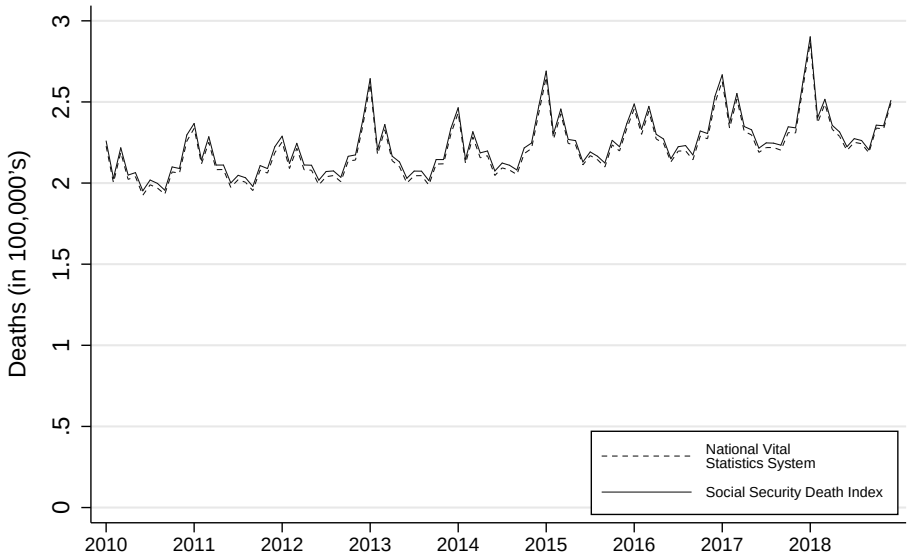
Online Appendix to Health Insurance and Mortality: Experimental Evidence from Taxpayer Outreach

Jacob Goldin, Ithai Z. Lurie, and Janet McCubbin

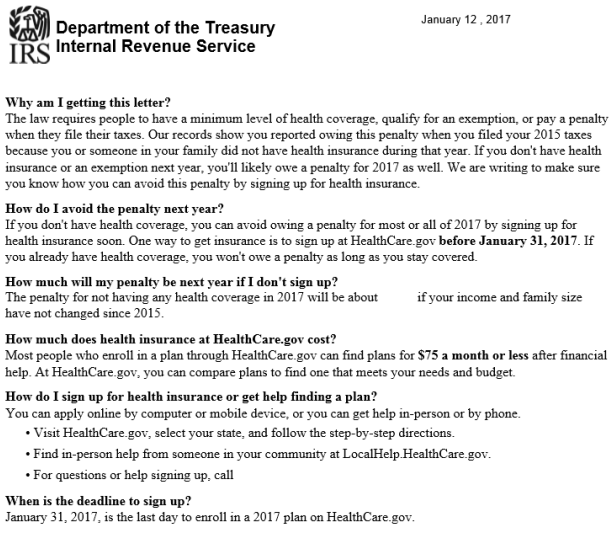
Figure A.I
Social Security Death Index Data Check



Notes: The figure compares monthly deaths recorded in the Social Security Death Index and the National Vital Statistics System Mortality Data from 2010 through the end of 2018. Deaths that occur abroad are recorded in the Social Security Death Index but not in the National Vital Statistics System.

Figure A.II
Sample Treatment Letters

(a) Base Letter



Department of the Treasury
Internal Revenue Service

January 12 , 2017

Why am I getting this letter?
The law requires people to have a minimum level of health coverage, qualify for an exemption, or pay a penalty when they file their taxes. Our records show you reported owing this penalty when you filed your 2015 taxes because you or someone in your family did not have health insurance during that year. If you don't have health insurance or an exemption next year, you'll likely owe a penalty for 2017 as well. We are writing to make sure you know how you can avoid this penalty by signing up for health insurance.

How do I avoid the penalty next year?
If you don't have health coverage, you can avoid owing a penalty for most or all of 2017 by signing up for health insurance soon. One way to get insurance is to sign up at HealthCare.gov **before January 31, 2017**. If you already have health coverage, you won't owe a penalty as long as you stay covered.

How much will my penalty be next year if I don't sign up?
The penalty for not having any health coverage in 2017 will be about if your income and family size have not changed since 2015.

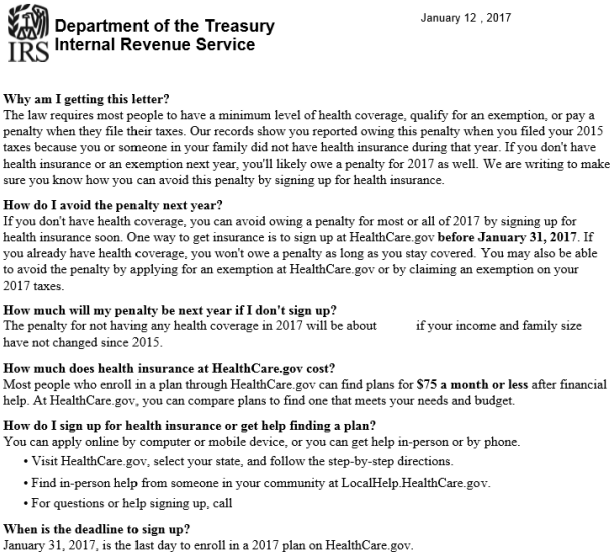
How much does health insurance at HealthCare.gov cost?
Most people who enroll in a plan through HealthCare.gov can find plans for **$75 a month or less** after financial help. At HealthCare.gov, you can compare plans to find one that meets your needs and budget.

How do I sign up for health insurance or get help finding a plan?
You can apply online by computer or mobile device, or you can get help in-person or by phone.

- Visit HealthCare.gov, select your state, and follow the step-by-step directions.
- Find in-person help from someone in your community at LocalHelp.HealthCare.gov.
- For questions or help signing up, call

When is the deadline to sign up?
January 31, 2017, is the last day to enroll in a 2017 plan on HealthCare.gov.

(b) Exemption Information



Department of the Treasury
Internal Revenue Service

January 12 , 2017

Why am I getting this letter?
The law requires most people to have a minimum level of health coverage, qualify for an exemption, or pay a penalty when they file their taxes. Our records show you reported owing this penalty when you filed your 2015 taxes because you or someone in your family did not have health insurance during that year. If you don't have health insurance or an exemption next year, you'll likely owe a penalty for 2017 as well. We are writing to make sure you know how you can avoid this penalty by signing up for health insurance.

How do I avoid the penalty next year?
If you don't have health coverage, you can avoid owing a penalty for most or all of 2017 by signing up for health insurance soon. One way to get insurance is to sign up at HealthCare.gov **before January 31, 2017**. If you already have health coverage, you won't owe a penalty as long as you stay covered. You may also be able to avoid the penalty by applying for an exemption at HealthCare.gov or by claiming an exemption on your 2017 taxes.

How much will my penalty be next year if I don't sign up?
The penalty for not having any health coverage in 2017 will be about if your income and family size have not changed since 2015.

How much does health insurance at HealthCare.gov cost?
Most people who enroll in a plan through HealthCare.gov can find plans for **$75 a month or less** after financial help. At HealthCare.gov, you can compare plans to find one that meets your needs and budget.

