Health screening and selection: Evidence from biennial subsidies in South Korea

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Motivation

- The goal of health screening is to find diseases early
  - Some cancers are easier to treat when diagnosed early
  - 5 year survival rates show large difference by the stage of cancers
    - Breast cancer: 98% (localized) $\Rightarrow$ 30% (distant)
    - Lung cancer: 57% (localized) $\Rightarrow$ 7% (distant)
    - Stomach cancer: 97% (localized) $\Rightarrow$ 6% (distant) - (Korea)
  - Health screenings are designed to diagnose diseases at an early stage

- Despite wide practice, the evidence on health screenings are mixed
  - Many clinical RCTs on general/cancer screenings find limited impact on mortality (Krogsbøll et al., 2012)
  - Many screening guidelines change due to insignificant impact on mortality
  - One reason is the selection of healthy people participating in screening

Motivation

- Characteristics of screening participants
  - Symptomatic group: self-aware high risk group
  - Asymptomatic group
    - Participants are from higher socioeconomic background (Bender et al., 2014)
    - Participants are more likely to show other positive health behaviors (Oster, 2020)
    - Participants show lower mortality (Strandberg et al., 1995)

- Policies to better target people who may be carrying a disease but do not yet know about it
  - Age-based recommendation is not well targeted (Einav et al., 2020)

- Another common policy for increasing screening participation: subsidies
  - Low income people might be more sensitive to subsidies
  - Affordable Care Act / National Breast and Cervical Cancer Early Detection Program

Research question

1. How do subsidies affect screening participation?
   - National Health Screening Program in Korea
   - Subsidies for various screenings (general and cancer screenings)
   - Multiple policies (age-based recommendation, subsidies)
   - Variation in age cutoff and subsidy schedules (biennial, annual)
2. Who responds to screening subsidies?
   - Characterize compliers with respect to age-based recommendation and subsidies
   - Compare compliers with always-takers and never-takers
   - Health conditions / socioeconomic status / health behaviors
3. What is the effect of screening on health care utilizations, diagnoses and mortality?

Preview of results

1. Biennial subsidies increases screening participation from 10% to 30%
2. There are positive and negative cross-spillover effects between different types of screenings
3. Subsidies increase not only one's own but also the spouse's participation in screening
4. Compared to always-takers, compliers with screening subsidies have lower socioeconomic background and are more likely to be diagnosed with a disease
5. In 1 year of screening, the number of first hospital visits for a new illness, a proxy for new diagnosis, increases significantly

Contributions to literature

- Health screening decision
- Compliers to different screening policies

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Korean health screening program

- 3 types of screening covered by the National Health Insurance in Korea
  - General health screening
  - Cancer screenings (5 types)
  - Infant/children health screening
- General health screening
  - Most basic tests for health conditions
  - Measurement of height, weight, blood pressure, chest X-ray, dental test, blood test, uroscopy and health risk evaluation
- Cancer screening
  - Stomach cancer screening
  - Breast cancer screening
  - Cervical cancer screening
  - Liver cancer screening
  - Colorectal cancer screening

Screening subsidy criteria

- Biennial subsidy rule
  - Those born in even years can get subsidized screening in even years
  - Those born in odd years can get subsidized screening in odd years
- Eligible for subsidies during a calendar year when the age is even
  - Age = current year - birth year
  - No subsidy when age is odd
  - Subsidy eligibility switch on and off every year
  - Eligible once every two years
- Age cutoff
  - $Age \geq 40$: biennial subsidy
  - $Age < 40$: no subsidy

Variation in subsidy eligibility across screenings

	Biennial				Annual		No-subsidy	
	General	Stomach	Breast	Cervical	Liver	Colorectal	Lung	Prostate
Frequency	2 years	2 years	2 years	2 years	0.5 year	1 year		
Subsidy starting age	40	40	40	30	40	50		
Subsidy amount	100%	90%	90%	100%	90%	90%	0%	0%
Copay ($)	0	7	3.5	0	10	5	110	20
Target			Female	Female	High risk group			Male
Subsidized medical tests		Gastroscopy, biopsy	Mammogram	Pap smear	Ultrasound, MSAFP	Fecal occult blood test, colonoscopy, biopsy		

Liver high risk group

Implementation of the health screening program

- Nationwide program
  - No "outside" of the program
    $\Rightarrow$ target: all the citizens covered by National Health Insurance Service (NHIS)
  - Do not examine the introduction of the program
    $\Rightarrow$ Comparison between those eligible and ineligible for subsidies
- How to receive subsidized screenings
  - Access point: public health clinics / private clinics and hospitals designated by the NHIS
    $\Rightarrow$ (Dec 2023) 5,800 screening centers in Seoul $\rightarrow$ 900 people per center
  - Appointment: normally required but varies by hospitals and type of screenings
- How was subsidy eligibility conveyed
  - Even-odd subsidy rule has been used since 1980s
  - Reminder mails (and mobile notifications) sent to those eligible for subsidies
  - Mail contains the type of screenings to receive and health care providers in the neighborhood

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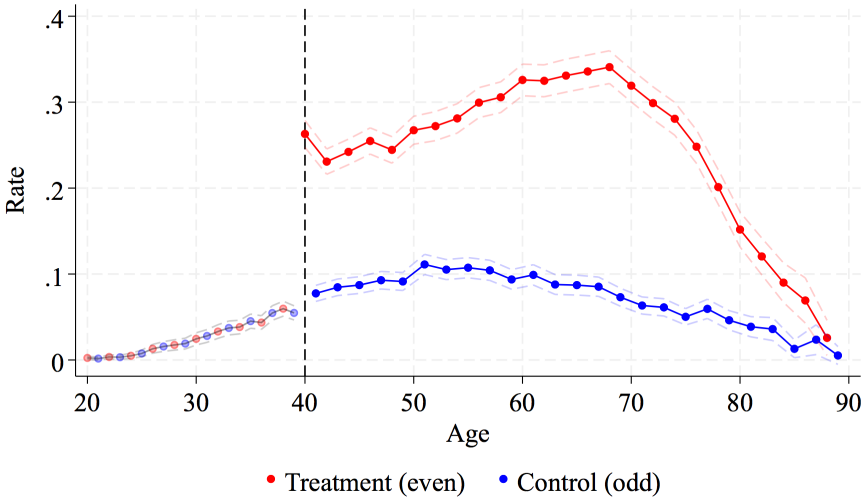
Stomach cancer screening take-up by age



Conceptual framework for 3 effects

- 2 policies and 3 effects
  - Recommendation effect: increase participation from age 40 regardless of even or odd age
  - Subsidy effect: increase participation at even ages from age 40
  - Substitution effect: move screening from odd to even ages
- Regression discontinuity design at age 40 using 2 year average take-up
  - Increase in participation due to recommendation and subsidies
  - 2-year average take-up cancels out substitution effect
- Comparing even vs odd age group from age 40
  - Increase in participation due to subsidies and substitution
  - Recommendation effect is cancelled out

Regression discontinuity at age 40 using 2 year bins

- Bin ages by 2 years and use bins as a unit of age
  - Bins: [34, 35], [36, 37], [38, 39], [40, 41], [42, 43], [44, 45]
    $\Rightarrow$ Denote each bin with the midpoint

- Econometric specification

$$screen_{it} = \alpha_0 + \alpha_1 \cdot a_{it} + \alpha_2 \cdot \mathbb{1}\{a_{it} > 0\} + \alpha_3 \cdot a_{it} \times \mathbb{1}\{a_{it} > 0\} + \varepsilon_{it} \quad (1)$$

  - $a_{it} = (agebin_{it} - 39.5)$
  - Individual i in year t
  - Analytical sample: age $\in$ [34, 45]
  - Standard error clustered at the individual level

Comparing even vs odd age groups from age 40

- Comparison between even age vs odd age from age 40
  - Variation comes from year of birth being even or odd
- Balance between even (treatment) and odd (control) group
  - Even age (treatment) group is younger than the odd age (control) group
  - Subsidy eligibility is random conditional on $f(age)$
- Econometric specification

$$y_{it} = \beta_0 + \beta_1 \cdot age\_even_{it} + f(age_{it}) + \epsilon_{it} \quad (2)$$

  - Individual i in year t
  - Analytical sample: age $\in$ [40,89]
  - $f(age)$: linear splines with 5 years interval
  - Standard error clustered at the individual level

Balance table: balanced conditional on f(age)

	(1)	(2)	(3)
	Treatment group	Control group	Conditional difference
Age	58.697	59.240	-
	(12.532)	(12.353)	-
Female	0.530	0.532	–0.002*
	(0.499)	(0.499)	(0.001)
Currently married	0.799	0.798	–0.001
	(0.401)	(0.402)	(0.001)
Years of education	10.320	10.227	–0.003
	(4.510)	(4.538)	(0.008)
Working status	0.610	0.608	–0.003*
	(0.488)	(0.488)	(0.001)
Individual income	1446.3	1425.7	2.8
	(2081.6)	(2068.1)	(5.2)
Household income	4104.4	4086.7	3.2
	(3708.6)	(3737.9)	(14.3)
Own a house	0.734	0.737	–0.000
	(0.442)	(0.441)	(0.001)
Number of household members	3.067	3.051	–0.004
	(1.317)	(1.317)	(0.003)
N	54274	52909	
Share	(0.51)	(0.49)	
F(8, 15939)			1.65
			(0.10)

Robustness Bounding

Data

- Korean health panel study dataset
  - Annual panel data from 2008 to 2018
  - Household level sampling (7000) / Individual level data (21,300)
  - Survey data collected through face-to-face interview (self-reported)
  - Information on
    - Demographic and SES
    - Health care usage
    - Health behaviors

- Health care usage (outpatient, inpatient, emergency)
  - Unit of observations: **every visit to a hospital**
  - Information
    - Date
    - Hospital bills, drug expenditures
    - Type of hospitals visited
    - Diagnosis (ICD-10)
    - First visit vs Recurring visit
    - Health screening records: screening type, tests performed, screening results, disease found

Data comparison Data collection

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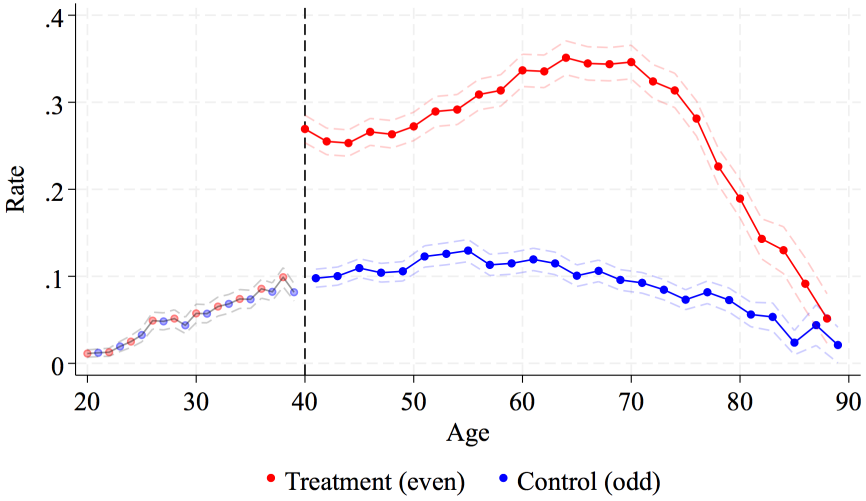
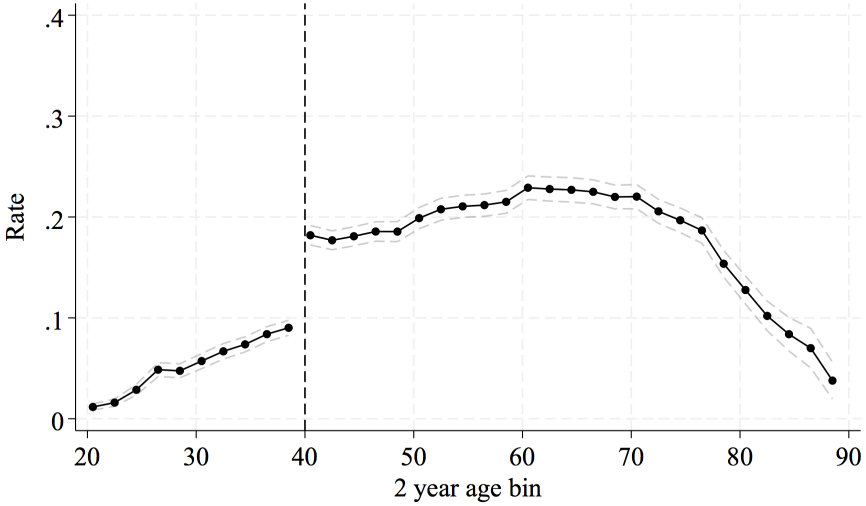
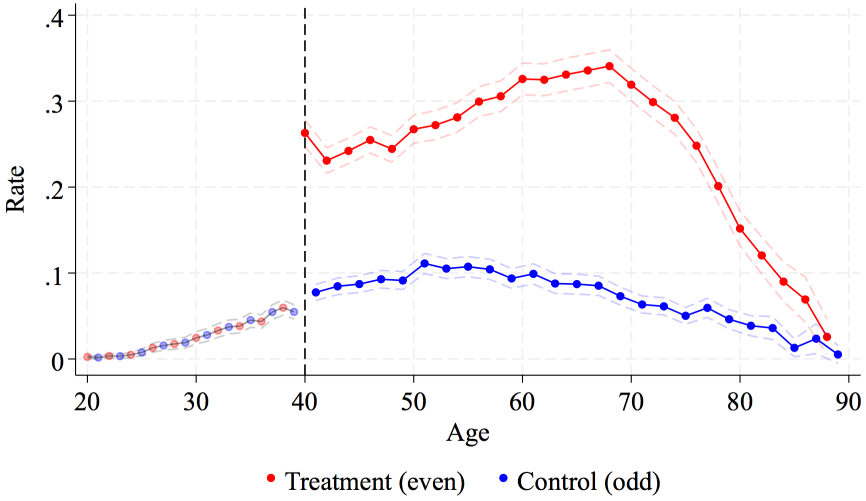
General screening - even vs odd age



