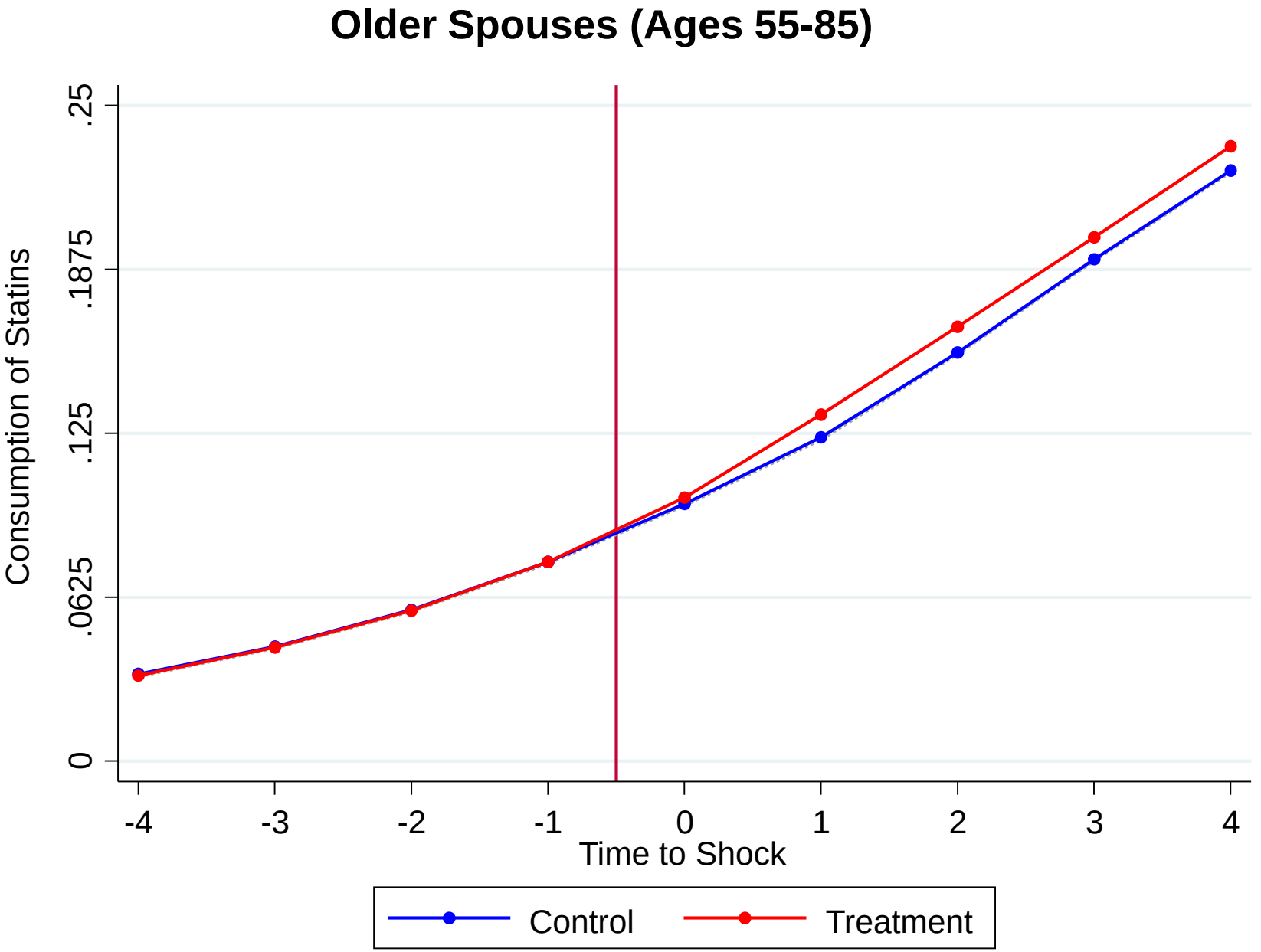
Spousal Statin Effect of Cardiovascular Shock



Spousal Statin Effect of Cardiovascular Shock

	Ages 25-55
	(1)
-4	.0005
	(.0010)
-3	.0003
	(.0010)
-2	.0010
	(.0008)
-1	0
	0
0	.0039***
	(.0010)
1	.0051***
	(.0013)
2	.0070***
	(.0017)
3	.0101***
	(.0020)
4	.0117***
	(.0023)
Baseline	.0786
% change	14.9%
Obs.	441,720
Number of clusters	49,080

Spousal Statin Effect of Cardiovascular Shock



Spousal Statin Effect of Cardiovascular Shock

	Ages 25-55	Ages 55-85
	(1)	(2)
-4	.0005	-.0007
	(.0010)	(.0016)
-3	.0003	-.0006
	(.0010)	(.0014)
-2	.0010	-.0007
	(.0008)	(.0011)
-1	0	0
	0	0
0	.0039***	.0023*
	(.0010)	(.0012)
1	.0051***	.0093***
	(.0013)	(.0018)
2	.0070***	.0109***
	(.0017)	(.0022)
3	.0101***	.0104***
	(.0020)	(.0025)
4	.0117***	.0123***
	(.0023)	(.0028)
Baseline	.0786	.2284
% change	14.9%	5.4%
Obs.	441,720	667,980
Number of clusters	49,080	74,220

Spousal Statin Effect of Cardiovascular Shock

	Ages 25-55	Ages 55-85	Different Family Physicians
	(1)	(2)	(3)
-4	.0005	-.0007	-.0019
	(.0010)	(.0016)	(.0019)
-3	.0003	-.0006	-.0016
	(.0010)	(.0014)	(.0018)
-2	.0010	-.0007	-.0017
	(.0008)	(.0011)	(.0015)
-1	0	0	0
	0	0	0
0	.0039***	.0023*	.0039**
	(.0010)	(.0012)	(.0017)
1	.0051***	.0093***	.0068***
	(.0013)	(.0018)	(.0024)
2	.0070***	.0109***	.0104***
	(.0017)	(.0022)	(.0029)
3	.0101***	.0104***	.0140***
	(.0020)	(.0025)	(.0034)
4	.0117***	.0123***	.0107***
	(.0023)	(.0028)	(.0038)
Baseline	.0786	.2284	.1333
% change	14.9%	5.4%	8.03%
Obs.	441,720	667,980	238,779
Number of clusters	49,080	74,220	26,531

Spousal Statin Effect of Cardiovascular Shock

- Does the event-driven consumption response interact with underlying risk?
  - All faced with shock, but does it trigger more action among higher risk

- Calculate an annual measure of cardiovascular risk using population data
  - Prediction relies on known risk factors (age, gender, diabetes, hypertension) and education (correlated with behaviors)
  - Match to each spouse a measure of underlying risk based on predicted probability in t=-1
  - Divide sample to high/low risk by median

- Estimate an augmented differences-in-differences equation of the form

$$y_{i,t} = \alpha + \beta treat_i + \gamma post_{i,t} + \delta_i treat_i \times post_{i,t} + \lambda X_{i,t} + \varepsilon_{i,t}$$

where: $\delta_i = \delta_0 + \delta_1 High\ Risk_i$

  - Post-shock periods t=3,4 (when response levels out)

Spousal Statin Effect of Cardiovascular Shock

	Spouse's Statin Consumption
	(1)
Treat x Post	.0043**
	(.0020)
Treat x Post x High Risk	.0108***
	(.0030)
Obs.	715,692
Number of clusters	119,282

Spousal Statin Effect of Cardiovascular Shock

- Reponses may be stronger when spouses are more exposed
  - To disease, morbidity effects, treatment
- Exploit variation in timing of death following the shock
  - Logic: all spouses in affected households might share common risk factors with sick individual so that now may realize being at higher risk, but their experience of the shock may differ by length of exposure to disease
- We ask: are spouses more likely to adhere to statins by the end of our analysis window (period 4) when experience more exposure?