How do I sign up for health insurance or get help finding a plan?
You can apply online by computer or mobile device, or you can get help in-person or by phone.

- Visit HealthCare.gov, select your state, and follow the step-by-step directions.
- Find in-person help from someone in your community at LocalHelp.HealthCare.gov.
- For questions or help signing up, call

When is the deadline to sign up?
January 31, 2017, is the last day to enroll in a 2017 plan on HealthCare.gov.

(c) Non-Personalized



Department of the Treasury
Internal Revenue Service

January 12 , 2017

Why am I getting this letter?
The law requires most people to have a minimum level of health coverage, qualify for an exemption, or pay a penalty when they file their taxes. Our records show you reported owing this penalty when you filed your 2015 taxes because you or someone in your family did not have health insurance during that year. If you don't have health insurance or an exemption next year, you'll likely owe a penalty for 2017 as well. We are writing to make sure you know how you can avoid this penalty by signing up for health insurance.

How do I avoid the penalty next year?
If you don't have health coverage, you can avoid owing a penalty for most or all of 2017 by signing up for health insurance soon. One way to get insurance is to sign up at HealthCare.gov **before January 31, 2017**. If you already have health coverage, you won't owe a penalty as long as you stay covered.

How much will my penalty be next year if I don't sign up?
The penalty for not having any health coverage in 2017 will be at least $695 per adult and $347 per child (up to $2,085 per family), and could be more, depending on your income.

How much does health insurance at HealthCare.gov cost?
Most people who enroll in a plan through HealthCare.gov can find plans for **$75 a month or less** after financial help. At HealthCare.gov, you can compare plans to find one that meets your needs and budget.

How do I sign up for health insurance or get help finding a plan?
You can apply online by computer or mobile device, or you can get help in-person or by phone.

- Visit HealthCare.gov, select your state, and follow the step-by-step directions.
- Find in-person help from someone in your community at LocalHelp.HealthCare.gov.
- For questions or help signing up, call

When is the deadline to sign up?
January 31, 2017, is the last day to enroll in a 2017 plan on HealthCare.gov.

(d) Spanish

¿Por qué recibo esta carta?
La ley le requiere a la mayoría de las personas tener un nivel mínimo de cobertura médica, calificar para una exención o pagar una multa al presentar sus impuestos. Nuestros registros muestran que usted informó adeudar esta multa cuando presentó sus impuestos del año 2015, porque usted o alguien en su familia no tuvo el seguro médico durante ese año. Si usted no tiene el seguro médico o una exención el próximo año, es probable que también adeude una multa para 2017. Le escribimos para asegurar que usted sabe cómo puede evitar esta multa inscribiéndose a un seguro médico.

¿Cómo puedo evitar la multa el próximo año?
Si usted no tiene la cobertura médica, puede evitar adeudar una multa para la mayor parte o la totalidad del año 2017 inscribiéndose cuanto antes a un seguro médico. Una manera de obtener un seguro, es inscribirse en *CuidadoDeSalud.gov* **antes del 31 de enero de 2017**. Si ya tiene la cobertura médica, usted no adeudará una multa siempre y cuando mantenga su cobertura.

¿Cuánto será mi multa el próximo año si no me inscribo?
La multa en el año 2017 por no tener ninguna cobertura de salud, será aproximadamente si sus ingresos y el tamaño de su familia no han cambiado desde 2015.

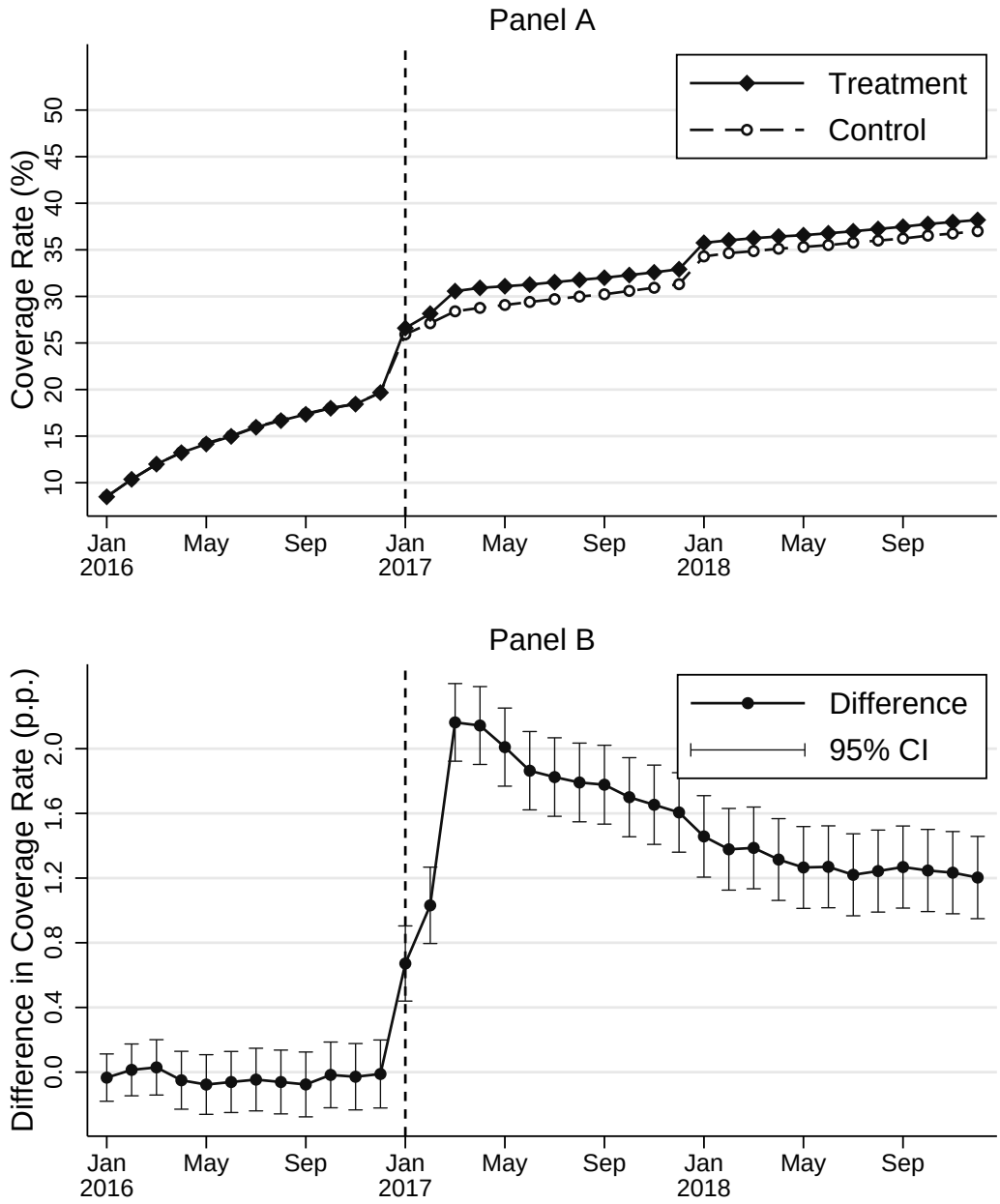
¿Cuánto cuesta el seguro médico en *CuidadoDeSalud.gov*?
La mayoría de las personas que se inscriben en un plan a través de *CuidadoDeSalud.gov*, pueden encontrar planes de **$75 o menos al mes**, después de la ayuda financiera. En *CuidadoDeSalud.gov*, puede comparar los planes para encontrar uno que se ajuste a sus necesidades y presupuesto.