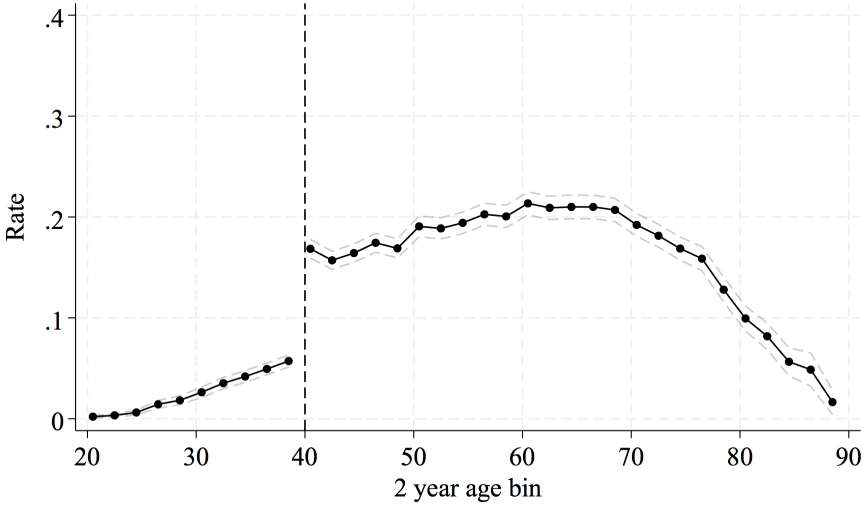
General screening - 2 year age bins



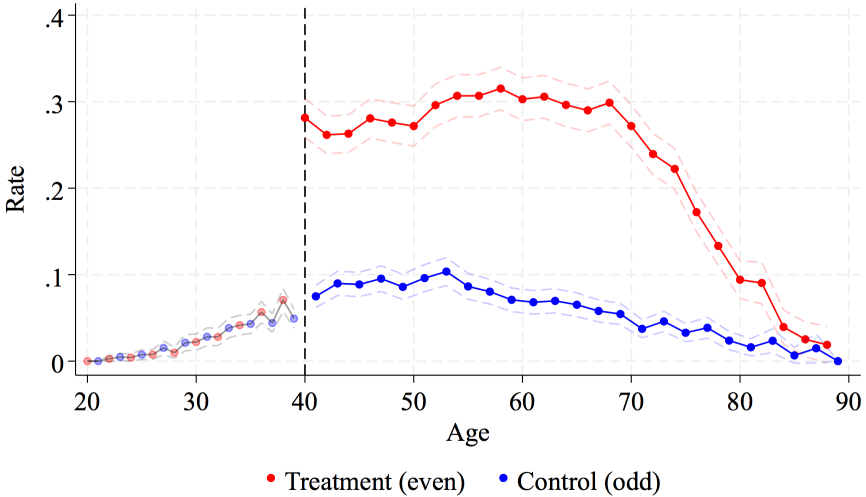
Stomach screening - even vs odd age



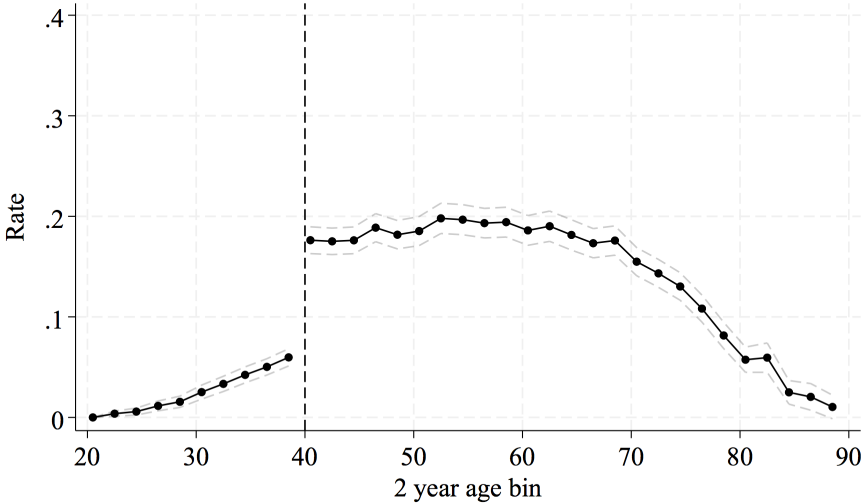
Stomach screening - 2 year age bins



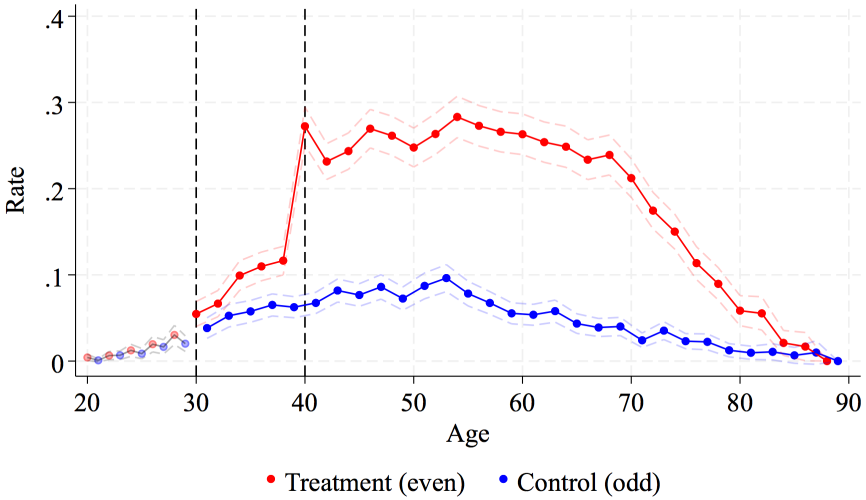
Breast screening - even vs odd age



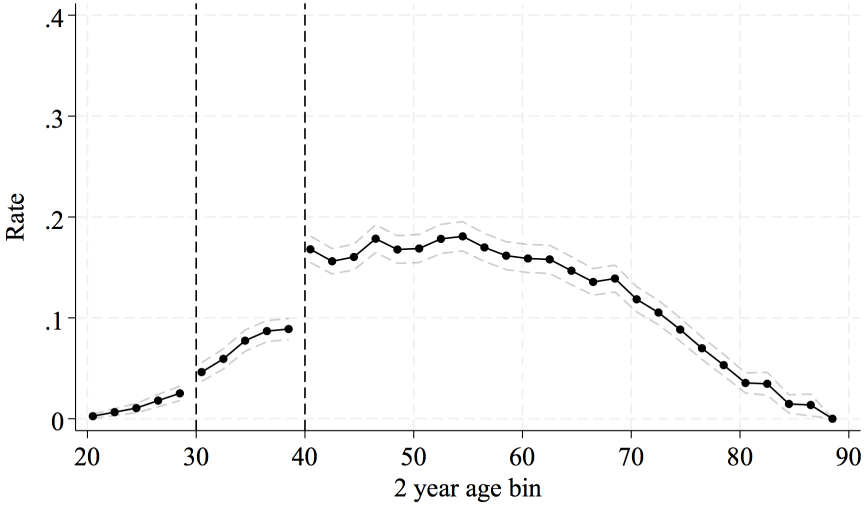
Breast screening - 2 year age bins



Cervical screening - even vs odd age



Cervical screening - 2 year age bins



Regression discontinuity using 2-year age bins

	(1)	(2)	(3)	(4)	(5)
	Any	General	Stomach	Breast	Cervical
$Age \geq 40$	0.097***	0.086***	0.105***	0.112***	0.074***
	(0.008)	(0.007)	(0.006)	(0.009)	(0.010)
Constant	0.121***	0.095***	0.061***	0.064***	0.093***
	(0.005)	(0.005)	(0.004)	(0.005)	(0.006)
N	34713	34713	34713	17725	17725
Adj R^2	0.017	0.020	0.032	0.037	0.013
Sample age range	[34, 45]	[34, 45]	[34, 45]	[34, 45]	[34, 45]
Subsidy starting age	40	40	40	40	30

Comparing even vs odd age

	(1)	(2)	(3)	(4)	(5)
	Any	General	Stomach	Breast	Cervical
Age even	0.204***	0.187***	0.190***	0.191***	0.164***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
N	107183	107183	107183	56923	56923
Adj R^2	0.068	0.061	0.069	0.080	0.074
F-statistic	5012	4804	4830	2904	2520
Sample age range	[40, 89]	[40, 89]	[40, 89]	[40, 89]	[40, 89]
Subsidy starting age	40	40	40	40	30
Age controls	Y	Y	Y	Y	Y
Control group mean	0.122	0.102	0.083	0.067	0.056

Robustness Bounding

Intertemporal substitution

- One can move the screening from odd to even age to be eligible for subsidies
  - Intertemporal reallocation can widen the gap between even and odd ages
  - Even/odd comparison captures the sum of subsidy and substitution effect
- Hard to disentangle the subsidy effect from substitution effect
  - Counterfactual: recommendation for biennial screening from age 40 but without subsidies
  - Time periods before and after the introduction of the subsidy policies
  - 2-year binning presents effect size without substitution effect

  US mammogram
- Evidence for (the lack of) intertemporal substitution
  1. Ages before and after the introduction of the subsidies (around age 40) Around age 40
  2. Monthly distribution of screening take-up Screening months