Spousal Statins Effect of Cardiovascular Shock

- Focus on variation within treatment group, comparing only households in which the sick spouse died within the data horizon
  - Assumption: timing of death as good as random conditional on experiencing the health shock at the same period

- Estimate variation in statin take-up using:

$$y_{i,t} = \alpha + \beta z_i + \gamma post_{i,t} + \delta \times z_i \times post_{i,t} + \lambda X_{i,t} + \varepsilon_{i,t}$$

  - Post-shock period is t=4
  - z_i is an indicator for whether the sick survived longer:

    (1) whether sick spouse died in the 4-year period before of after t=4

    (2) For households in which sick spouse died by t=4, indicator for whether died before/after the middle of this period (t=2)

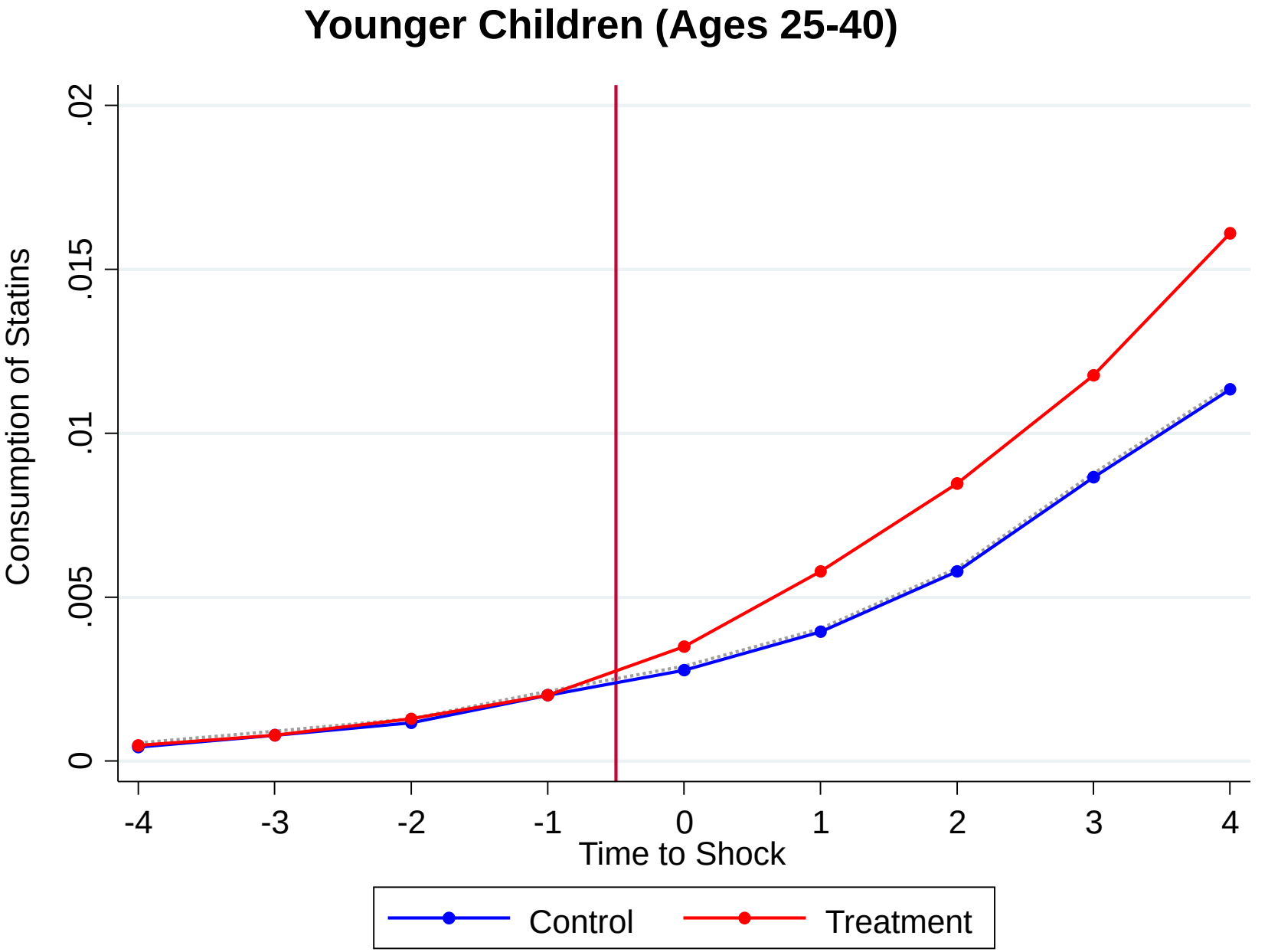
Spousal Statins Effect of Cardiovascular Shock

	Spouse's Statin Consumption – Treatment Group	
	Death around t=4	Death before t=4
	(1)	(2)
Period 4 x	.0108**	.0094**
Sick survived longer	(.0049)	(.0047)
Obs.	161,780	134,380
Number of clusters	32,356	26,876

Intergenerational Effects of Cardiovascular Shock

- Next, analyze households with adult children at the time of the shock
- Study the statin responses of biological children
  - At different stages of their life-cycle