¿Cómo me inscribo a un seguro médico u obtengo ayuda para encontrar un plan?
Puede solicitar en línea por computadora o un dispositivo móvil, o puede obtener ayuda en persona o por teléfono.

- Visite *CuidadoDeSalud.gov*, seleccione su estado y siga las instrucciones paso a paso.
- Encuentre ayuda en persona de alguien en su comunidad, en *LocalHelp.HealthCare.gov*.
- Para preguntas o ayuda para inscribirse, llame al (usuarios de *TTY*:)

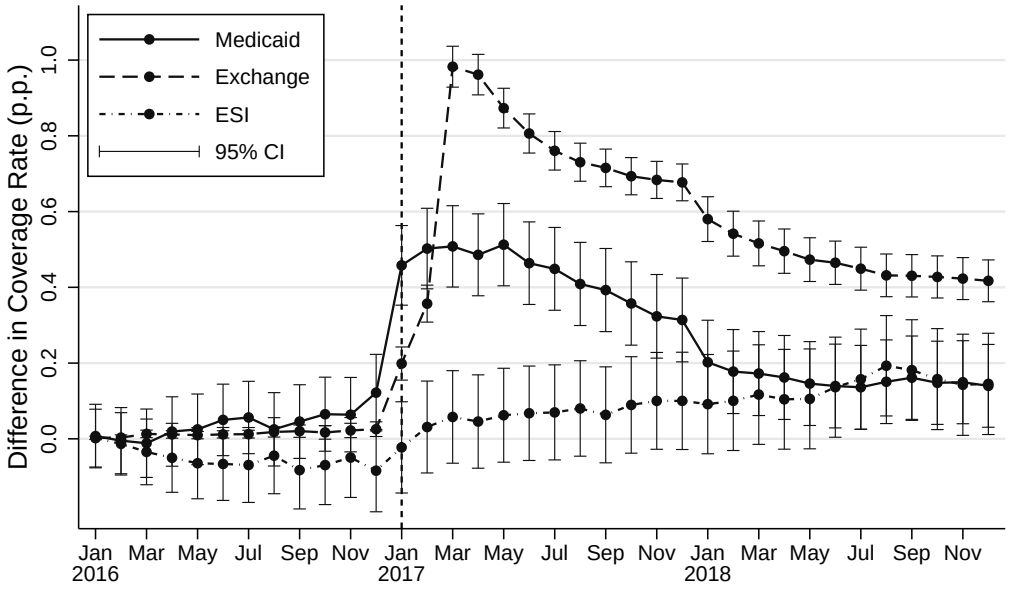
¿Cuándo es la fecha límite para inscribirse?
El 31 de enero de 2017 es el último día para inscribirse en un plan para 2017, en *CuidadoDeSalud.gov*.

Figure A.III
Coverage Effect Among Middle Age Adults



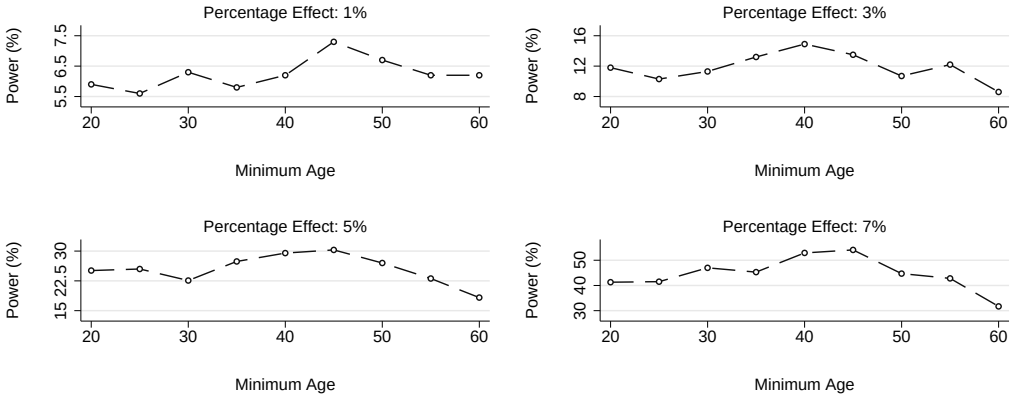
Notes: Panel A displays the shares of middle age adults in the treatment and control groups that were enrolled in any coverage in the specified month. Panel B displays the difference in the share of middle age adults between the treatment and control groups that were enrolled in any coverage in the specified month. Units are percentage points (0−100). Both panels are limited to individuals between the ages of 45 and 64 at the end of 2017 and exclude individuals with full coverage in January through November of 2016. Brackets denote the 95% confidence interval based on standard errors that are clustered by

Figure A.IV
Coverage Effect by Type of Coverage

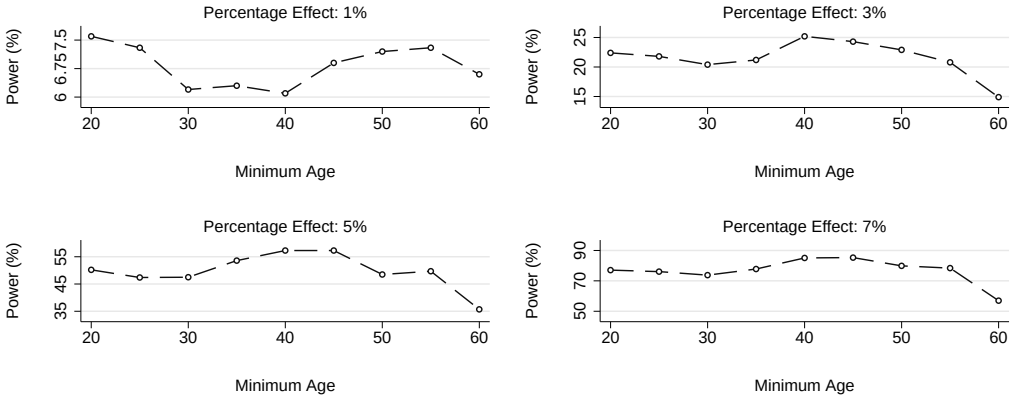


Notes: The figure displays the difference in the share of the treatment and control groups enrolled in Medicaid, Exchange and employer−sponsored coverage in the specified month. Units are percentage points (0−100). The figure excludes individuals with full coverage in January through November of 2016. Brackets denote the 95% confidence interval based on standard errors that are clustered by household.