  $\Rightarrow$ No strong sign of substitution

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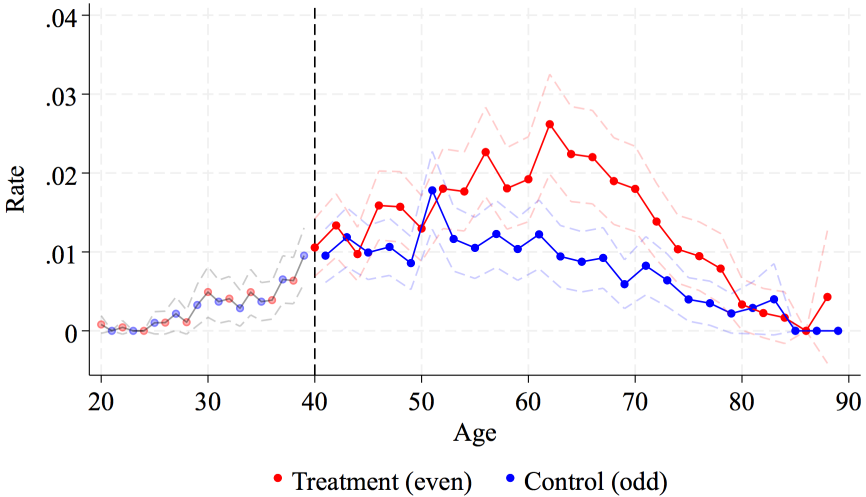
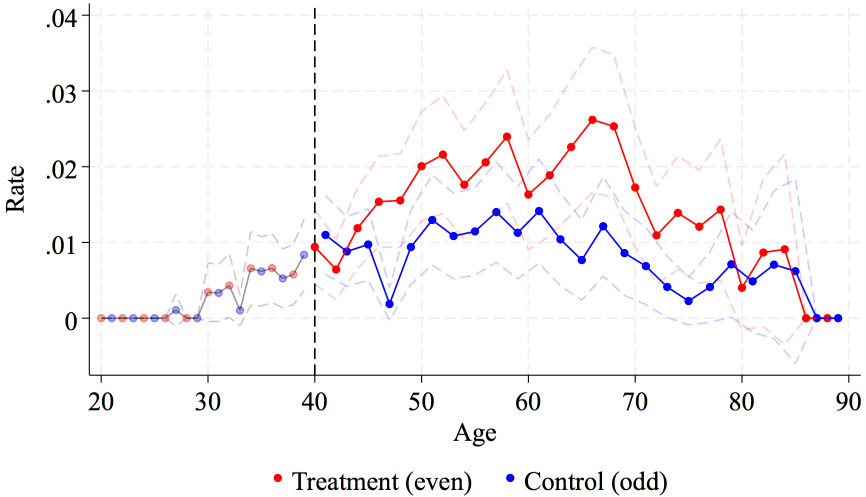
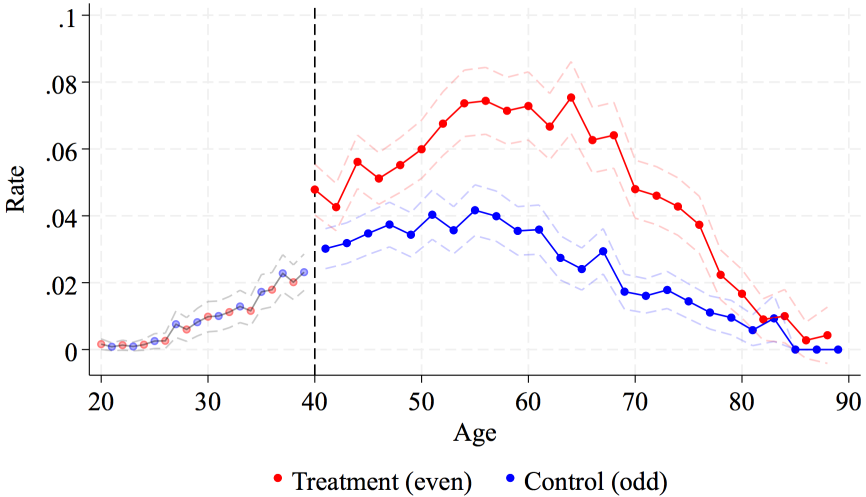
Lung screening - no subsidy



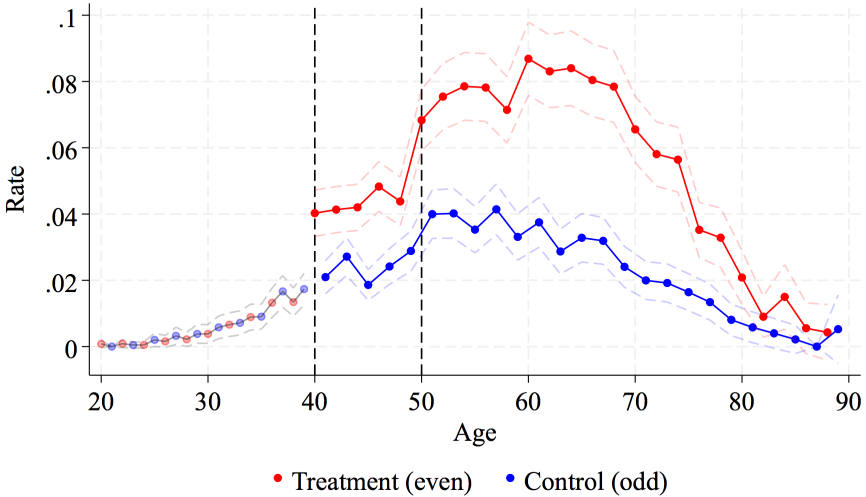
Prostate screening - no subsidy



Liver screening - annual subsidy



Colorectal screening - annual subsidy



Positive inter-screening spillover

	(1)	(2)	(3)
	No subsidy		Annual subsidy
	Lung	Prostate	Colorectal
Panel A. ITT			
Age even	0.006***	0.007***	0.020***
	(0.001)	(0.001)	(0.002)
Panel B. LATE			
Biennial screening	0.031***	0.046***	0.115***
	(0.003)	(0.006)	(0.011)
N	107183	50260	31089
Sample age range	[40, 89]	[40, 89]	[40, 49]
Subsidy starting age			50
Age controls	Y	Y	Y
Control group mean	0.009	0.009	0.024

Robustness

Negative inter-screening spillover

	(1)	(2)	(3)
	Annual subsidy		Biennial subsidy
	Liver	Colorectal	Cervical
Age even	0.027***	0.038***	0.177***
	(0.001)	(0.002)	(0.006)
Age even × age < 40			−0.135***
			(0.008)
N	107183	76094	27714
Sample age range	[40, 89]	[50, 89]	[30, 49]
Subsidy starting age	40	50	30
Age controls	Y	Y	Y
Control group mean	0.028	0.027	

Robustness Cervical screening

Mechanisms

- Annual- and no-subsidy screening participants are a subset of biennial-subsidy screening participants No always-takers
- People receive multiple screenings on the same day in one hospital visit
  - Fixed cost in visiting hospital (e.g. travel cost, psychological toll, taking a day off)
- Take-up pattern follows that of general health screening
  - Doctor's recommendation at general health screening

Share (multiple) Reg (multiple) Heterogeneity (gender)

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Spillover in take-up between spouses

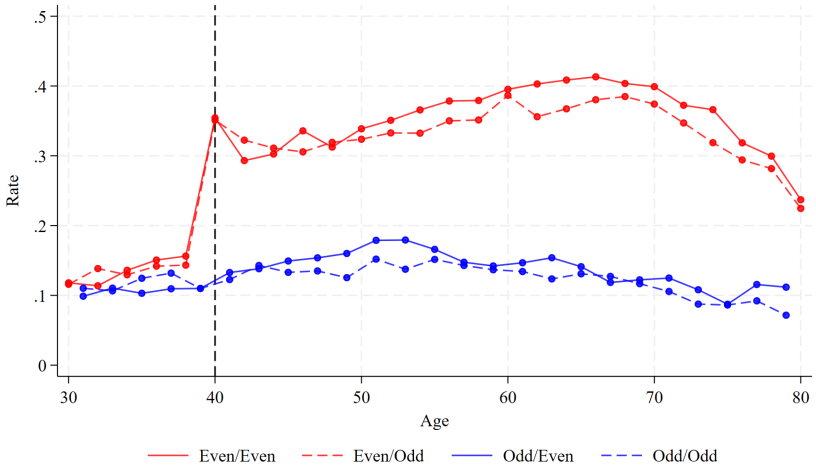
- Analytical sample
  - Dataset contains all the household members
  - Currently married people (50,863 couple pairs)
  - Own age $\geq$ 40 & spouse age $\geq$ 40

- Econometric specification

$$y_{it} = \theta \cdot age\_even_{it} + \sigma \cdot spouse\_age\_even_{it} + \tau \cdot age\_even_{it} \times spouse\_age\_even_{it} + \phi_{it} \quad (3)$$

  - y_{it}: own screening take-up of individual i in year t
  - Standard error clustered at couple level
  - Variation comes from 4 types of couples with different subsidy compositions

Comparing between 4 types of couples



Spousal spillover in take-up

	(1)	(2)	(3)	(4)
	Outcome var: Own screening take-up			
Age even	0.214***	0.213***	0.212***	0.212***
	(0.006)	(0.006)	(0.004)	(0.004)
Spouse age even	0.016***	0.015***		
	(0.005)	(0.004)		
Age even	0.000	0.003		
× Spouse age even	(0.009)	(0.009)		
Spouse screening			0.080***	0.080***
			(0.018)	(0.018)
N	79962	79782	79962	79782
Odd/Odd group mean	0.127	0.127	0.127	0.127
Demographic controls		Y		Y
Estimator	OLS	OLS	2SLS	2SLS

In each screening

Mechanisms

- Wife eligible for subsidies increase husband's screening take-up, but it does not work the other way.
  Direction
- Spouses can get screening on the same day.
  Share (same day) Reg (same day)

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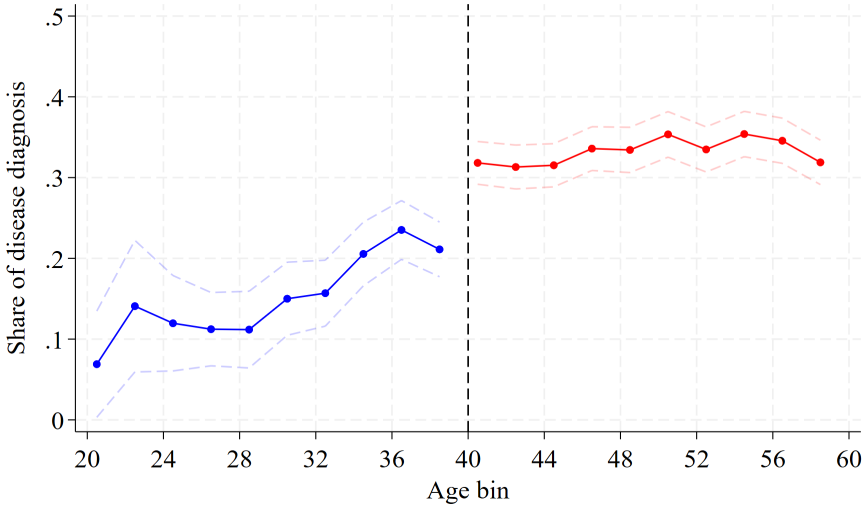
Selection into screening

- We care not only the increase in screening participation rate, but the characteristics of participants on the margin (compliers)
- Compliance groups following Angrist et al. (1996)

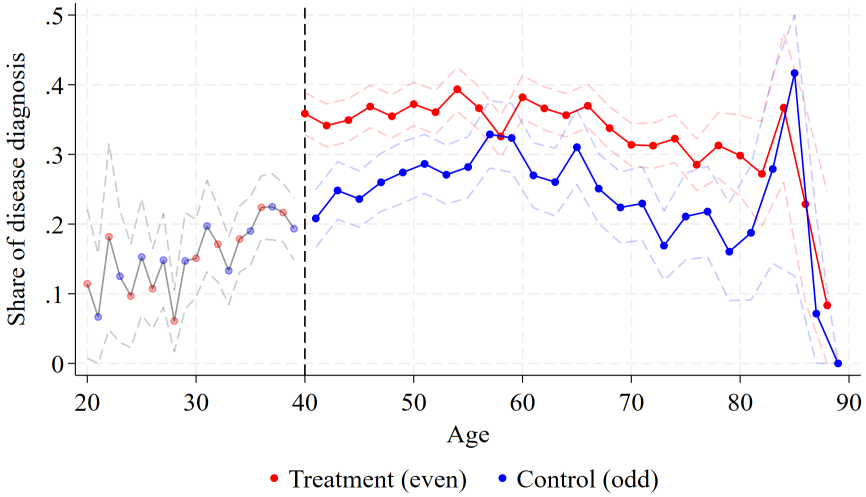
	Treatment	Control
Always-takers	Yes	Yes
Compliers	Yes	No
Defiers	No	Yes
Never-takers	No	No

- We want the policy to target compliers who are likely to have a disease
- 2 reference groups
  - Compliers vs Always-takers $\Rightarrow$ composition of screening participants
  - Compliers vs Never-takers $\Rightarrow$ who shows positive health behavior?