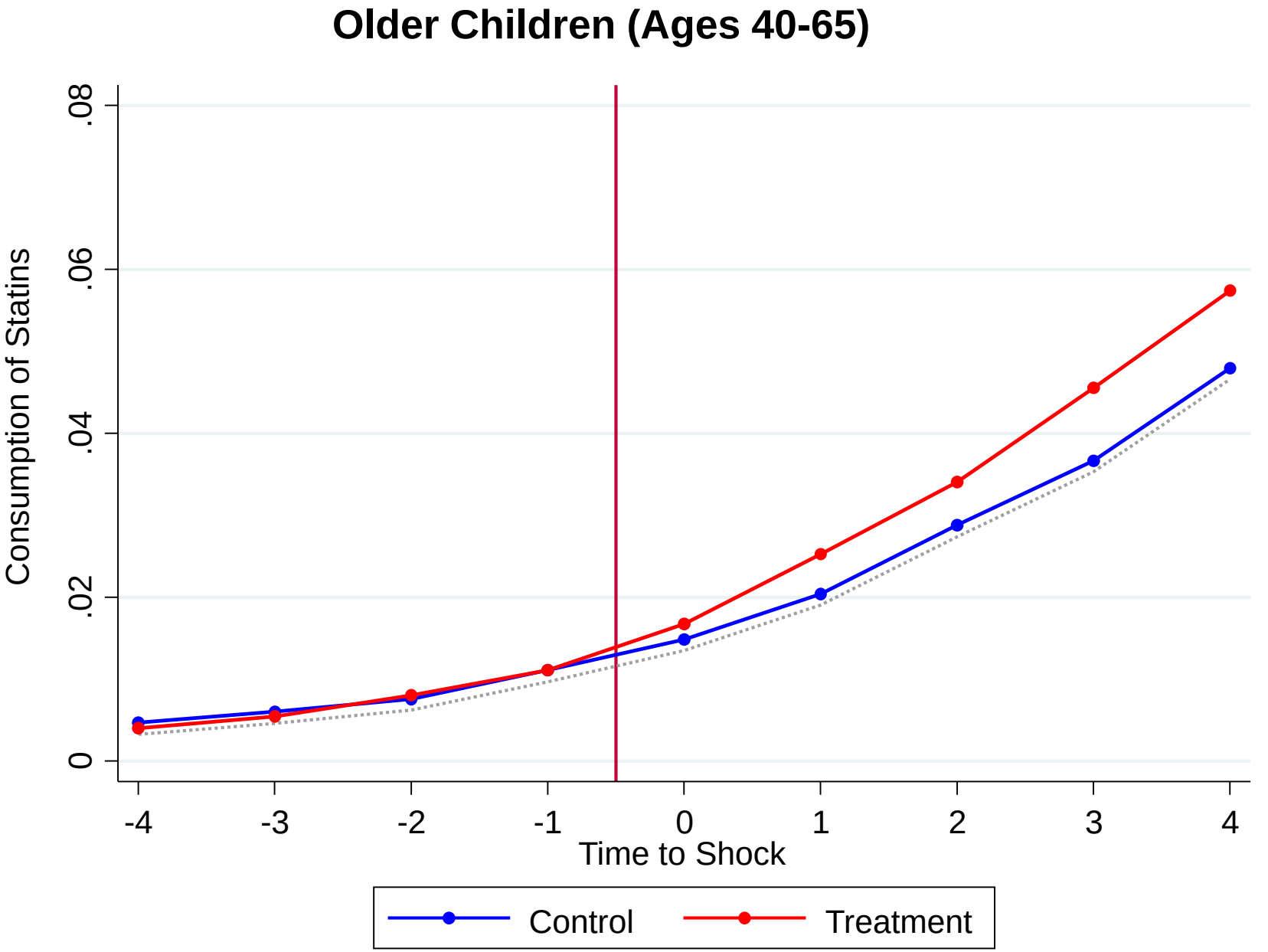
Children's Consumption of Preventive Care



Children's Consumption of Preventive Care

	Ages 25-40
	(1)
-4	.0001
	(.0002)
-3	.0001
	(.0002)
-2	.0002
	(.0002)
-1	0
	0
0	.0007***
	(.0002)
1	.0017***
	(.0003)
2	.0024***
	(.0004)
3	.0028***
	(.0005)
4	.0043***
	(.0006)
Baseline	.0118
% change	36.44%
Obs.	1,179,387
Number of hh clusters	67,460

Children's Consumption of Preventive Care



Children's Consumption of Preventive Care

	Ages 25-40	Ages 40-65
	(1)	(2)
-4	.0001	-.0000
	(.0002)	(.0007)
-3	.0001	-.0001
	(.0002)	(.0006)
-2	.0002	.0007
	(.0002)	(.0005)
-1	0	0
	0	0
0	.0007***	.0015**
	(.0002)	(.0006)
1	.0017***	.0043***
	(.0003)	(.0009)
2	.0024***	.0043***
	(.0004)	(.0011)
3	.0028***	.0077***
	(.0005)	(.0014)
4	.0043***	.0080***
	(.0006)	(.0016)
Baseline	.0118	.0493
% change	36.44%	16.23%
Obs.	1,179,387	647,667
Number of hh clusters	67,460	40,690

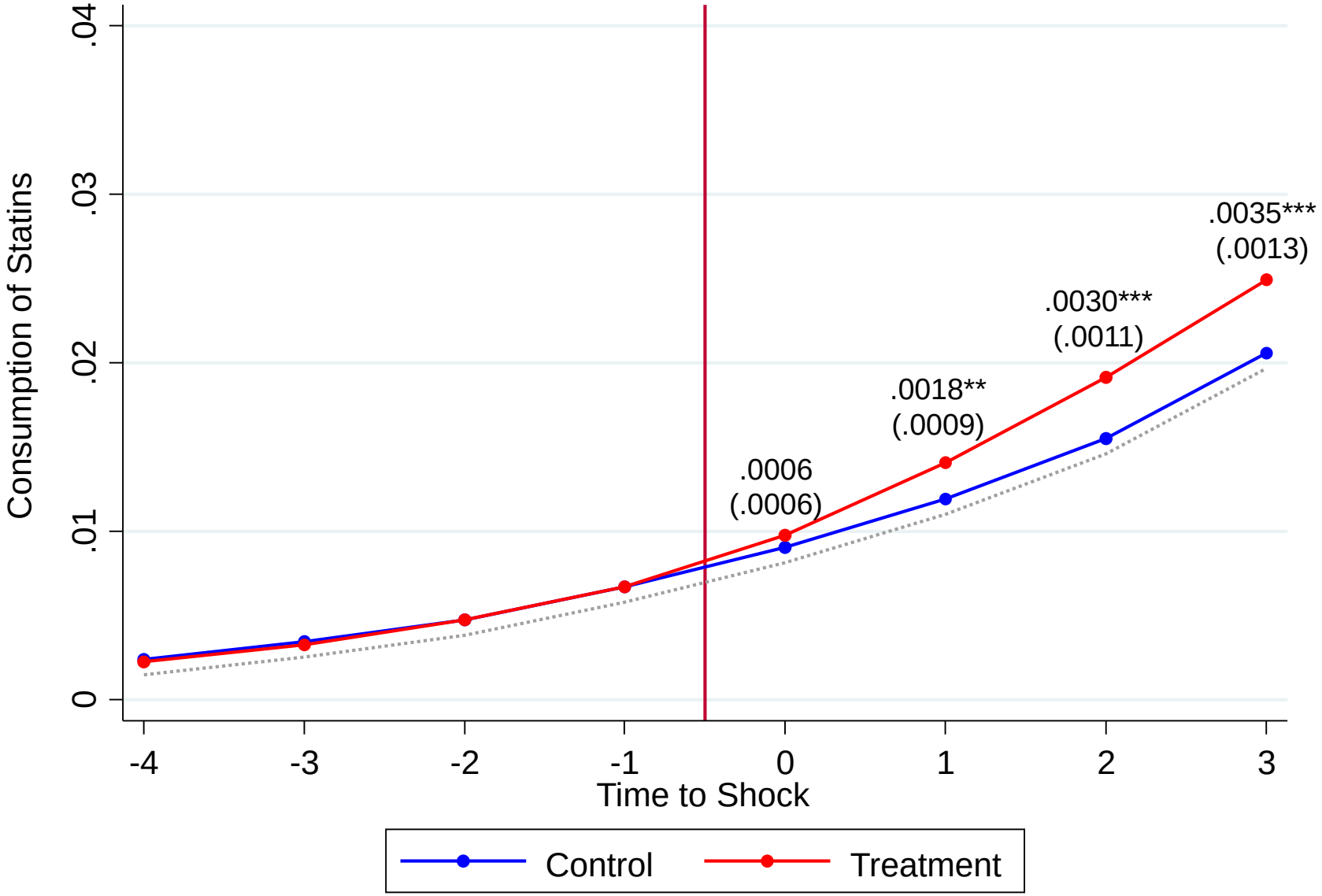
Children's Consumption of Preventive Care