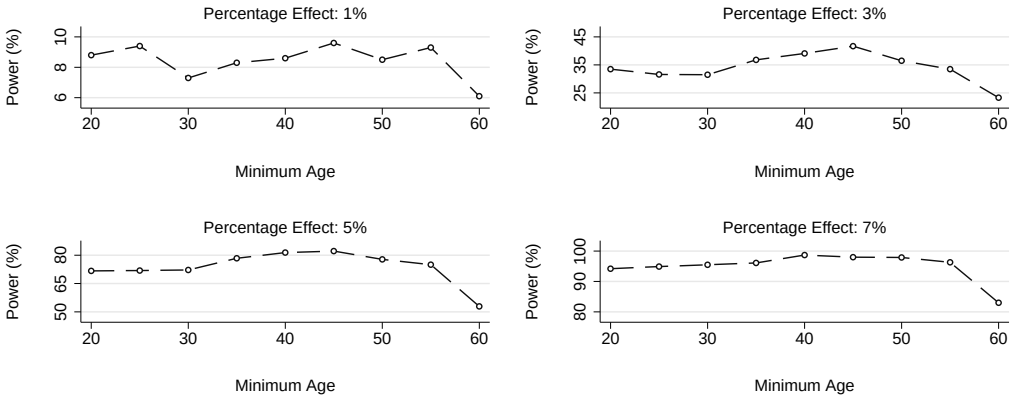
Figure A.V
Probability of Detecting Mortality Effect by Age Range



Uninsured Complier Scalar: 2



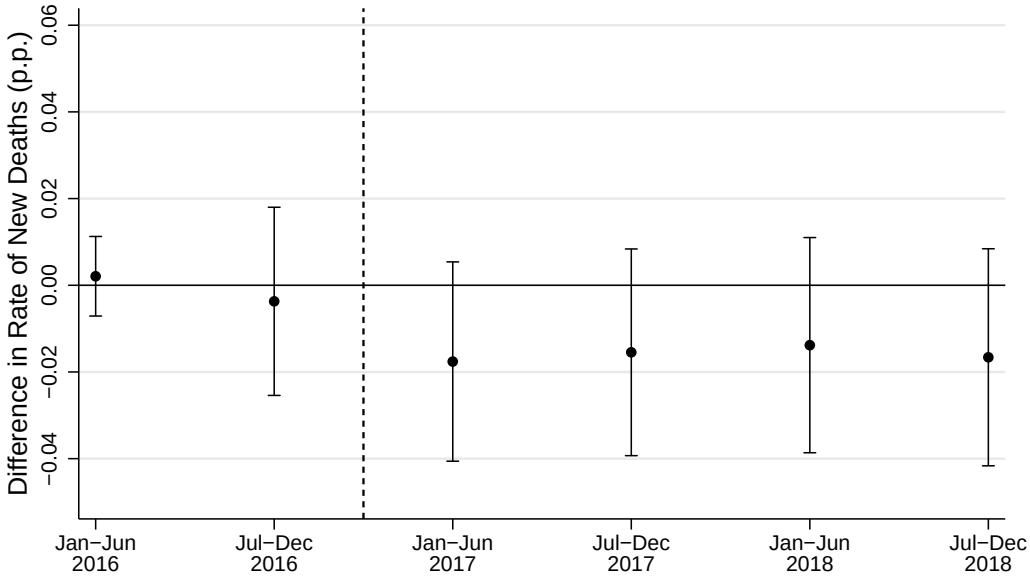
Uninsured Complier Scalar: 3



Uninsured Complier Scalar: 4

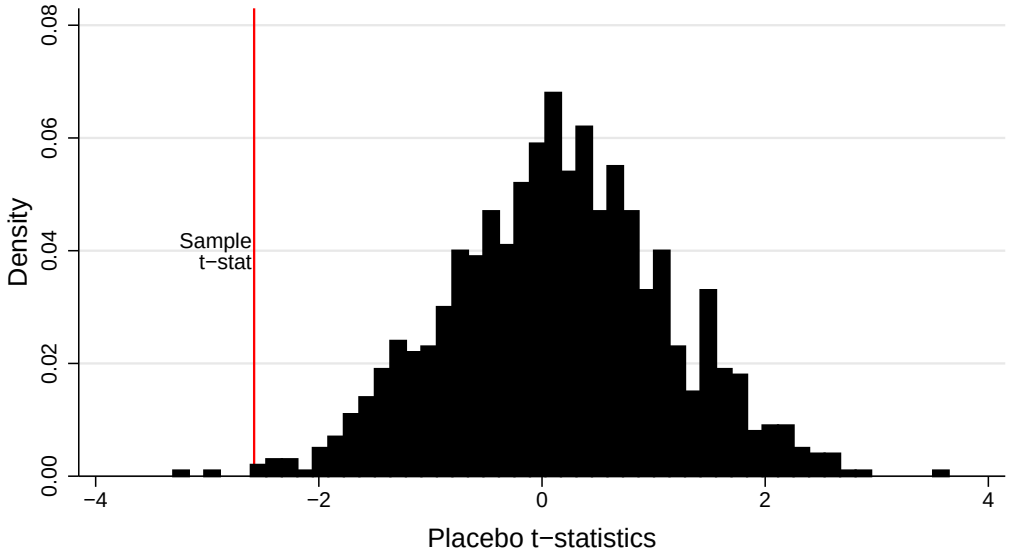
Notes: The figure displays the probability of detecting a difference between treatment and control group mortality at a 5% level of significance, for varying age ranges and mortality effect sizes. Results are based on simulations with N=1000 random draws of treatment and control populations. Within a figure, the x−axis reflects the minimum age included in the analysis; the maximum age is held fixed at 64. The effect of the intervention on coverage for each age range comes from comparing average months of 2017−18 coverage in the treatment and control groups, for individuals with the specified ages that did not have coverage in each month of 2016. The effect of coverage on mortality is alternatively assumed to be a reduction in baseline complier mortality of 1, 3, 5, or 7%. General population mortality is estimated from population−level mortality rates for 2016 from the Social Security Death Index among individuals alive at the end of 2015, aggregated into 5−year age bins. The mortality rate for uninsured compliers, absent insurance, is alternatively assumed to be 2, 3, or 4 times the average mortality rate for the general population.

Figure A.VI
Effect of Intervention on Additional Middle Age Deaths by Period



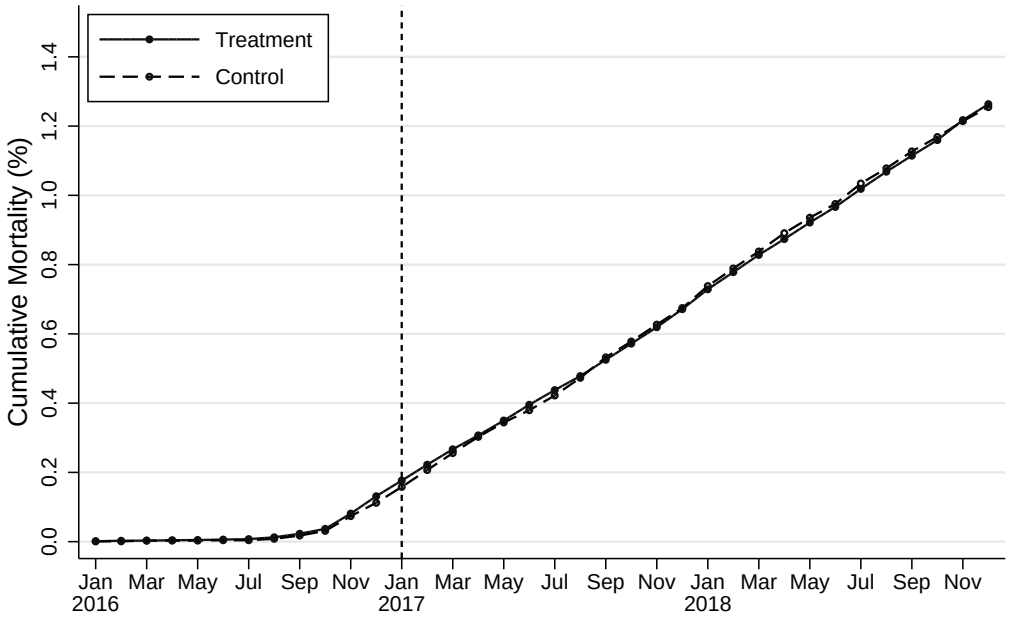
Notes: The figure displays the difference in the mortality rates between middle age adults in the control and treatment groups during the six−month interval extending through the end of the specified month. Units are percentage points (0−100). The analysis is limited to individuals between the ages of 45−64 at the end of 2017 and excludes individuals with full coverage in January through November of 2016. Brackets denote the 95% confidence interval based on standard errors that are clustered by household.