Compliers are more likely to be diagnosed with a disease than always-takers



Compliers are more likely to be diagnosed with a disease than always-takers



1. Estimate Always- and Never-takers characteristics

- Individually identifiable always- and never-takers

	Treatment group	Control group
Always-takers	Yes	Yes
Compliers	Yes	No
Never-takers	No	No

- Estimating equation

$$y_{it} = \beta_0 + \beta_1 treat_{it} + \beta_2 screen_{it} + \beta_3 treat_{it} \times screen_{it} + \nu_{it} \tag{4}$$

- Average characteristics
  - Always-takers: $g_{AT}(y) = \hat{\beta}_0 + \hat{\beta}_2$
  - Never-takers: $g_{NT}(y) = \hat{\beta}_0 + \hat{\beta}_1$

2. Back out complier characteristics

- Treated compliers in the treatment group, untreated compliers in the control group

	Treatment group	Control group
Always-takers	Yes	Yes
Compliers	Yes	No
Never-takers	No	No

- Estimating equation

$$y_{it} = \beta_0 + \beta_1 treat_{it} + \beta_2 screen_{it} + \beta_3 treat_{it} \times screen_{it} + \nu_{it} \tag{5}$$

- Those getting screened in the treatment group

$$\begin{aligned} g_T(y) &= \frac{\pi_{AT}}{\pi_{AT} + \pi_C} g_{AT}(y) + \frac{\pi_C}{\pi_{AT} + \pi_C} g_C^1(y) \\ &= \hat{\beta}_0 + \hat{\beta}_1 + \hat{\beta}_2 + \hat{\beta}_3 \end{aligned}$$

- Those not getting screened in the control group

$$\begin{aligned} g_U(y) &= \frac{\pi_{NT}}{\pi_{NT} + \pi_C} g_{NT}(y) + \frac{\pi_C}{\pi_{NT} + \pi_C} g_C^0(y) \\ &= \hat{\beta}_0 \end{aligned}$$

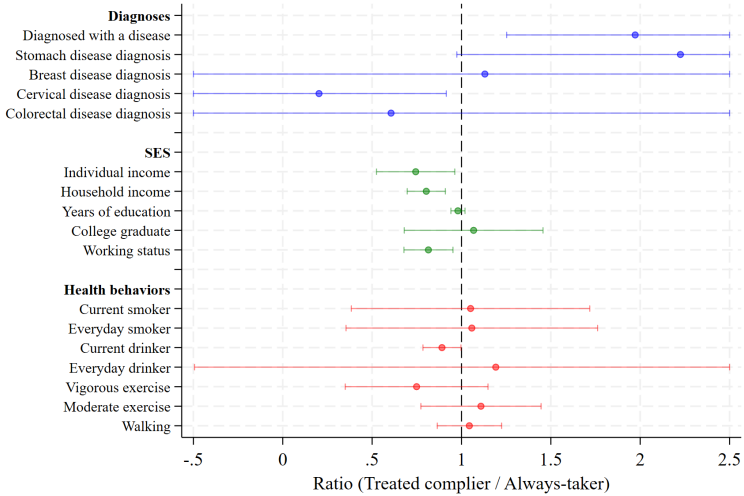
3. Compare compliers to always- and never-takers

- Taking ratios
  - Treated compliers to always-takers: $g_C^1(y)/g_{AT}(y)$
  - Untreated compliers to never-takers: $g_C^0(y)/g_{NT}(y)$

- Why differentiate between treated and untreated compliers?
  - Characteristics in the same year
  - Unclear pre-determined characteristics
  - Difference between treated and untreated complier characteristics = LATE

- Minor details in estimation
  - Age = 40
  - Standard error calculated with bootstrap with clustering at individual level (500 replications)

Compliers vs Always-takers using age 40 discontinuity



Cervical

Compliers vs Always-takers by comparing even and odd ages

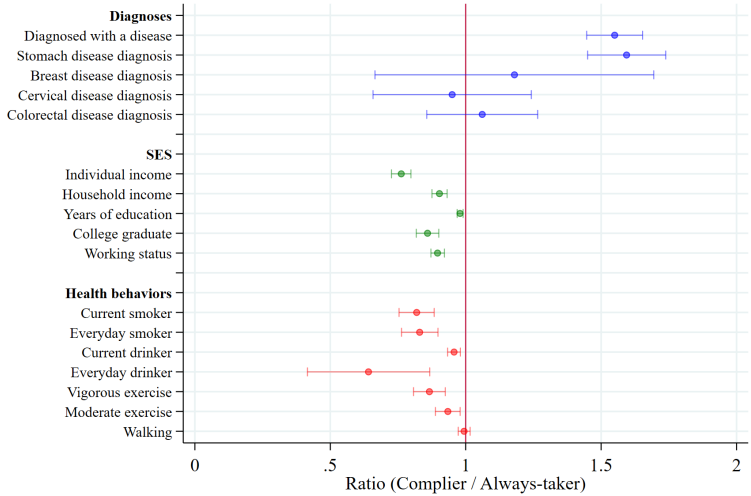
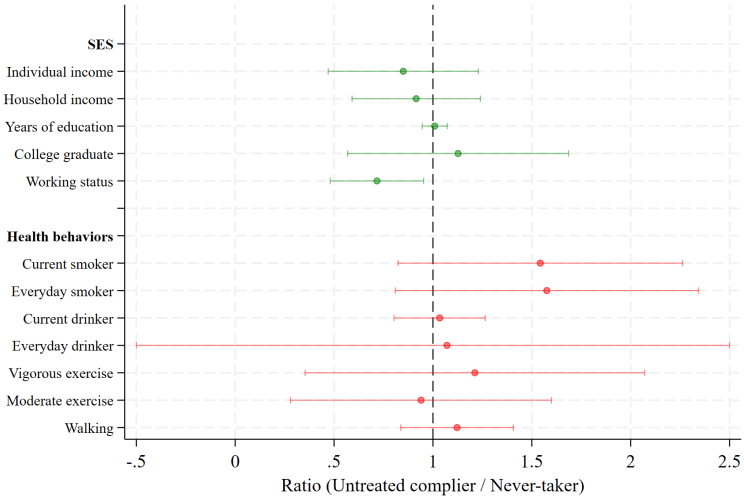


Table Screening results Medical tests Health care

Compliers vs Never-takers using age 40 discontinuity



Compliers vs Never-takers by comparing even and odd ages

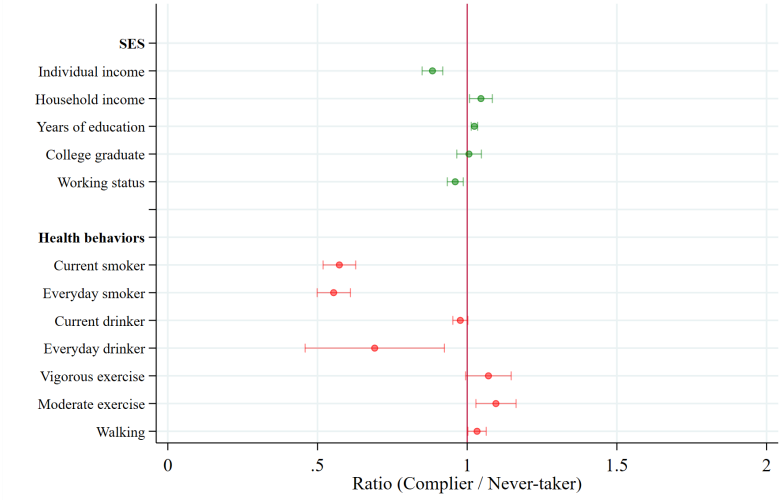


Table Health care

Summary of compliers with subsidies

- Compliers are negatively selected on income
  - Lower SES (income, edu)
  - More likely to be diagnosed with a disease
  - Less likely to smoke, drink and exercise
- Compliers are positively selected on health behaviors
  - Positive correlation in health behaviors (Oster, 2020)
- Opposite selection pattern compared to Einav et al. (2020)
  - Einav et al. (2020): Mammogram starting age recommendation based on medical studies
  - This study: Subsidizing 90-100% of screening costs

  $\Rightarrow$ Subsidies better target those who are more likely to benefit from screenings

Literature Einav et al. (2020)

Compliers to inter-screening spillover

- Among biennial screening participants, who shows spillover effect and participate in annual- and no-subsidy screenings?
- There are no always-takers (one-sided noncompliance)
  $\Rightarrow$ comparison between compliers and never-takers
- Compliers are
  - Less likely to be diagnosed with a breast and cervical disease
  - More likely to be from higher socioeconomic background
  - More likely to smoke, drink, and exercise

Regression

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Effect of screening on diagnoses

- Does health screening lead to new diagnoses?
  - How to measure diagnoses
    - Health screening results
    - **Outpatient care data**
  - Number of first hospital visits for a new illness
    - ⇒ First visit vs recurring visit
    - ⇒ Diagnosis code (ICD-10)
- Two-stage least square estimation

$$y_{it} = \eta + \lambda \cdot screen_{it} + f(age_{it}) + \mu_{it} \tag{6}$$

  - $screen_{it}$ is instrumented by age_even_{it}
  - Standard error clustered at individual level
  - Westfall-Young adjusted p-values for multiple hypotheses testing (Jones et al., 2019)
  - Only capture short-run effect

Effect of screening on diagnoses

	(1)	(2)	(3)	(4)	(5)
	Control mean	ITT	LATE	Adjusted p-values	N
Panel A. Health care utilizations					
Outpatient visit	20.7796	0.0713	0.3494	0.886	107183
		(0.0757)	(0.3713)		
Inpatient visit	0.2329	0.0056	0.0272	0.702	107183
		(0.0039)	(0.0192)		
Emergency visit	0.1252	−0.0024	−0.0117	0.886	107183
		(0.0026)	(0.0127)		
Panel B. First outpatient visits					
First outpatient visit	3.9160	0.0607***	0.2976***	0.003	107183
		(0.0152)	(0.0747)		
First outpatient visit for a cancer	0.0160	0.0029***	0.0143***	0.123	107183
		(0.0011)	(0.0055)		
Stomach cancer	0.0023	0.0007	0.0037	0.675	107183
		(0.0004)	(0.0024)		
Breast cancer	0.0033	0.0016**	0.0086**	0.352	56923
		(0.0008)	(0.0042)		
Cervical cancer	0.0003	−0.0001	−0.0007	0.886	56923
		(0.0002)	(0.0009)		
Liver cancer	0.0009	0.0002	0.0071	0.886	107183
		(0.0003)	(0.0104)		
Colorectal cancer	0.0019	0.0005	0.0150	0.807	107183
		(0.0004)	(0.0126)		
Lung cancer	0.0020	0.00001	0.0011	0.988	107183
		(0.00042)	(0.0666)		
Prostate cancer	0.0032	−0.0011	−0.1525	0.675	50260
		(0.0007)	(0.0994)		

Effect of screening on short-term mortality

- National Vital Statistics death certificate data
  - All individual level deaths (1997-2017)
  - Death age
  - Cause of deaths
- Registered population data
  - Population for each age and year
- Reduced form regression

$$mort_{ay} = \nu + \omega \cdot age\_even_a + f(age_a) + \xi_{ay} \tag{7}$$

  - Mortality: number of deaths per 1,000 people
  - Weighted by population
  - Robust standard errors used
  - Short-term effect within at most 1 year

Effect of screening on short-term mortality

	(1)	(2)	(3)	(4)
	Total	Cancer	Cardiovascular	Other
Age even	0.035	0.007	0.008	0.020
	(0.169)	(0.036)	(0.064)	(0.081)
N	945	945	945	945
Age controls	Y	Y	Y	Y
Control group mean	20.053	6.684	6.684	6.684

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Conclusion

1. Biennial screening policy **raises screening rate** by 20%P from 12%.
2. There is **spillover in take-up** across different types of screening and between spouses.
3. Subsidizing screening induces **compliers negatively selected on income and health conditions** compared to always-takers.
4. Subsidizing screening **increases first hospital visits for new diseases.**

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High risk group for liver screening

1. Individuals with the following diseases
   - Cirrhosis
   - Chronic liver disease
2. Individuals who were diagnosed with positive results in the previous year general health screening
   - Hepatitis B surface antigen test
   - Hepatitis C virus HCV antibody test

   $\Rightarrow$ can be found through blood test
3. Individuals who used medical services for the following diseases in the past two years are excluded
   - Liver cell carcinoma, hepatocellular carcinoma and liver cancer (C22.0)
   - Intrahepatic bile duct carcinoma and Cholangiocarcinoma (C22.1)

back

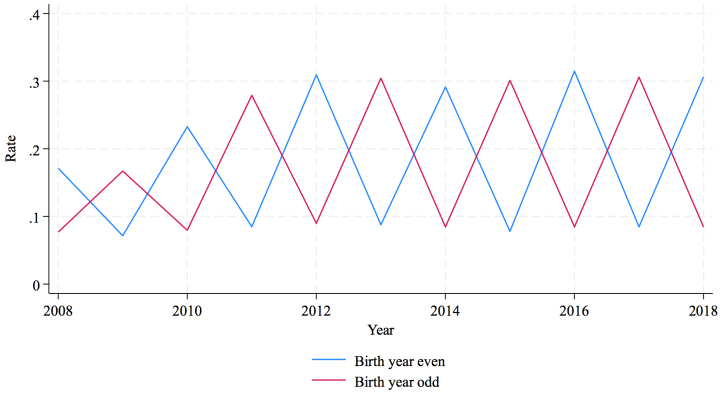
Previous studies

- $>^{Kim}$: Kim and Lee (2017) $>^{Einav}$: Einav et al. (2020) $>^{Kw}$: Kowalski (2023)