	Ages 25-40	Ages 40-65	Different Family Physicians
	(1)	(2)	(3)
-4	.0001	-.0000	-.0000
	(.0002)	(.0007)	(.0003)
-3	.0001	-.0001	-.0001
	(.0002)	(.0006)	(.0003)
-2	.0002	.0007	.0002
	(.0002)	(.0005)	(.0003)
-1	0	0	0
	0	0	0
0	.0007***	.0015**	.0011***
	(.0002)	(.0006)	(.0003)
1	.0017***	.0043***	.0029***
	(.0003)	(.0009)	(.0005)
2	.0024***	.0043***	.0036***
	(.0004)	(.0011)	(.0006)
3	.0028***	.0077***	.0049***
	(.0005)	(.0014)	(.0007)
4	.0043***	.0080***	.0063***
	(.0006)	(.0016)	(.0008)
Baseline	.0118	.0493	.0252
% change	36.44%	16.23%	25%
Obs.	1,179,387	647,667	1,296,423
Number of hh clusters	67,460	40,690	72,855

Intergenerational Effects of Cardiovascular Shock

- Effects on biological children involve several routes
  - Revelation of information about biological risk
  - Revelation of information about shared-environment risk growing up
  - Salience and increased awareness
- Analyze responses by stepchildren to abstract from biological channel
- Increase statistical power by reducing the data requirement to condition on 3 years of survival (instead of 4)
  - Can only look at the 3-year effect but able to increase the sample by 20 percent

Effects of Cardiovascular Shock on Stepchildren



Intergenerational Effects of Cardiovascular Shock

- Compare magnitudes by estimating the mean-effect equation:

$$y_{i,t} = \alpha + \beta treat_i + \gamma post_{i,t} + \delta_i treat_i \times post_{i,t} + \lambda X_{i,t} + \varepsilon_{i,t}$$

Intergenerational Effects of Cardiovascular Shock

	Biological Children	Step Children
	(1)	(2)
Treat x Post	.0045***	.0025**
	(.0005)	(.0010)
Baseline	.0241	.0226
Percent change	18.7%	11.06%
Obs.	1,206,065	282,863
Number of clusters	172,295	40,409

Intergenerational Effects of Cardiovascular Shock

- Abstract from shared environment growing up by studying mean effect on children in-law

Intergenerational Effects of Cardiovascular Shock

	Children In-Law
	(1)
Treat x Post	.0011**
	(.0005)
Further from Parents In-Law	
Closer to Parents In-law	
Baseline	.0297
Obs.	1,206,065
Number of clusters	172,295

Intergenerational Effects of Cardiovascular Shock

- Abstract from shared environment growing up by studying mean effect on children in-law
- Does physical distance matter?
  - Calculate distance using municipality centroids
  - Divide sample by median distance

Intergenerational Effects of Cardiovascular Shock

	Children In-Law	Children In-Law by Distance	
		Sub-Sample Mean	By Median Distance
	(1)	(2)	(3)
Treat x Post	.0011**	.0012**	
	(.0005)	(.0006)	
Further from Parents In-Law			.0006
			(.0007)
Closer to Parents In-law			.0021**
			(.0009)
Baseline	.0297		
Obs.	1,206,065	1,041,215	1,041,215
Number of clusters	172,295	148,745	148,745

Column (2)-(3): different GPs, non-missing residence; distance by municipality centroids

Magnitude of Spillovers

- To gauge economic magnitudes, calculate how much of the time pattern can be explained by the spillover
  - Share of treatment effect out of overall increase within analysis window
  - Takes time, life-cycle, and spillover effects into account

- Children: younger – 28%; older – 15.6%
- Spouses: prime-age – 14.5%

- Capture effect of a single shock over the life-cycle of only one type (parental/spousal)

Summary: Effects of Cardiovascular Shocks

- We find immediate and sustainable effects of family health shocks on spouses' and adult children's consumption of preventive care
  - Which also cascade to stepchildren and to the next generation's households
- Effects are economically significant and the degree of adherence points to a role of the family in habit formation

Part 2: Fatal Health Shocks

Effects of Fatal Health Shocks

- Study the effects of the extreme event of fatal health shocks
- Focus is on spouses but replicate mean effects for adult children as well
- Two steps:

  (1) Effects of general fatal shocks on family members' awareness of health and common health-related behaviors

  (2) Consumption of condition-specific preventive care by exploiting variation in specific causes of death

Increased Awareness of Health

- Analyze effects on family members' general awareness of health using two proxies for the degree to which individuals pay attention to health issues
  - Hospital contacts for suspected conditions that are ruled out ex-post
    - Can be indicative of greater vigilance to symptoms
  - Non-hospital contacts initiated outside of regular working hours
    - Can be indicative of sense of urgency