Figure A.VII
Permutation Test for Effect of Intervention on Middle Age Mortality



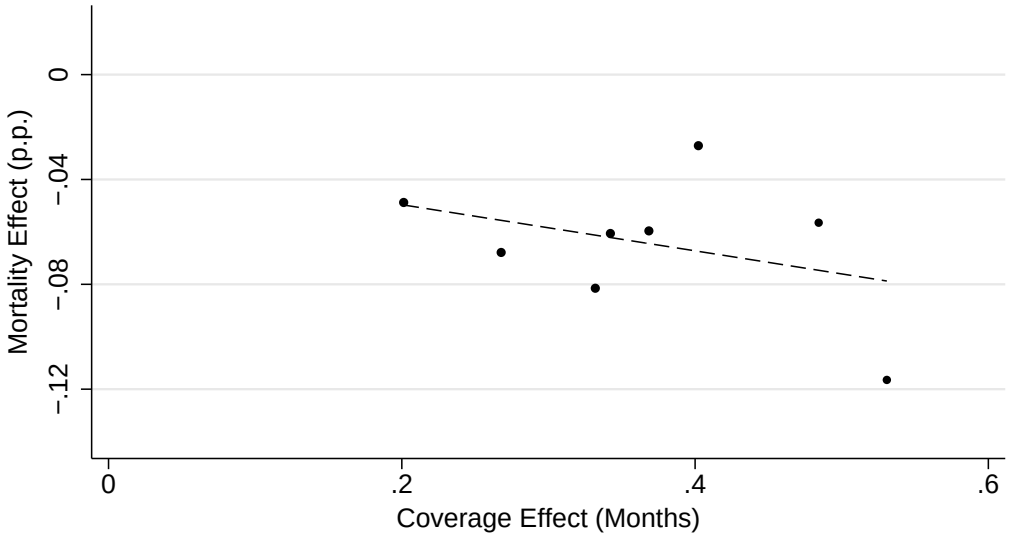
Notes: The figure plots the distribution of t−statistics corresponding to the estimated intent−to−treat effect of the intervention on 2017−18 mortality, generated from 1000 random reassignments of the treatment variable across households in the sample population. The vertical line denotes the t−statistic estimated using the actual treatment assignment. The analysis is limited to individuals between the ages of 45−64 at the end of 2017 and excludes individuals with full coverage in January through November of 2016.

Figure A.VIII
Effect of Intervention on Middle Age Mortality Among Prior-Year Insured



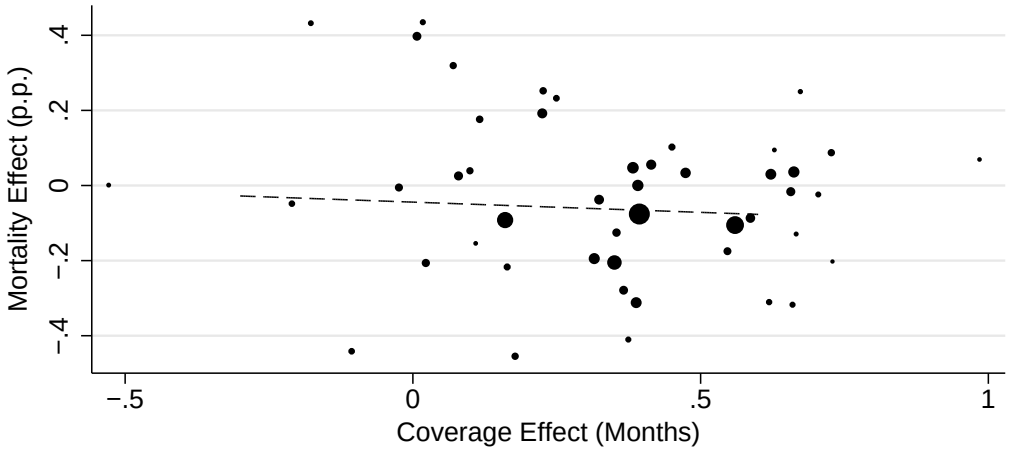
Notes: The figure displays the percentage of middle age adults with full prior−year coverage that died during or prior to the specified month. The analysis is limited to individuals between the ages of 45−64 at the end of 2017 that were enrolled in coverage during each of the first 11 months of 2016.

Figure A.IX
Coverage and Mortality Effects by Treatment Arm Among Middle Age Adults



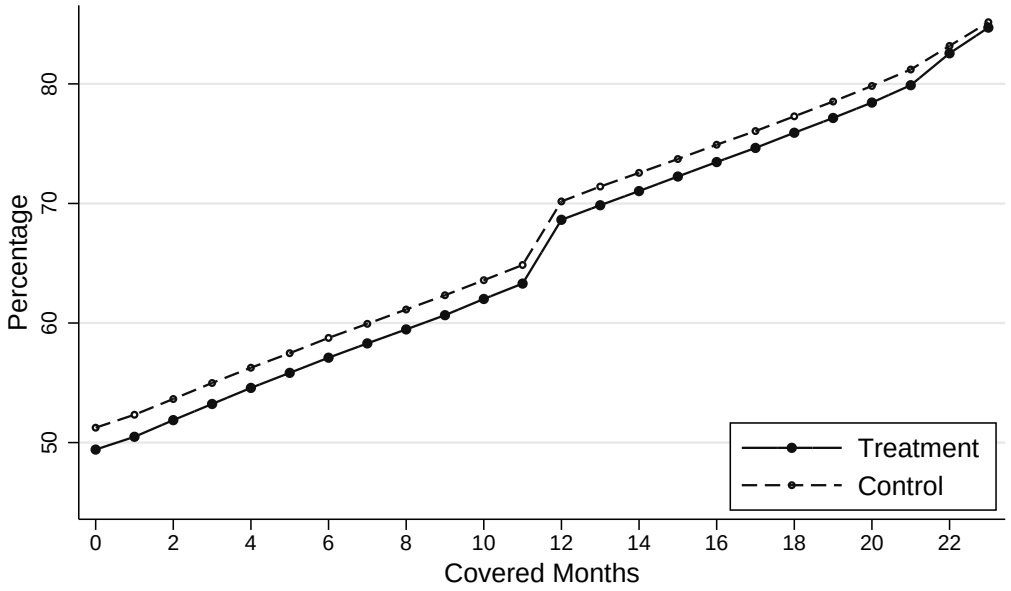
Notes: The figure plots the estimated effect of the intervention on coverage and mortality, separately for each treatment arm. The coverage effect (x−axis) corresponds to the effect of the intervention on the number of months of coverage enrolled in during 2017−18. The mortality effect (y−axis) corresponds to the effect of the intervention on mortality in 2017−18; units are percentage points (0−100). All analyses are limited to individuals between the ages of 45−64 at the end of 2017 and exclude individuals with full coverage in January through November of 2016. The best linear fit (dashed line), weighted by cell sample size, has a slope of −0.088, with standard error 0.094.