	Always-takers	Compliers	Never-takers
Health conditions (Cancer incidence, all-cause mortality)		Kim > $Einav$ < $Park$	Kim > $Einav$ > Kw
Socioeconomic status (Income, education)		$Einav$ ≈ $Park$	$Einav$ > $Park$ ≈
Health Behaviors (Smoking, drinking)		Kw > $Einav$ ≈ $Park$	Kw > $Einav$ > $Park$

back

First stage by birth year



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Comparison with administrative dataset

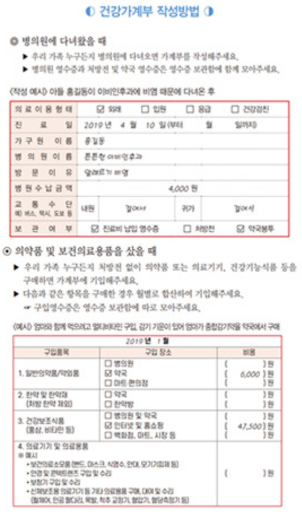
	Health panel survey	Administrative panel
N / year	18,000	1,000,000
Used by		Kim and Lee (2017) Kim et al. (2019)
Unit of sampling	Household	Individual
Health behavior	Every year	Conditional on screening
First visit for an illness	Yes	No
Demographic & SES	Detailed	Limited

back

Health care usage data collection

- Recording health care usage
  - Survey participants are asked to keep health diary and store receipts from every visit to hospitals and pharmacies
- No gap
  - During annual interviews, enumerator goes through health diary from the last time of interview

Health diary



◐ 건강가계부 작성방법 ◑

◎ 병의원에 다녀왔을 때

▶ 우리 가족 누구든지 병의원에 다녀오면 가계부를 작성해주세요.

▶ 병의원 영수증과 처방전 및 약국 영수증은 영수증 보관함에 함께 모아주세요.

(작성 예시) 아들 홍길동이 이비인후과에 비염 때문에 다녀온 후

의료이용형태	☑ 외래 ☐ 입원 ☐ 응급 ☐ 건강검진			
진료일	2019년 4월 10일(부터 월 일까지)			
가구원 이름	홍길동			
병의원 이름	튼튼한 이비인후과			
방문 이유	알레르기 비염			
병원수납금액	4,000 원			
교통수단 예) 버스, 택시, 도보 등	내원	걸어서	귀가	걸어서
보관 여부	☑ 진료비 납입 영수증 ☐ 처방전 ☑ 약국봉투			

◉ 의약품 및 보건의료용품을 샀을 때

▶ 우리 가족 누구든지 처방전 없이 의약품 또는 의료기기, 건강기능식품 등을 구매하면 가계부에 기입해주세요.

▶ 다음과 같은 항목을 구매한 경우 월별로 합산하여 기입해주세요.

☞ 구입영수증은 영수증 보관함에 따로 모아주세요.

(예시) 엄마와 함께 먹으려고 멀티비타민 구입, 감기 기운이 있어 엄마가 종합감기약을 약국에서 구매

2019년 1월		
구입품목	구입 장소	비용
1. 일반의약품/약외품	☐ 병의원 ☑ 약국 ☐ 마트·편의점	( )원 (6,000)원 ( )원
2. 한약 및 한약재 (처방 한약 제외)	☐ 약국 ☐ 한약방	( )원 ( )원
3. 건강보조식품 (홍삼, 비타민 등)	☐ 병의원 및 약국 ☑ 인터넷 및 홈쇼핑 ☐ 백화점, 마트, 시장 등	( )원 (47,500)원 ( )원
4. 의료기기 및 의료용품 ※ 예시 • 보건의료소모품(밴드, 마스크, 식염수, 안대, 모기기피제 등) • 안경 및 콘택트렌즈 구입 및 수리 • 보청기 구입 및 수리 • 신체보조용 의료기기 등 기타 의료용품 구매, 대여 및 수리 (휠체어, 인공 팔다리, 목발, 척추 교정기, 혈압기, 혈당측정기 등)		( )원

<How to write health diary>

- Visit to hospital
  - Record it for all the household members
  - Store hospital receipts, prescriptions and pharmacy receipts in a box

<Example> After a visit to ENT for allergy

Type	□Outpatient □Inpatient □ Emergency □ Screening			
Date	From: April 10, 2019 To:			
Name	John Doe			
Name of the hospital	Dr. Jane M. Doe, MD			
Purpose	Allergy			
Hospital bills	$40			
Transportation	To	Walking	From	Walking
Receipts	□ Hospital □ Prescription □ Pharmacy			

- Purchase of OTC drugs, oriental medicine, dietary supplements
  - Record it for all the household members
  - Store hospital receipts, prescriptions and pharmacy receipts in a box

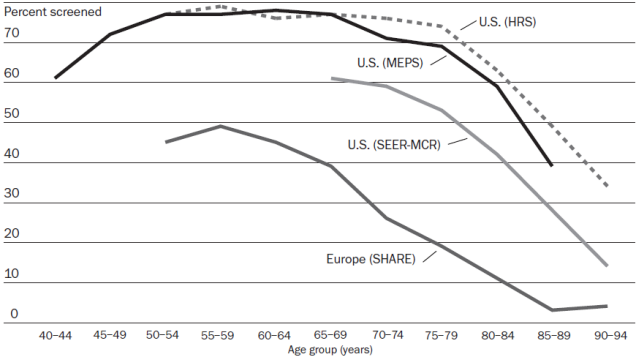
<Example> Purchase of multivitamin and Tylenol

January 2019		
Item	Place	Cost
OTC drugs	□ Hospital □ Pharmacy □ CVS	{ } KRW { } KRW { } KRW
Oriental medicine	□ Pharmacy □ Acupuncture clinic	{ } KRW { } KRW
Dietary supplement (ginseng, vitamin, etc)	□ Hospital or pharmacy □ Internet shopping □ Department store	{ } KRW { } KRW { } KRW
Any other medical products (e.g.) - Bandage, mask, insect repellent - Glasses, contact lenses - Hearing aid		{ } KRW

back

Breast screening in the US and Europe (Howard et al., 2009)

EXHIBIT 3
Receipt Of Mammography In The Past Two Years Among Women Ages 44–94 In Europe And The United States, By Age Group, 2004

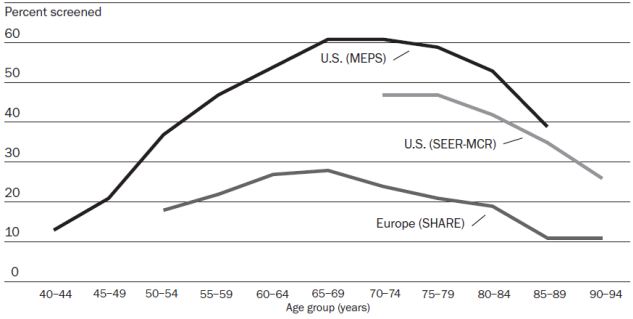


SOURCES: U.S. screening rates are from the Medical Expenditure Panel Survey (MEPS), the Health and Retirement Study (HRS), and Surveillance, Epidemiology, and End Results (SEER)–Medicare data (SEER-MCR). European rates are from the Survey of Health, Ageing, and Retirement in Europe (SHARE).

back

Colorectal screening in the US and Europe (Howard et al., 2009)

EXHIBIT 4
Receipt Of Colonoscopy, Sigmoidoscopy, And Fecal Occult Blood Tests Among Women And Men Ages 44–94 In The Past Ten Years In Europe And In The Past Five Years In The United States, By Age Group, 2004



SOURCES: U.S. screening rates are from the Medical Expenditure Panel Survey (MEPS); and Surveillance, Epidemiology, and End Results (SEER)–Medicare data (SEER-MCR). European rates are from the Survey of Health, Ageing, and Retirement in Europe (SHARE).

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Age distribution for $age \in [40, 89]$

back

Robustness: balance table

	(1)	(2)	(3)
	3 years	5 years	7 years
Female	–0.002*	–0.002*	–0.002*
	(0.001)	(0.001)	(0.001)
Currently married	–0.001*	–0.001	–0.001
	(0.001)	(0.001)	(0.001)
Years of education	–0.003	–0.003	–0.003
	(0.008)	(0.008)	(0.008)
Working status	–0.003**	–0.003*	–0.003*
	(0.002)	(0.001)	(0.001)
Individual income	1.1	2.8	1.2
	(5.3)	(5.2)	(5.2)
Household income	0.6	3.2	–4.5
	(15.4)	(14.3)	(14.1)
Own a house	–0.000	–0.000	0.000
	(0.001)	(0.001)	(0.001)
Number of household members	–0.004	–0.004	–0.004*
	(0.003)	(0.003)	(0.003)

back

Bounding: balance table

	(1)	(2)	(3)
	Age $\in$ [39, 89]	Age $\in$ [40, 89]	Age $\in$ [41, 89]
Age	0.521***	–0.543***	0.562***
	(0.026)	(0.026)	(0.025)
Female	–0.001	–0.002**	–0.001
	(0.001)	(0.001)	(0.001)
Currently married	–0.001	0.001	–0.002**
	(0.001)	(0.001)	(0.001)
Years of education	–0.094***	0.093***	–0.107***
	(0.009)	(0.009)	(0.010)
Working status	–0.006***	0.001	–0.007***
	(0.001)	(0.002)	(0.002)
Individual income	–16.235***	20.607***	–24.789***
	(5.470)	(5.508)	(5.618)
Household income	–23.153	17.735	–31.182**
	(14.766)	(14.555)	(14.995)
Own a house	0.003***	–0.002*	0.003**
	(0.001)	(0.001)	(0.001)
Number of household members	–0.027***	0.016***	–0.034***
	(0.003)	(0.003)	(0.003)
N	110121	107183	104153

back

Robustness: first stage

	(1)	(2)	(3)	(4)	(5)
	Any	General	Stomach	Breast	Cervical
Panel A. Linear splines of age					
Interval 3	0.204***	0.187***	0.189***	0.190***	0.163***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Interval 5	0.204***	0.187***	0.189***	0.191***	0.164***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Interval 7	0.204***	0.187***	0.189***	0.190***	0.164***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Panel B. Linear splines with 5 years interval plus additional covariates					
Full controls	0.204***	0.187***	0.190***	0.191***	0.164***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)
Individual FE	0.206***	0.189***	0.191***	0.192***	0.165***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)

back

Bounding: first stage

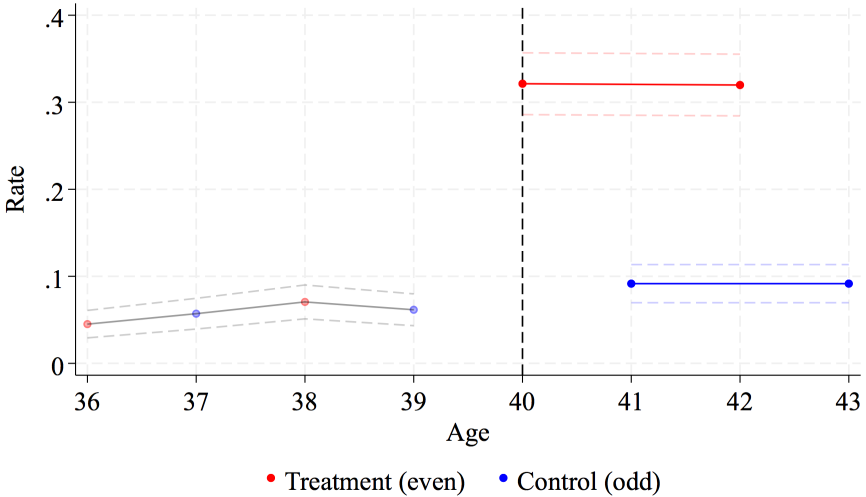
	(1)	(2)	(3)
	Age $\in [39, 89]$	Age $\in [40, 89]$	Age $\in [41, 89]$
Any	0.205***	0.204***	0.204***
	(0.003)	(0.003)	(0.003)
General	0.187***	0.186***	0.188***
	(0.003)	(0.003)	(0.003)
Stomach	0.191***	0.189***	0.190***
	(0.003)	(0.003)	(0.003)
Breast	0.192***	0.191***	0.190***
	(0.003)	(0.004)	(0.004)
Cervical	0.165***	0.165***	0.162***
	(0.003)	(0.003)	(0.003)
N	110121	107183	104153