Increased Awareness of Health

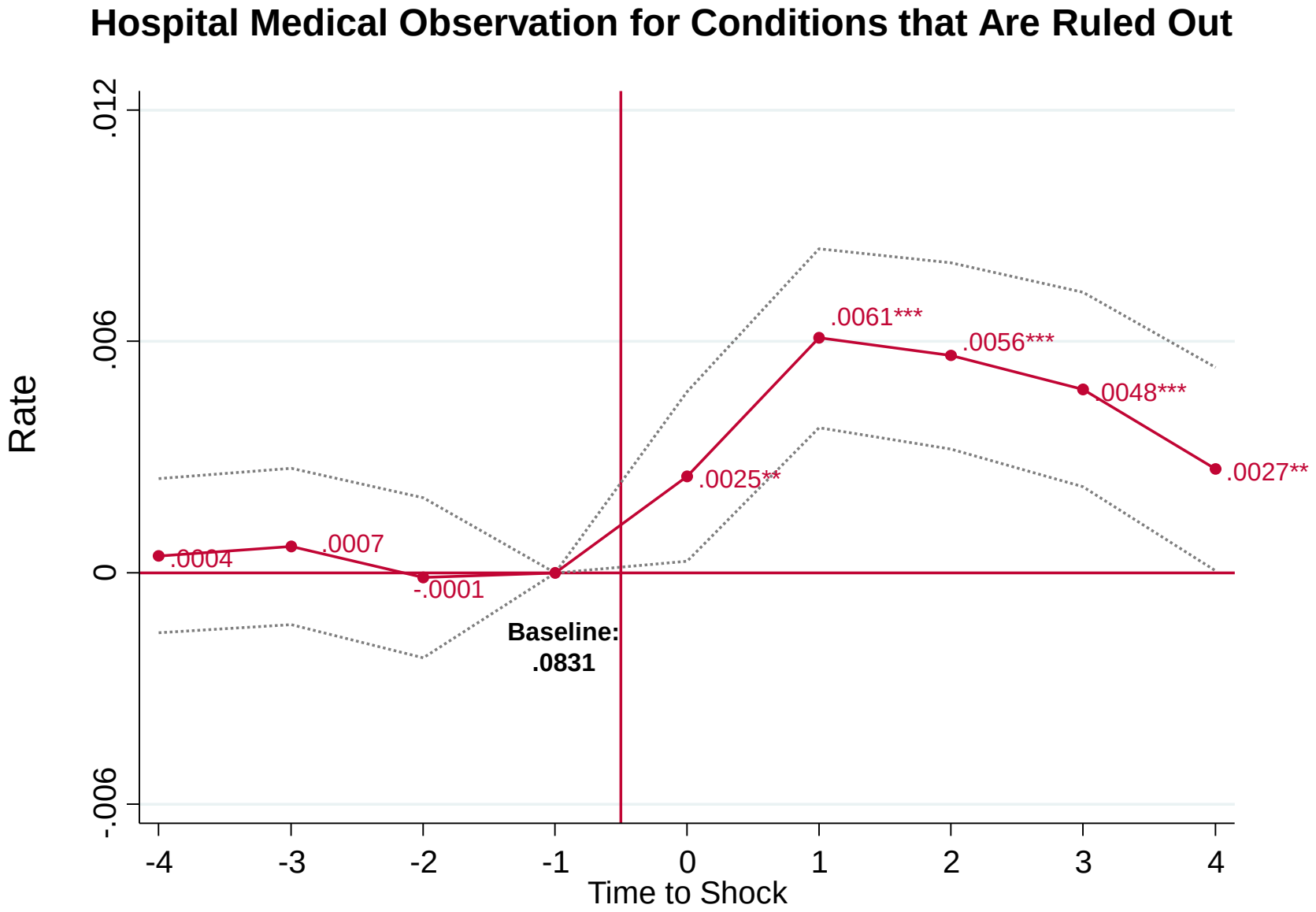
- Estimate dynamic differences-in-differences equation:

$$y_{i,t} = \alpha + \beta treat_i + \sum_{r \neq -1; r=-4}^{4} \gamma_r \times I_r + \sum_{r \neq -1; r=-4}^{4} \delta_r \times I_r \times treat_i + \lambda X_{i,t} + \varepsilon_{i,t}$$

where $I_r = 1(t = r)$

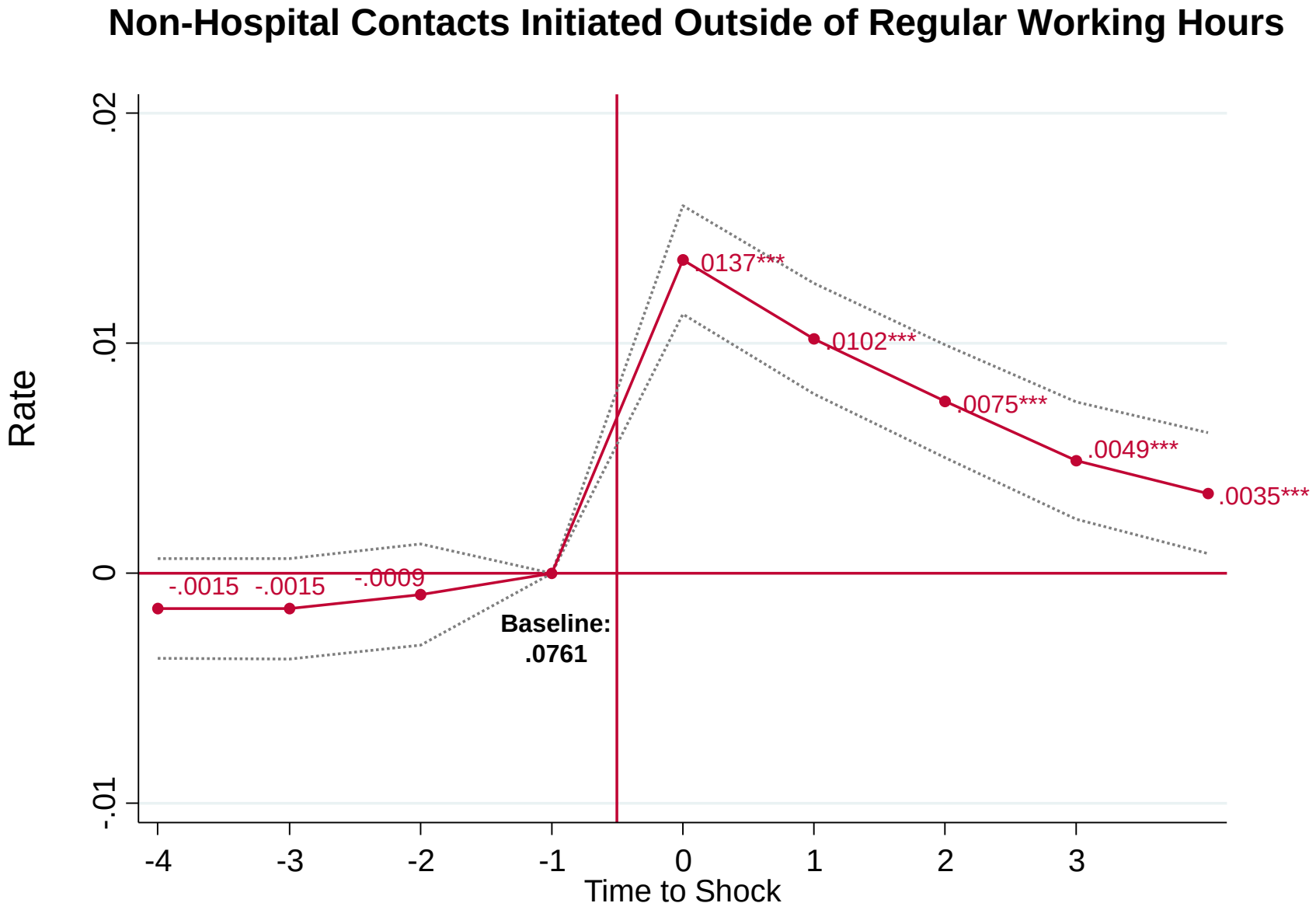
  - Parameter vector of interest: δ_r

Increased Awareness of Health



ICD-10 code Z03: “encounter for medical observation for suspected diseases and conditions ruled out”