Figure A.X
Coverage and Mortality Effects by State Among Middle Age Adults



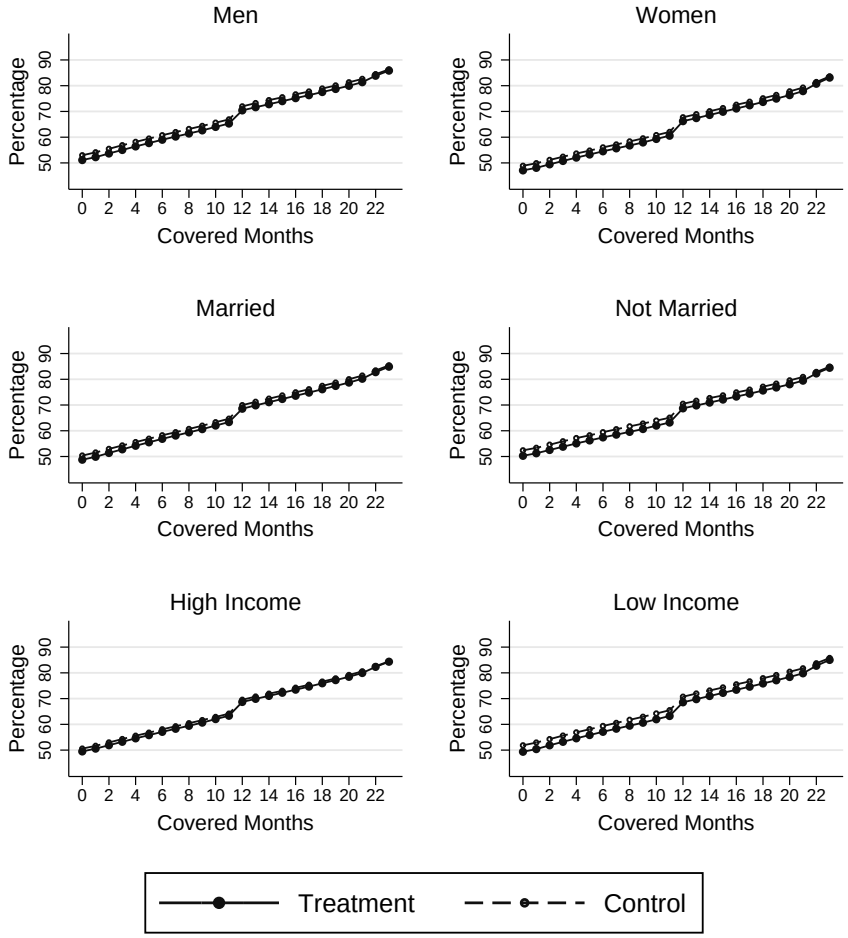
Notes: The figure plots the estimated effect of the intervention on coverage and mortality, separately by state. The coverage effect (x−axis) corresponds to the effect of the intervention on the number of months of coverage enrolled in during 2017−18. The mortality effect (y−axis) corresponds to the effect of the intervention on mortality in 2017−18; units are percentage points (0−100). All analyses are limited to individuals between the ages of 45−64 at the end of 2017 and exclude individuals with full coverage in January through November of 2016.The best linear fit (dashed line) is weighted by population; its slope is −0.055, with standard error 0.120. For ease of presentation, the figure does not plot 4 states with estimated mortality effects greater than 0.5 percentage points or less than −0.5 percentage points, although those states are used in estimating the best linear fit. Collectively, the excluded states represent approximately 1.97 percent of the United States population.

Figure A.XI
Cumulative Distribution of Coverage-Months Among Middle Age Adults



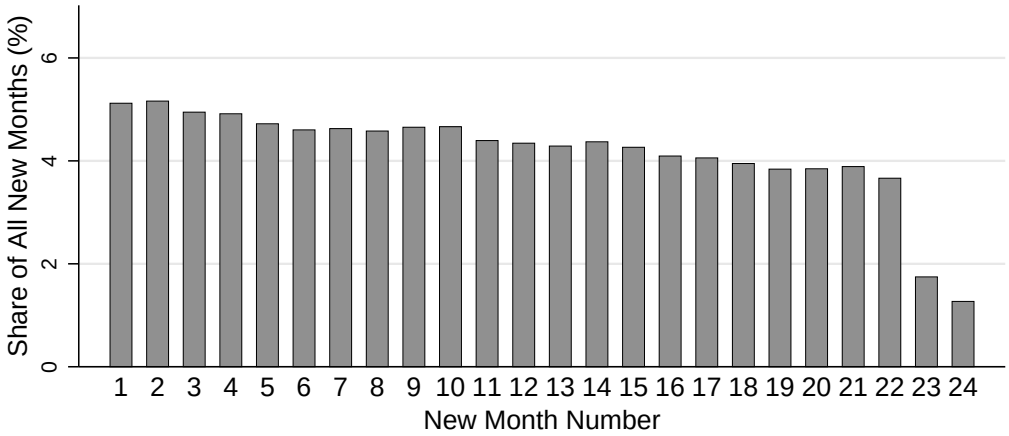
Notes: The figure displays the cumulative distribution function of the number of months of coverage enrolled in during 2017 and 2018 separately for the treatment and control groups. The figure is limited to individuals between the ages of 45−64 at the end of 2017 and excludes individuals with full coverage in January through November of 2016.

Figure A.XII
Cumulative Distribution of Coverage-Months Among Middle Age Adults by Demographic Group