back

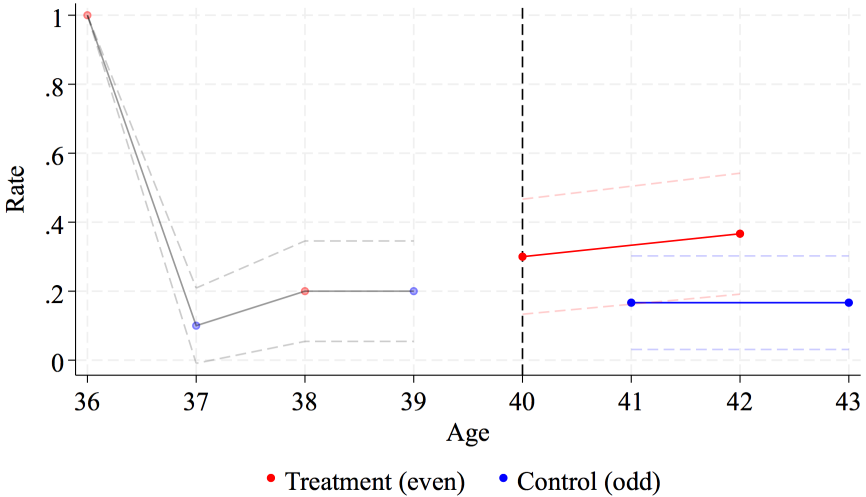
Tracking cohorts around age 40

- Drop in screening rate in odd age group after 40 is a sufficient sign of intertemporal substitution
- Opposing recommendation effect can increase participation in odd age group canceling out substitution effect
- Shut down recommendation effect by examining people who were already participating in screening before 40
  - Track 4 age cohorts around age 40
  - Common age range 36 - 43
  - Examine those who took up screening at age 36, 37, 38 and 39

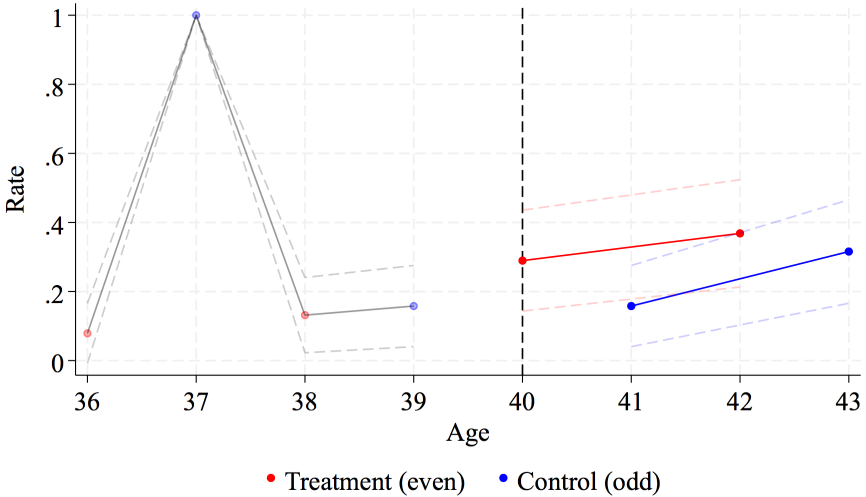
Stomach screening take-up for the 4 cohorts



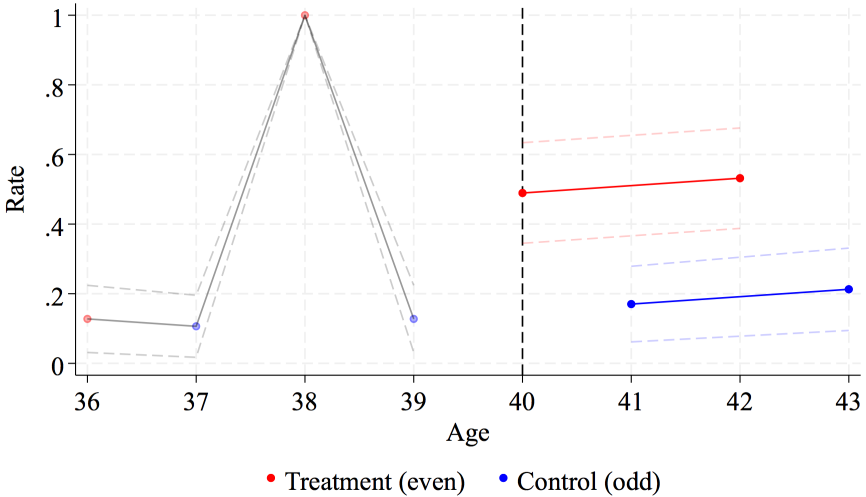
Stomach screening take-up for participants at age 36



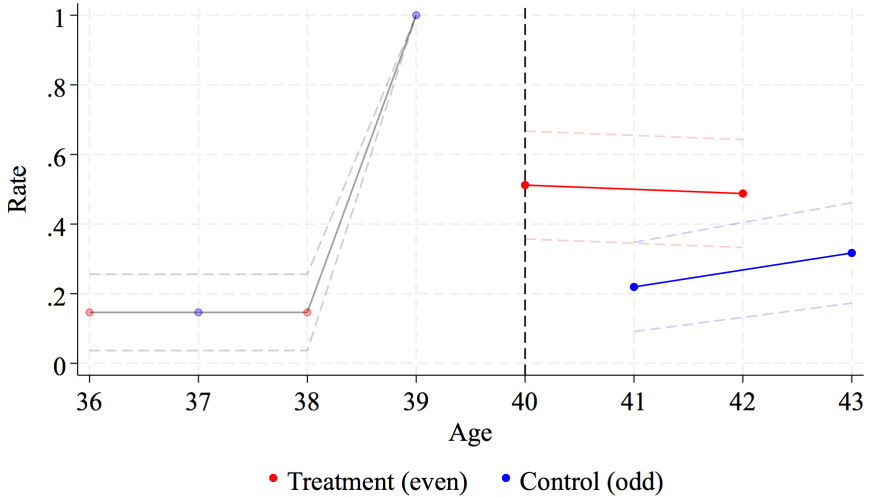
Stomach screening take-up for participants at age 37



Stomach screening take-up for participants at age 38



Stomach screening take-up for participants at age 39



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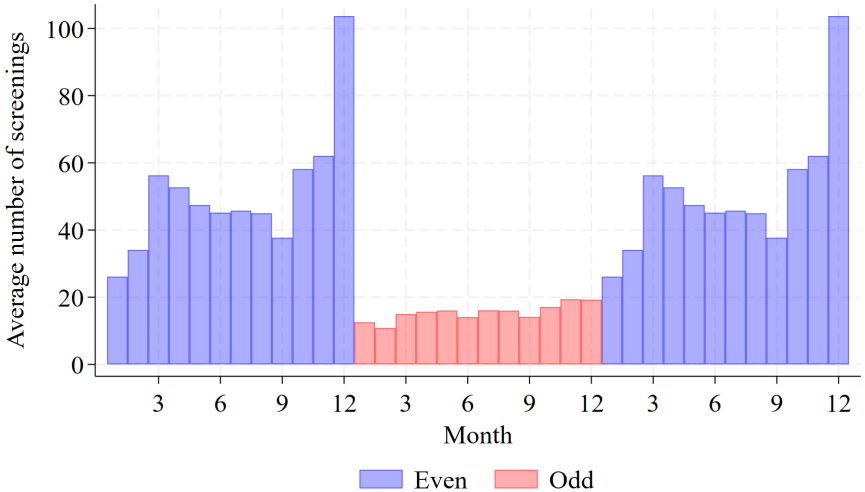
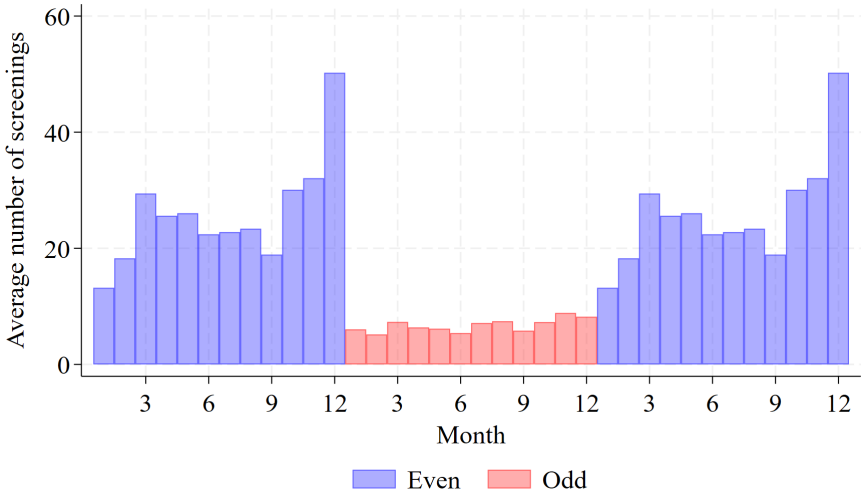
Months of stomach screening for age [40, 89]



back

Months of breast screening for age [40, 89]



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Comparing screening months before and after 40

- Stacked regression

$$screen_{imt} = \gamma_0 + \gamma_1 \cdot after40_{imt} + \gamma_2 \cdot age\_even_{imt} + \sum_{m=2}^{12} month_m \tag{8}$$

$$+ \gamma_3 \cdot after40_{imt} \cdot age\_even_{imt} + \sum_{m=2}^{12} month_m \cdot after40_{imt} + \sum_{m=2}^{12} month_m \cdot age\_even_{imt} \tag{9}$$

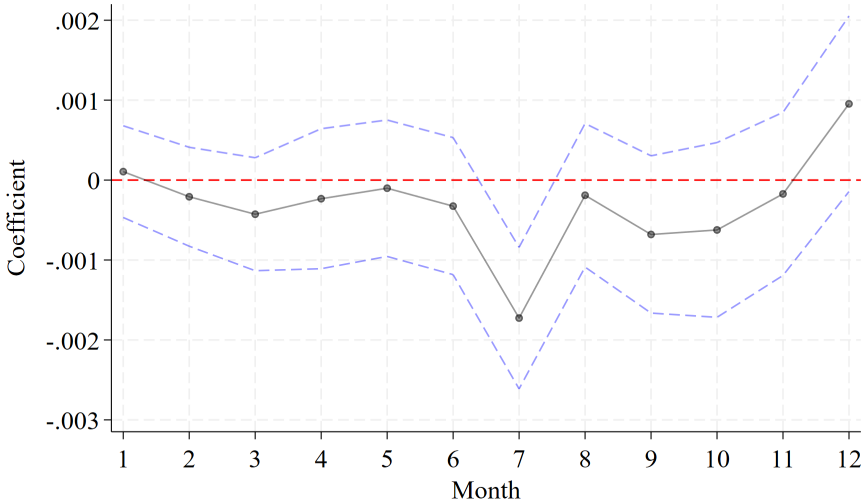
$$+ \sum_{m=2}^{12} month_m \cdot after40_{imt} \cdot age\_even_{imt} \tag{10}$$

  - Stacked by months $\Rightarrow$ Unit of observations: individual-month-year
  - Sample: age $\in$ [20, 89]
  - Standard error clustered at the individual level

Interpretation of coefficients

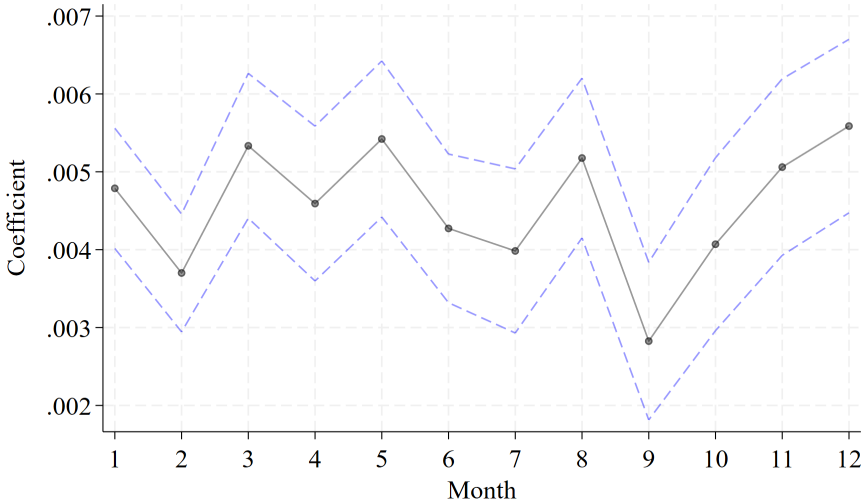
- $\sum_{m=2}^{12} month_m \cdot age\_even_{imt}$
  - $\Rightarrow$ comparison between even and odd before 40
  - $\Rightarrow$ There should be no difference
- $\sum_{m=2}^{12} month_m \cdot above40_{imt}$
  - $\Rightarrow$ comparison between odd ages before and after 40
  - $\Rightarrow$ Jan/Feb/Nov/Dec should show smallest increase
- $\sum_{m=2}^{12} month_m \cdot after40_{imt} + \sum month_m \cdot after40_{imt} \cdot age\_even_{imt}$
  - $\Rightarrow$ comparison between even ages before and after 40