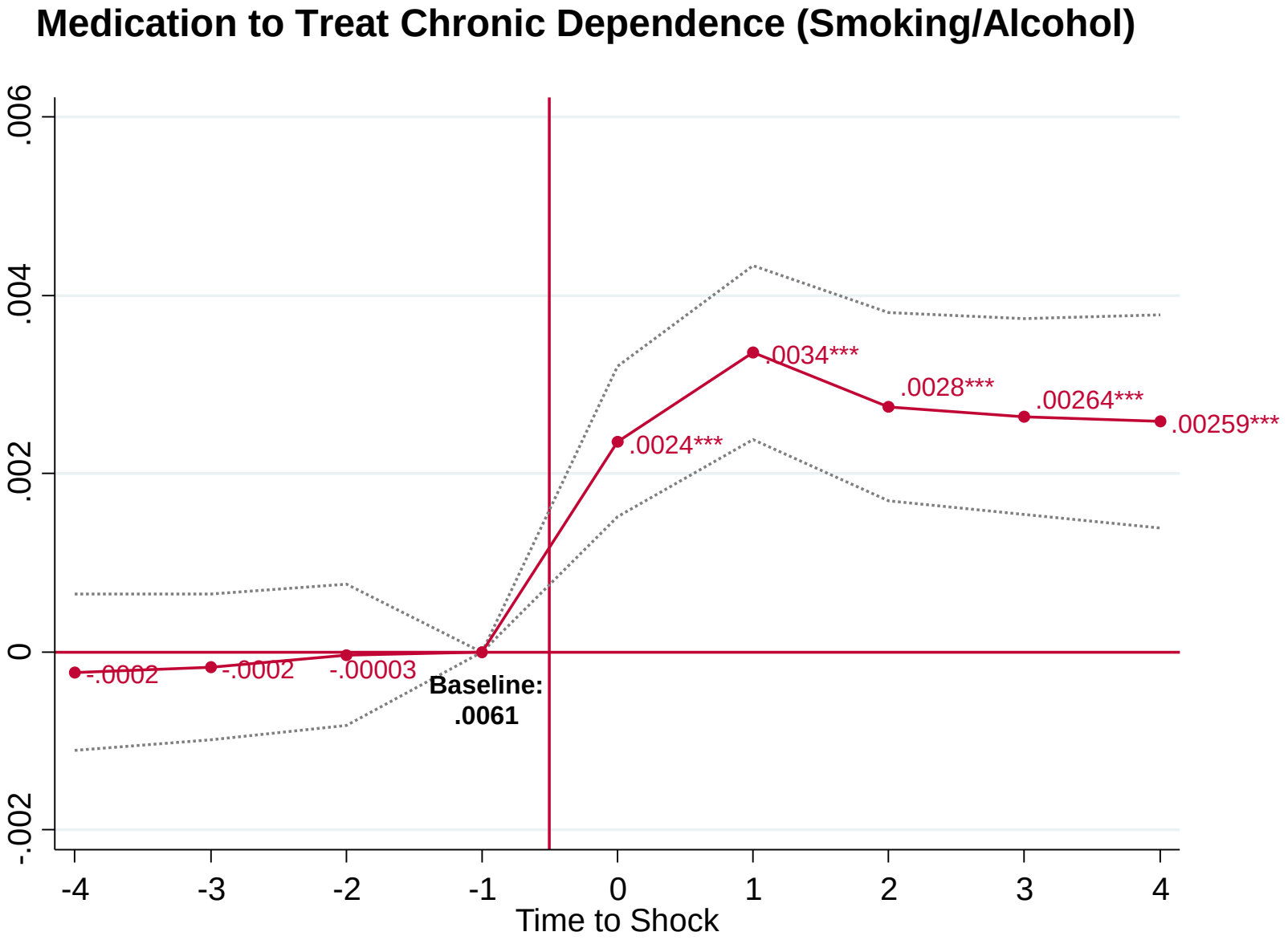
Increased Awareness of Health



Declines in Harmful Behaviors and Medication

- Literature on adverse health behaviors has focused on smoking and alcohol abuse
  - Do fatal family shocks lead individuals to seek treatments that reduce these harmful behaviors?
- Study consumption of medications that treat nicotine or alcohol dependence
  - Prescribed to individuals who wish to cease (or substitute away from) chronic smoking or drinking

Declines in Harmful Behaviors and Medication



Declines in Harmful Behaviors and Medication

- Test the hypothesis that effects cannot be fully attributed to responses to new information and knowledge regarding the risk involved in these behaviors

- Study mean effects when spousal cause of death is not linked to risky behaviors (in particular, smoking and drinking)
  - Autoimmune disease and Alzheimer's

	Dependence medication
	(1)
Treat x Post	.0064**
	(.0025)
Baseline	.0042
Obs.	25,304
Number of clusters	3,562

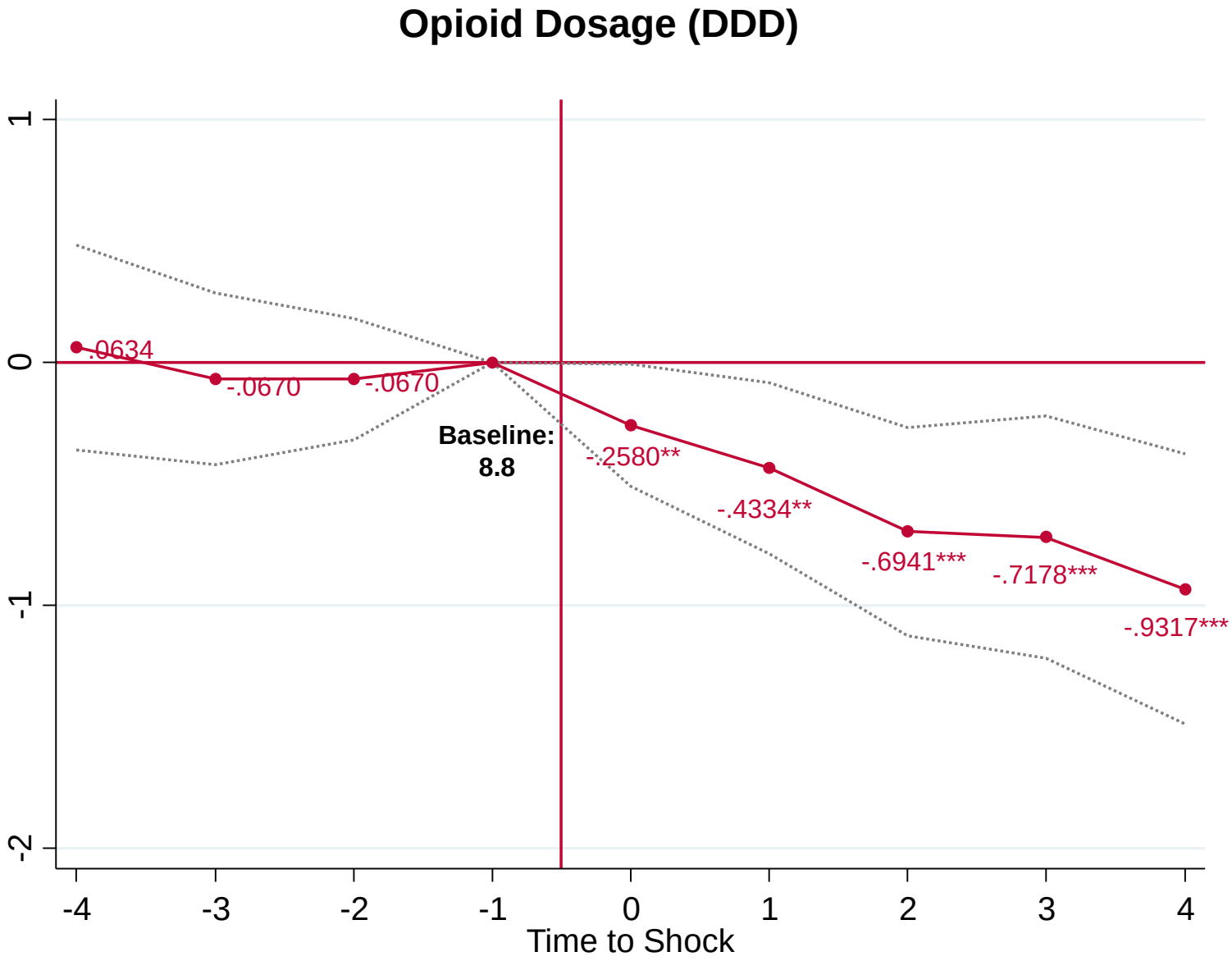
Declines in Harmful Behaviors and Medication