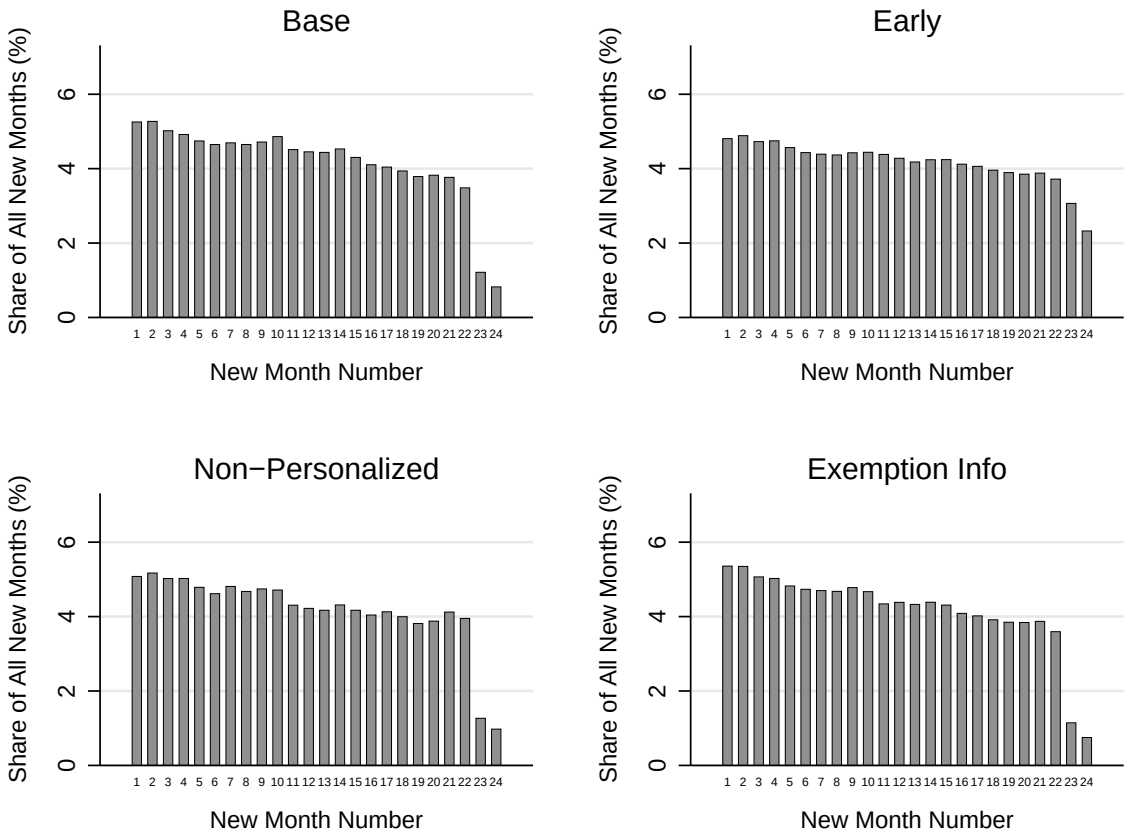
Notes: Each figure displays the cumulative distribution function of the number of months of coverage enrolled in during 2017 and 2018 among individuals in the specified demographic group. Individuals are categorized as high or low income based on whether their 2015 adjusted gross income was above or below the sample median. The figure is limited to individuals between the ages of 45−64 at the end of 2017 and excludes individuals with full coverage in January through November of 2016.

Figure A.XIII
Distribution of Coverage-Months Induced by the Intervention Among Middle Age Adults



Notes: The figure displays the share of coverage−months induced by the intervention that represent the specified month of coverage for an individual during 2017−18. For example, the bar for month 3 indicates that approximately 5% of the additional months of coverage induced by the intervention represent the third month of coverage that an individual was enrolled in during 2017−18. The bar for a particular month is estimated by comparing the share of the treatment group that enrolled in at least the specified number of months of coverage during 2017−18 with the corresponding share of the control group that did so. Repeating this calculation for each month yields each new month's share of all coverage−months induced by the intervention. The figure is limited to individuals between the ages of 45−64 at the end of 2017 and excludes individuals with full coverage in January through November of 2016.

Figure A.XIV
Distribution of Coverage-Months Induced by Treatment Arm Among Middle Age Adults



Notes: The figure displays the share of coverage−months induced by the specified treatment arm that represent the specified month of coverage for an individual during 2017−18. The bar for a particular month is estimated by comparing the share of the specified treatment arm that enrolled in at least the specified number of months of coverage during 2017−18 with the corresponding share of the control group that did so. Repeating this calculation for each month yields each new month's share of all coverage−months induced by the intervention. The figure is limited to individuals between the ages of 45−64 at the end of 2017 and excludes individuals with full coverage in January through November of 2016.

Table A.I
Sample Restrictions

(1) Exclusion	(2) Rationale	(3) Affected Tax Returns
The taxpayer was claimed as a dependent	The obligation to pay the penalty falls on the taxpayer that claims the dependent on his or her return.	1,661
The filing address was not from one of the 50 U.S. states or D.C.	There were few returns in this category and sending letters outside the U.S. required some administrative hassle.	3,816
The taxpayer filed multiple (non-amended) 2015 returns	There were few returns in this category and in such cases there may have been ambiguity regarding the proper address to send the letter.	163
The filing address listed a second address line (typically "C/O")	Taxpayers in this category may not have been permanently residing at the address and therefore were less likely to receive the letter.	39,323
The return listed an Individual Taxpayer Identification Number for a taxpayer or dependent	Taxpayers in this category may not have been eligible for Exchange or Medicaid coverage due to immigration status, so the information on the letter may have been inaccurate or confusing.	280,449
The taxpayer was over age 64 or under age 18 at the end of 2017	Taxpayers who are over 64 are most likely eligible for Medicare and should not be eligible for Exchange coverage. Taxpayers who are under 18 may be less likely to purchase their own health insurance.	223,981
The taxpayer was observed to die prior to the date of sample construction	Information about the penalty is no longer helpful for taxpayers in this group.	19,012
The taxpayer's account was subject to certain audit or examination codes	The IRS requested this group of taxpayers to be excluded to avoid potential confusion stemming from multiple communications with IRS.	25,804
A household member listed on the return was observed to have enrolled in Exchange Coverage either in 2015 or in 2016 prior to our sample being finalized	One of the primary goals of the letter was to inform taxpayers about the availability of Exchange coverage. Individuals who had already enrolled in such coverage were likely already aware of this information.	1,111,738

Notes. The table describes the restrictions that were applied to construct the sample population and the rationale for imposing each restriction. The initial sample (prior to imposing the restrictions) included all individuals listed on one of the 6,144,171 tax returns for 2015 that reported a positive tax penalty for lacking health insurance and had been filed by October 2016. The quantity listed in the "Affected Tax Returns" column refers to the number of tax returns in the initial sample to which the exclusion applied (some tax returns met the criteria for multiple exclusions). The final sample consists of 4,526,717 tax returns.

Table A.II
Sample Allocation by Treatment Arm

	(1)	(2)	(3)
	Individuals	Households	Share
Overall	8,893,653	4,526,717	1.00
Treatment	7,647,822	3,892,847	0.86
Control	1,245,831	633,870	0.14
Treatment arm			
Base	2,019,499	1,027,869	0.23
Early	1,575,856	801,918	0.18
Non-Personalized	2,032,115	1,034,322	0.23
Exemption info	2,020,352	1,028,738	0.23
Language			
English only	3,817,452	1,943,212	0.43
English + Spanish	3,830,370	1,949,635	0.43

Notes. The table reports the assignment of individuals and households across treatment arms. The base treatment was personalized, did not include information about applying for an exemption, and was sent during the mid-January mailing. The shares reported in column 3 are calculated at the household level. Households correspond to the individuals listed on a tax return.

Table A.III
Summary Statistics for Non-Filers

	Non-Filer Sample
Female	0.415
Age	43.082
Income	13581.661
2015 Coverage	
Any Coverage	0.761
Covered Months	8.222
Full-year Coverage	0.596
Observations	24,387,852

Notes. The table provides summary statistics for the universe of individuals that did not file a 2015 tax return and that were listed on a 2015 information return. The sample is limited to individuals that were between the ages of 19-64 at the end of 2015. Income is derived from information returns reported to the IRS for 2015. Coverage is measured from Forms 1095 A/B/C submitted to the IRS for the applicable year. Any coverage indicates one or more month of coverage during 2015. Covered months indicates the number of months of coverage the individual enrolled in during 2015. Full-year coverage indicates the individual was enrolled in 12 months of coverage during 2015.