Comparison between even and odd before 40



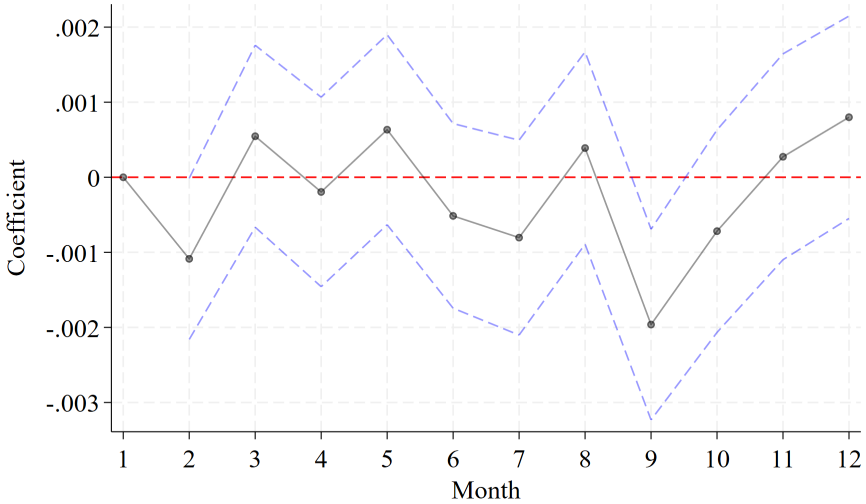
back

Comparison of odd age group before and after 40



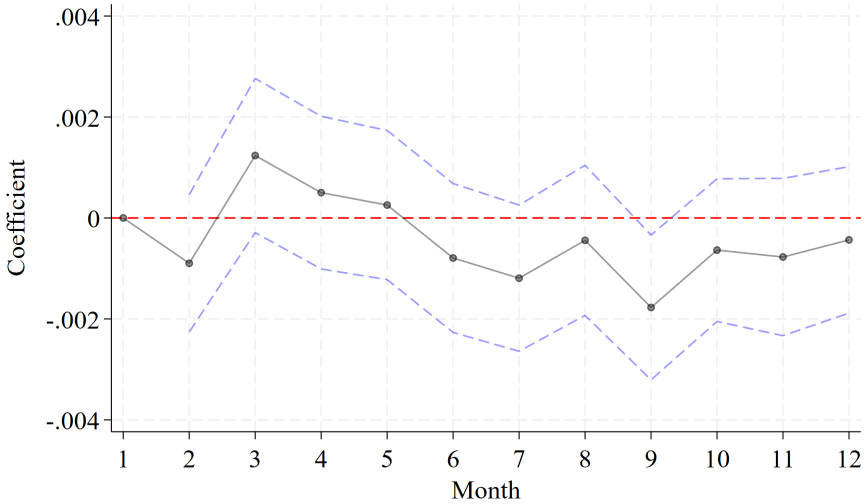
back

Comparison of odd age group before and after 40



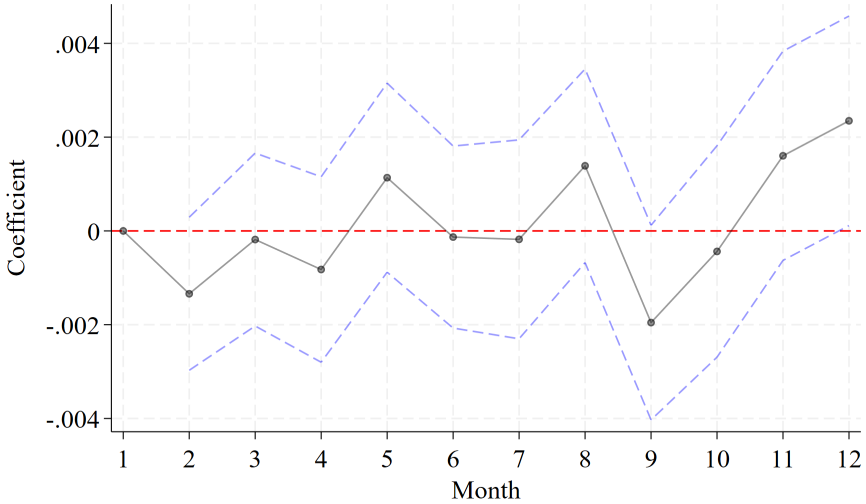
back

Comparison of **low income** odd age group before and after 40



back

Comparison of **high income** odd age group before and after 40



back

Robustness: positive inter-screening spillover

	(1)	(2)	(3)
	No subsidy		Annual subsidy
	Lung	Prostate	Colorectal
Panel A. Linear splines of age			
Interval 3	0.006***	0.007***	0.020***
	(0.001)	(0.001)	(0.002)
Interval 5	0.006***	0.007***	0.020***
	(0.001)	(0.001)	(0.002)
Interval 7	0.006***	0.007***	0.020***
	(0.001)	(0.001)	(0.002)
Panel B. Linear splines with 5 years interval plus additional covariates			
Full controls	0.006***	0.007***	0.020***
	(0.001)	(0.001)	(0.002)
Individual FE	0.006***	0.007***	0.021***
	(0.001)	(0.001)	(0.002)

back

Robustness: negative inter-screening spillover

	(1)	(2)	(3)	(4)
	Liver	Colorectal	Cervical	
	Age odd	Age odd	Age even	Age even × age < 40
Panel A. Linear splines of age				
Interval 3	–0.027***	–0.038***	0.176***	–0.133***
	(0.001)	(0.002)	(0.006)	(0.008)
Interval 5	–0.027***	–0.038***	0.177***	–0.135***
	(0.001)	(0.002)	(0.006)	(0.008)
Interval 7	–0.027***	–0.038***	0.177***	–0.134***
	(0.001)	(0.002)	(0.006)	(0.008)
Panel B. Linear splines with 5 years interval plus additional covariates				
Full controls	–0.027***	–0.038***	0.179***	–0.136***
	(0.001)	(0.002)	(0.006)	(0.008)
Individual FE	–0.028***	–0.038***	0.181***	–0.141***
	(0.001)	(0.002)	(0.006)	(0.008)

back

Bounding: Inter-screening spillover

	(1)	(2)	(3)
	Age $\in$ [39, 89]	Age $\in$ [40, 89]	Age $\in$ [41, 89]
Liver	0.027***	0.027***	0.027***
	(0.001)	(0.001)	(0.001)
Colorectal	0.033***	0.033***	0.034***
	(0.001)	(0.001)	(0.001)
Lung	0.006***	0.006***	0.007***
	(0.001)	(0.001)	(0.001)
Prostate	0.007***	0.007***	0.008***
	(0.001)	(0.001)	(0.001)
N	110121	107183	104153

back

Screening participants in inter-screening spillover

Annual- and no-subsidy screening participants are a subset of biennial subsidy screening participants

- $\Pr(\text{Any biennial screening} = 1 \mid \text{liver screening} = 1) = 0.98$
- $\Pr(\text{Any biennial screening} = 1 \mid \text{colorectal screening} = 1) = 0.96$
- $\Pr(\text{Any biennial screening} = 1 \mid \text{lung screening} = 1) = 0.98$
- $\Pr(\text{Any biennial screening} = 1 \mid \text{prostate screening} = 1) = 0.99$

back

Inter-screening spillover: take-up on the same day with general screening

	(1)	(2)	(3)	(4)
	Liver	Colorectal	Lung	Prostate
$\Pr(\text{general} = 1 \mid \text{screen} = 1)$	0.845	0.801	0.703	0.790
$\Pr(\text{same day} \mid \text{screen} = 1, \text{general} = 1)$	0.948	0.856	0.937	0.960
$\Pr(\text{general first} \mid \text{screen} = 1, \text{general} = 1)$	0.035	0.122	0.044	0.024
$\Pr(\text{general later} \mid \text{screen} = 1, \text{general} = 1)$	0.008	0.177	0.004	0.004

back

Inter-screening spillover: take-up on the same day with general screening

	(1)	(2)	(3)	(4)
	Annual subsidy		No subsidy	
	Liver	Colorectal	Lung	Prostate
Panel A. Outcome: conducted on the same day				
Age even	0.023***	0.024***	0.004***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
N	107183	107183	107183	50260
Control group mean	0.022	0.017	0.006	0.007
Panel B. Outcome: conducted after general screening				
Age even	0.0013***	0.0041***	0.0005***	0.0001
	(0.0002)	(0.0004)	(0.0001)	(0.0001)
N	107183	107183	107183	50260
Control group mean	0.0006	0.0022	0.0002	0.0002
Panel C. Outcome: conducted before general screening				
Age even	0.0003***	0.0063***	0.0001**	0.0001
	(0.0001)	(0.0005)	(0.0000)	(0.0001)
N	107183	107183	107183	50260
Control group mean	0.0002	0.0029	0.0000	0.0000
Sample age range	[40, 89]	[40, 89]	[40, 89]	[40, 89]
Subsidy starting age	40	50		
Age controls	Y	Y	Y	Y

back

Inter-screening spillover: heterogeneity by gender

	(1)	(2)	(3)
	Liver	Colorectal	Lung
Age even	0.025***	0.036***	0.007***
	(0.002)	(0.002)	(0.001)
Age even × Female	0.002	−0.005*	−0.002
	(0.003)	(0.003)	(0.001)
Female	−0.017***	−0.012***	−0.008***
	(0.002)	(0.002)	(0.001)
N	107183	107183	107183
Control group mean	0.028	0.026	0.009

back

Tests for colorectal screening (CDC)

Method	Recommended frequency	Description
Fecal occult blood test (FOBT)	Annual	Use the chemical guaiac to detect blood in the stool
Fecal immunochemical test (FIT)	Annual	Use antibodies to detect blood in the stool
FIT-DNA test	Every 3 years	Combine FIT with a test to detect altered DNA in the stool
Flexible sigmoidoscopy	Every 5 years, or every 10 years with a FIT every year	check for polyps or cancer inside the rectum and lower third of the colon with a short, thin, flexible lighted tube
Colonoscopy	Every 10 years	check for polyps or cancer inside the rectum and the entire colon with longer tube
CT Colonography (Virtual Colonoscopy)	Every 5 years	use X-rays and computers to produce images of the entire colon

back

Spousal spillover in each screening

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	General	Stomach	Liver	Colorectal	Lung	Breast	Cervical	Prostate
Age even	0.162***	0.163***	0.023***	0.029***	0.005***	0.167***	0.155***	0.007***
	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)	(0.004)	(0.004)	(0.001)
Spouse screening	0.059***	0.065***	0.010	0.022***	0.004	0.010	0.003	−0.003
	(0.017)	(0.017)	(0.008)	(0.008)	(0.004)	(0.026)	(0.025)	(0.005)
N	101726	101726	101726	101726	101726	50863	50863	50863

back

Spousal spillover direction

	(1)	(2)	(3)	(4)
	Among wives (husband ⇒ wife)		Among husbands (wife ⇒ husband)	
Even age	0.220***	0.218***	0.142***	0.141***
	(0.004)	(0.004)	(0.004)	(0.004)
Spouse even age	0.007		0.017***	
	(0.004)		(0.004)	
Spouse checkup		0.048		0.079***
		(0.031)		(0.018)
N	50863	50863	50863	50863
Estimator	OLS	2SLS	OLS	2SLS

back

Spousal spillover: take-up on the same day

	(1)	(2)	(3)	(4)	(5)
	Total	Even/Even	Even/Odd	Odd/Even	Odd/Odd
Pr(same day | both participate)	0.423	0.494	0.303	0.362	0.462
Pr(Spouse first | both participate)	0.114	0.132	0.095	0.105	0.096
Pr(Spouse later | both participate)	0.114	0.134	0.088	0.113	0.091