- Research on the dangers of abusing medication has been concerned with developing dependence or addiction
  - Do fatal family shocks induce reduction in consumption of addictive medication?

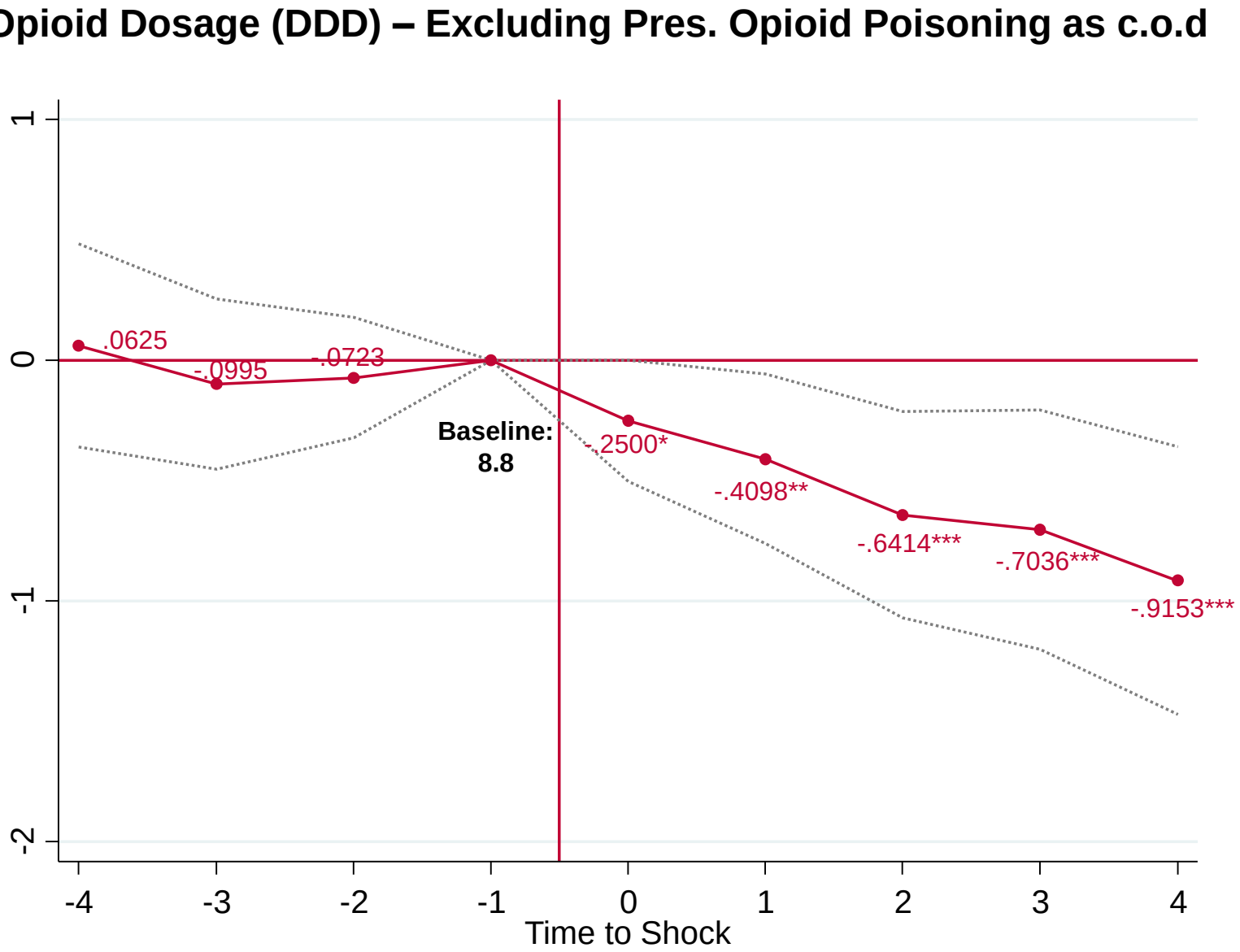
- Study a main class of addictive harmful medication
  - Prescription opioids for pain relief
  - Account for the greatest proportion of mortality cases linked to prescription drug abuse (Volkow 2014; Rudd et al. 2016)

- Health-promoting behavioral responses would translate into reductions in consumption
  - Dose reductions should be gradual for withdrawal symptoms (HHS 2006)
  - Study continuous measure of dosage – day equivalents measured by "defined daily dose" (DDD)

Declines in Harmful Behaviors and Medication



Declines in Harmful Behaviors and Medication



Intergenerational Effects of Fatal Shocks

- Mean effects on children

	Hosp. for Suspected Conditions Ruled Out (1)	After Hours Visits (2)	Dependence Medication (3)
Treat x Post	.0019***	.0015**	.0006***
	(.0004)	(.0006)	(.0002)
Baseline	.0634	.0617	.0121
Obs.	6,276,868	3,002,647	5,764,516
Number of clusters	306,841	188,719	294,943

Condition-Specific Preventive Care

- In related work we find direct health effects of fatal spousal shocks
- We therefore seek to isolate behavioral responses by exploiting variation in specific causes of death
  - Idea: all individuals are faced with main effects of spousal death, but their experience may differ by the cause of death
- We ask: do individuals increase their utilization of types of preventive-care that are directly-linked to particular health conditions?
  - Consistent with both new information and salience that are risk specific

Condition-Specific Preventive Care

- Two main classes of preventive-care practices that are tied to the two leading causes of death, cardiovascular disease and cancer
  - Consumption of statins as before
  - Visits to diagnostic radiologists: who specialize in disease diagnosis and are responsible for screening patients for major types of cancer

Condition-Specific Preventive Care

- Strategy: analyze the utilization of a particular type of preventive-care related to disease 'x', by individuals whose spouse died of disease 'x' compared to those whose spouse died of any other cause