back

Spousal spillover by screening day

	(1)	(2)	(3)	(4)	(5)	(6)
	Outcome var: On the same day		Outcome var: In 30 days before spouse		Outcome var: In 30 days after spouse	
Age even	0.002	0.002	0.004***	0.004***	0.004***	0.004***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Spouse age even	0.002	0.002	0.004***	0.004***	0.003***	0.003***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Age even	0.069***	0.070***	0.014***	0.015***	0.014***	0.015***
× Spouse age even	(0.005)	(0.005)	(0.002)	(0.002)	(0.002)	(0.002)
N	101726	101493	101726	101493	101726	101493
Odd/Odd group mean	0.029	0.029	0.006	0.006	0.006	0.006
Demographic controls		Y		Y		Y
Estimator	OLS	OLS	OLS	OLS	OLS	OLS

back

Complier characterization - Diagnoses

	(1)	(2)	(3)	(4)	(5)	(6)
	Average value				Ratio	
	Always-takers	Treated compliers	Untreated compliers	Never-takers	CP_1/AT	CP_0/NT
Panel A. Diagnoses						
Diagnosed with a disease	0.258	0.399	-	-	1.550***	-
	(0.006)	(0.007)	-	-	(0.053)	-
Stomach disease diagnosis	0.171	0.273	-	-	1.594***	-
	(0.006)	(0.006)	-	-	(0.074)	-
Breast disease diagnosis	0.022	0.026	-	-	1.180	-
	(0.004)	(0.003)	-	-	(0.263)	-
Cervical disease diagnosis	0.069	0.065	-	-	0.950	-
	(0.007)	(0.006)	-	-	(0.149)	-
Colorectal disease diagnosis	0.190	0.202	-	-	1.061	-
	(0.011)	(0.011)	-	-	(0.104)	-

always never

Complier characterization - SES

	(1)	(2)	(3)	(4)	(5)	(6)
	Average value				Ratio	
	Always-takers	Treated compliers	Untreated compliers	Never-takers	CP_1/AT	CP_0/NT
Panel B. SES						
Individual income	2614	1991	1949	2205	0.762***	0.884***
	(55)	(50)	(53)	(40)	(0.018)	(0.018)
Household income	5568	5030	4997	4778	0.903***	1.046**
	(74)	(69)	(95)	(54)	(0.014)	(0.019)
Years of education	14.174	13.880	13.888	13.560	0.979***	1.024***
	(0.066)	(0.068)	(0.081)	(0.046)	(0.006)	(0.005)
College graduate	0.388	0.333	0.335	0.333	0.859***	1.006
	(0.011)	(0.010)	(0.011)	(0.009)	(0.021)	(0.021)
Working status	0.796	0.713	0.724	0.754	0.896***	0.960***
	(0.010)	(0.010)	(0.012)	(0.008)	(0.013)	(0.014)

always never

Complier characterization - Health behaviors

	(1)	(2)	(3)	(4)	(5)	(6)
	Average value				Ratio	
	Always-takers	Treated compliers	Untreated compliers	Never-takers	CP_1/AT	CP_0/NT
Panel C. Health behaviors						
Current smoker	0.233	0.191	0.171	0.298	0.819***	0.573***
	(0.010)	(0.010)	(0.011)	(0.009)	(0.033)	(0.028)
Everyday smoker	0.218	0.181	0.157	0.284	0.830***	0.554***
	(0.010)	(0.009)	(0.011)	(0.009)	(0.034)	(0.028)
Current drinker	0.849	0.812	0.797	0.816	0.957***	0.977*
	(0.009)	(0.009)	(0.012)	(0.007)	(0.012)	(0.013)
Everyday drinker	0.043	0.028	0.035	0.051	0.641***	0.691***
	(0.005)	(0.005)	(0.006)	(0.004)	(0.115)	(0.119)
Vigorous exercise	0.310	0.268	0.283	0.264	0.866***	1.071*
	(0.009)	(0.009)	(0.012)	(0.007)	(0.030)	(0.039)
Moderate exercise	0.456	0.426	0.426	0.389	0.934***	1.096***
	(0.010)	(0.010)	(0.015)	(0.008)	(0.023)	(0.034)
Walking	0.791	0.786	0.778	0.753	0.994	1.033**
	(0.008)	(0.008)	(0.012)	(0.007)	(0.011)	(0.016)

always never

Complier characterization - Medical tests

	(1)	(2)	(3)
	Average value		Ratio
	Always-takers	Treated Compliers	CP_1 / AT
Panel A. Tests covered by NHIS			
Blood/urine/stool/X-ray	0.801	0.886	1.106***
	(0.005)	(0.006)	(0.012)
Endoscopy	0.574	0.776	1.352***
	(0.007)	(0.008)	(0.024)
Biopsy	0.026	0.031	1.190
	(0.002)	(0.002)	(0.153)
Panel B. Tests not covered by NHIS			
Sonogram	0.319	0.275	0.863***
	(0.007)	(0.007)	(0.031)
CT	0.042	0.016	0.374***
	(0.003)	(0.002)	(0.071)
MRI	0.010	0.006	0.593**
	(0.001)	(0.001)	(0.180)
PET	0.002	–0.000	–0.229***
	(0.001)	(0.000)	(0.266)
EEG	0.002	0.002	0.743
	(0.001)	(0.001)	(0.618)
EKG	0.159	0.127	0.794***
	(0.005)	(0.005)	(0.048)
Bone density	0.033	0.029	0.857
	(0.003)	(0.003)	(0.126)

always never

Complier characterization - Health care usage & expenditures

	(1)	(2)	(3)	(4)	(5)	(6)
	Average value				Ratio	
	Always-takers	Treated compliers	Untreated compliers	Never-takers	CP_1/AT	CP_0/NT
Panel A. Health care utilizations						
Outpatient visit	9.098	10.263	10.007	6.532	1.128**	1.532***
	(0.360)	(0.350)	(0.482)	(0.213)	(0.058)	(0.087)
Inpatient visit	0.089	0.085	0.057	0.117	0.954	0.481***
	(0.012)	(0.011)	(0.020)	(0.009)	(0.167)	(0.176)
Emergency visit	1.221	1.211	1.356	1.332	0.992	1.018
	(0.055)	(0.064)	(0.096)	(0.050)	(0.043)	(0.068)
Panel B. Health care expenditures						
Outpatient expenditure	294931	280914	301873	161079	0.952	1.874***
	(13122)	(13001)	(19773)	(7445)	(0.064)	(0.147)
Inpatient expenditure	67598	75791	97104	79261	1.121	1.225
	(15311)	(13440)	(28395)	(9612)	(0.347)	(0.400)
Emergency expenditure	3467	4475	4642	3811	1.291	1.218
	(713)	(821)	(1742)	(584)	(0.365)	(0.539)

always never

Inter-screening spillover compliers

	(1)	(2)	(3)
	Annual	No-subsidy	Sample mean
Panel A. Diagnoses			
Breast disease diagnosis	–0.006*	–0.019***	0.022
	(0.003)	(0.004)	
Cervical disease diagnosis	–0.018***	–0.022	0.062
	(0.006)	(0.016)	
Panel B. SES			
Individual income	873***	1505***	1595
	(49)	(110)	
Household income	1008***	1392***	4570
	(66)	(146)	
Years of education	0.971***	1.352***	10.778
	(0.072)	(0.127)	
College graduate	0.074***	0.131***	0.197
	(0.007)	(0.014)	
Working status	0.064***	0.142***	0.634
	(0.008)	(0.012)	

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Inter-screening spillover compliers

	(1)	(2)	(3)
	Annual	No-subsidy	Sample mean
Panel C. Health behaviors			
Current smoker	0.044***	0.117***	0.146
	(0.006)	(0.013)	
Everyday smoker	0.041***	0.101***	0.138
	(0.006)	(0.013)	
Current drinker	0.066***	0.150***	0.655
	(0.008)	(0.012)	
Everyday drinker	0.018***	0.034***	0.060
	(0.004)	(0.009)	
Vigorous exercise	0.050***	0.106***	0.235
	(0.007)	(0.014)	
Moderate exercise	0.049***	0.108***	0.409
	(0.008)	(0.015)	
Walking	0.012**	0.030***	0.812
	(0.006)	(0.010)	

back

Screening results

- Screening results
  - Find any disease? $\Rightarrow$ Which disease? (ICD-10)
  - Multiple answers allowed
  - Not available for never-takers

Screening	Take-up	Find a disease	ICD-10 codes
Find disease		32.6%	
Stomach	17.8%	22.8%	ICD-10
Breast	16.3%	2.2%	ICD-10
Cervical	13.9%	6.2%	ICD-10
Colorectal	4.3%	19.8%	ICD-10

back

Disease classifications for stomach

- (K29) Gastritis and duodenitis
- (K52) Other noninfective gastroenteritis and colitis
- (K21) Gastro-oesophageal reflux disease
- (K25) Gastric ulcer
- (B98) Helicobacter pylori
- (K31) Other diseases of stomach and duodenum
- (K20) Esophagitis
- (C16) Malignant neoplasm of stomach
- (K26) Duodenal ulcer

back

Disease classifications for breast

- (N63) Unspecified lump in breast
- (N64) Other disorders of breast
- (D24) Benign neoplasm of breast
- (N60) Benign mammary dysplasia
- (C50) Malignant neoplasm of breast

back

Disease classifications for female reproductive system

- (N76) Other inflammation of vagina and vulva
- (N71) Inflammatory disease of uterus, except cervix
- (N85) Other noninflammatory disorders of uterus, except cervix
- (N83) Noninflammatory disorders of ovary, fallopian tube and broad ligament

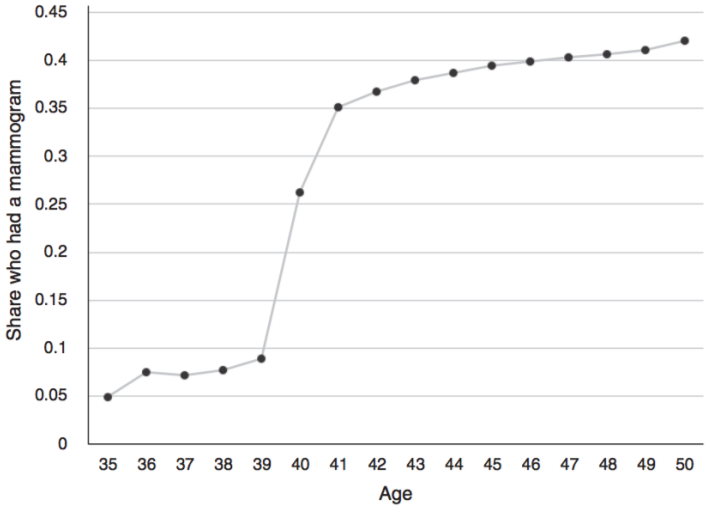
back

Disease classifications for colon and rectum

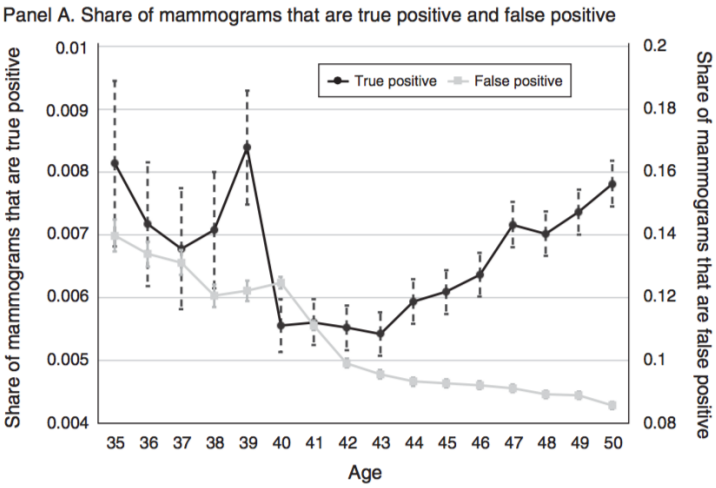
- (K63) Other diseases of intestine
- (D12) Benign neoplasm of colon, rectum, anus and anal canal
- (D13) Benign neoplasm of other and ill-defined parts of digestive system
- (R19) Other symptoms and signs involving the digestive system and abdomen
- (C18) Malignant neoplasm of colon

back

Einav et al. (2020) AER



Einav et al. (2020) AER



Complier vs Always-taker Selection summary