- Estimate the following equation on treated households

$$y_{i,t} = \alpha + \beta c.o.d_i + \sum_{r \neq -1; r=-4}^{4} \gamma_r \times I_r + \sum_{r \neq -1; r=-4}^{4} \delta_r \times I_r \times c.o.d_i + \lambda X_{i,t} + \varepsilon_{i,t}$$

where $c.o.d_i$ divides the sample by cause of death

Statin Use when Cause of Death is Cardiovascular

	Spouses
	(1)
-4	0.0021
	(0.0020)
-3	0.0001
	(0.0018)
-2	0.0013
	(0.0014)
-1	0
	0
0	0.0036**
	(0.0015)
1	0.0047**
	(0.0020)
2	0.0050**
	(0.0023)
3	0.0062**
	(0.0025)
4	0.0071***
	(0.0027)
Baseline	0.0769
Obs.	889,837
No. of Clusters	126,816
HH with Condition	13,589

Statin Use when Cause of Death is Cardiovascular

	Spouses	Children
	(1)	(2)
-4	0.0021	-.0007
	(0.0020)	(.0006)
-3	0.0001	-.0006
	(0.0018)	(.0005)
-2	0.0013	-.0002
	(0.0014)	(.0004)
-1	0	0
	0	0
0	0.0036**	.0020***
	(0.0015)	(.0005)
1	0.0047**	.0020***
	(0.0020)	(.0007)
2	0.0050**	.0033***
	(0.0023)	(.0009)
3	0.0062**	.0049***
	(0.0025)	(.0010)
4	0.0071***	.0066***
	(0.0027)	(.0012)
Baseline	0.0769	0.0495
Obs.	889,837	2,922,141
No. of Clusters	126,816	167,586
HH with Condition	13,589	38,076

Diag. Radiology when Cause of Death is Cancer

- Next, study costs of visits to diagnostic radiologists in the context of fatal cancer
  - Compare individuals whose spouse died of cancer to those whose spouse died of any other cause
- Diagnosis rather than treatment, so behavioral responses should translate to transitory effects

Diag. Radiology when Cause of Death is Cancer

	Diagnostic Radiology
	(1)
-4	-0.5069
	(0.5222)
-3	0.1728
	(0.5213)
-2	-0.2273
	(0.5141)
-1	0
	0
0	0.6333
	(0.5316)
1	1.5464***
	(0.5472)
2	1.2307**
	(0.5568)
3	0.9273
	(0.5676)
4	0.5947
	(0.5851)
Baseline	12.72
Obs.	2,382,999
No. of Clusters	303,192
HH with Condition	107,565

Diag. Radiology when Cause of Death is Cancer

	Diagnostic Radiology	Hospital Contact with Family Code
	(1)	(2)
-4	-0.5069	-.0000
	(0.5222)	(.0001)
-3	0.1728	-.0001
	(0.5213)	(.0001)
-2	-0.2273	-.0000
	(0.5141)	(.0001)
-1	0	0
	0	0
0	0.6333	-.0000
	(0.5316)	(.0001)
1	1.5464***	.0002**
	(0.5472)	(.0001)
2	1.2307**	.0000
	(0.5568)	(.0001)
3	0.9273	-.0000
	(0.5676)	(.0001)
4	0.5947	.0001
	(0.5851)	(.0001)
Baseline	12.72	.00017
Obs.	2,382,999	1,524,096
No. of Clusters	303,192	213,925
HH with Condition	107,565	76,101

Diag. Radiology when Cause of Death is Cancer

	Diagnostic Radiology	Hospital Contact with Family Code		Children
	(1)	(2)		(3)
-4	-0.5069	-.0000	c.o.d x Post	.7401**
	(0.5222)	(.0001)		(.2932)
-3	0.1728	-.0001	Baseline	12.1192
	(0.5213)	(.0001)	Obs	2,612,139
-2	-0.2273	-.0000	# Children	228,835
	(0.5141)	(.0001)	# c.o.d	137,138
-1	0	0		
	0	0		
0	0.6333	-.0000		
	(0.5316)	(.0001)		
1	1.5464***	.0002**		
	(0.5472)	(.0001)		
2	1.2307**	.0000		
	(0.5568)	(.0001)		
3	0.9273	-.0000		
	(0.5676)	(.0001)		
4	0.5947	.0001		
	(0.5851)	(.0001)		
Baseline	12.72	.00017		
Obs.	2,382,999	1,524,096		
No. of Clusters	303,192	213,925		
HH with Condition	107,565	76,101		

Spousal Responses by Specific Cancer Types

- Further investigate how directed are the responses by exploiting detailed types of cancer
  - Study husbands' diagnostic radiology costs when wife dies of breast cancer
  - Study the consumption of medication for smoking cessation in the context of lung cancer
- Estimate a DD regression of the form:

$$y_{i,t} = \alpha + \beta c.o.d_i + \gamma post_{i,t} + \delta \times c.o.d_i \times post_{i,t} + \lambda X_{i,t} + \varepsilon_{i,t}$$

Spousal Responses by Specific Cancer Types

	Diag. Radiology by Breast Cancer (1)
c.o.d x Post	1.8166**
	(.8982)
Baseline	8.0080
Obs.	287,815
Number of Clusters	55,415
HHs with condition	8,695

Spousal Responses by Specific Cancer Types

	Diag. Radiology by Breast Cancer	Smoking Cessation by Lung Cancer	Smoking Cessation by (Non-Lung) Cancer
	(1)	(2)	(3)
c.o.d x Post	1.8166**	.0006**	.0002
	(.8982)	(.0003)	(.0002)
Baseline	8.0080	.0025	.0021
Obs.	287,815	583,585	768,480
Number of Clusters	55,415	84,301	109,912
HHs with condition	8,695	12,599	34,705

Summary: Fatal Shocks

- Fatal health shocks increase family members' awareness of health and lead to improved health behaviors
  - Even when shock is likely uninformative of own risk
- Evidence of health investments that are very specific to the cause of death

Conclusion and Implications

- We identify spillovers through family health shocks as a prevalent and significant determinant of health behaviors over the life-cycle
- Persistence of effects points to a role of the family in habit formation in the context of health
- Evidence suggests that salience of shocks may be a key explanation, drawing family members' attention to their own health
  - Specific nature of the shock; overall increased awareness
  - Even when shocks are likely uninformative of own risk

Conclusion and Implications

- Implications for models of health behaviors:
- Should analyze health behaviors and demand for preventive-care at the family level (similar to consumption and labor supply)
- Suggests ingredients to include in suitable models of health behaviors (event-driven responses/cue-triggered decision making [Bernheim and Rangel 2004]; salience of specific elements)

Conclusion and Implications

- Potential implications for policies to improve health and reduce disparities:
- Health behaviors are not immutable
- Leverage family events as window of opportunity for targeted interventions
  - Induce non-transitory behavioral changes; involve required intrinsic motives
  - E.g., provide individual-specific information of risks; exploit salience of health to actively offer preventive-care (introduce "defaults")
- Pay attention to pitfalls of salience
  - Excessive preventive-care can be harmful (and expensive)
  - Can divert attention from conditions with higher risks