Table A.IV
Coverage Effect by Prior-Year Insurance with Demographic and Geographic Controls

	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample		Prior-Year Insured		Prior-Year Uninsured	
	Months of Coverage	Any Coverage	Months of Coverage	Any Coverage	Months of Coverage	Any Coverage
Panel A: All Ages						
Treated	0.149	0.668	0.021	0.029	0.239	1.134
	(0.009)	(0.040)	(0.011)	(0.025)	(0.013)	(0.065)
Control mean	14.410	75.431	20.970	98.072	9.512	58.525
Observations	8,893,653	8,893,653	3,809,488	3,809,488	5,084,165	5,084,165
Panel B: Middle Age Adults						
Treated	0.266	1.255	0.054	0.040	0.368	1.865
	(0.017)	(0.080)	(0.022)	(0.053)	(0.022)	(0.116)
Control mean	12.286	65.223	21.189	97.869	7.795	48.753
Observations	2,047,778	2,047,778	688,795	688,795	1,358,983	1,358,983

Notes. The table reports the effect of the intervention on health insurance coverage enrollment from specifications that control for pre-randomization demographic and geographic covariates. Apart from the presence of controls, the reported analyses correspond to those reported in Table II. All columns control for age fixed effects, gender, marital status, 2016 insurance coverage, 2015 household income relative to the federal poverty line, mean 2016 state-level mortality, penalty payment in 2014, an indicator for being exempt from the penalty in 2014, and logged zip code-level measures from the American Communities Survey for median income, share of Spanish speakers, and share of college graduates. Missing values in control variables are replaced with zero and an additional variable is included to indicate missingness.

Table A.V
Coverage Effect by Prior-Year Insurance with Randomization Strata Controls

	(1)	(2)	(3)	(4)	(5)	(6)
	Full Sample		Prior-Year Insured		Prior-Year Uninsured	
	Months of Coverage	Any Coverage	Months of Coverage	Any Coverage	Months of Coverage	Any Coverage
Panel A: All Ages						
Treated	0.154	0.691	0.019	0.029	0.237	1.131
	(0.012)	(0.049)	(0.011)	(0.025)	(0.015)	(0.074)
Control mean	14.410	75.431	20.970	98.072	9.512	58.525
Observations	8,893,652	8,893,652	3,809,476	3,809,476	5,084,156	5,084,156
Panel B: Middle Age Adults						
Treated	0.276	1.314	0.054	0.043	0.369	1.895
	(0.022)	(0.101)	(0.022)	(0.053)	(0.025)	(0.131)
Control mean	12.286	65.224	21.189	97.868	7.795	48.753
Observations	2,047,714	2,047,714	688,712	688,712	1,358,905	1,358,905

Notes. The table reports the effect of the intervention on health insurance coverage enrollment from specifications that control for the randomization strata used to assign tax returns to treatment groups. Apart from the presence of controls, the reported analyses correspond to those reported in Table II. The randomization strata were defined based on age and gender of primary filer, marital status, number of dependents, income, the presence of self-employment income, 2014 penalty status, and whether the taxpayer's state expanded Medicaid and/or participated in the federal marketplace during 2017. All tax return data used in the construction of the randomization strata were derived from the 2015 tax return, unless otherwise specified. All specifications omit randomization strata that contain a single individual after imposing the specified restriction.

Table A.VI
Bounds on Responder Share

	(1)	(2)	(3)	(4)
	All Ages		Ages 45-64	
	Minimum	Maximum	Minimum	Maximum
Estimates	1.179	23.186	1.932	29.017

Notes. The table reports bounds on the share of individuals that enrolled in additional months of coverage during 2017-18 in response to the intervention. Units are percentage points (0-100). The bounds are derived by comparing the marginal distribution of coverage-months in the treatment and control groups, following the method described in Huang et al. (2017) and using their code R provided at https://github.com/emhuang1/fraction-who-benefit on June 11, 2020, and assuming that the effect of the intervention on coverage was weakly positive for all individuals. All columns exclude individuals with full coverage in January through November of 2016. Columns 3 and 4 are limited to individuals between the ages of 45-64 at the end of 2017. Standard errors, reported in parentheses, are clustered by household.

Table A.VII
Effect of Intervention on Likelihood of Enrolling in Any Coverage by Coverage Type

	(1)	(2)	(3)	(4)	(5)	(6)
	Exchange	Medicaid	ESI	Off-Exchange	VA	Medicare
Panel A: All Ages						
Treated	0.969	0.341	0.157	0.034	0.018	0.021
	(0.037)	(0.067)	(0.076)	(0.017)	(0.007)	(0.016)
Control mean	5.537	22.713	35.235	1.229	0.261	1.446
Observations	5,084,165	5,084,165	5,084,165	5,084,165	5,084,165	5,084,165
Panel B: Middle Age Adults						
Treated	1.712	0.318	0.167	0.073	0.046	0.032
	(0.075)	(0.093)	(0.122)	(0.027)	(0.016)	(0.044)
Control mean	7.566	13.765	28.932	0.955	0.426	3.200
Observations	1,358,983	1,358,983	1,358,983	1,358,983	1,358,983	1,358,983

Notes. The table reports the effect of the intervention on the likelihood of enrolling in one month or more of the specified form of coverage during 2017-18. Apart from the definition of the outcome variable, the reported analyses correspond to those in Table III.

Table A.VIII
Coverage Effect by Income and Medicaid Expansion State

	(1)	(2)	(3)	(4)	(5)	(6)
	All States		Expansion States		Non-Expansion States	
	FPL $\leq$ 138	FPL $>$ 138	FPL $\leq$ 138	FPL $>$ 138	FPL $\leq$ 138	FPL $>$ 138
Panel A: All Ages						
Treated	0.289	0.213	0.359	0.260	0.206	0.161
	(0.032)	(0.018)	(0.043)	(0.025)	(0.045)	(0.026)
Control mean	9.648	9.468	11.013	10.502	7.935	8.322
Observations	1,253,207	3,830,958	696,786	2,012,580	556,421	1,818,378
Panel B: Middle Age Adults						
Treated	0.551	0.317	0.588	0.367	0.519	0.263
	(0.061)	(0.029)	(0.083)	(0.040)	(0.085)	(0.041)
Control mean	7.736	7.807	9.272	8.744	5.541	6.697
Observations	234,874	1,124,109	137,725	608,419	97,149	515,690

Notes. The table reports the effect of the intervention on coverage by household income and Medicaid expansion state status. The outcome is the number of months of coverage enrolled in during 2017-18. Columns 1, 3, and 5 limit the analysis to individuals with 2015 household income less than or equal to 138% of the applicable Federal Poverty Line, which corresponds to the threshold for Medicaid eligibility in Medicaid expansion states. Columns 2, 4, and 6 limit the analysis to individuals with 2015 household income in excess of that threshold. Columns 3 and 4 limit the sample to individuals who in 2015 resided in states that expanded Medicaid under the Affordable Care Act; columns 5 and 6 limit the sample to individuals who in 2015 resided in states that had not. Medicaid expansion state status is measured as of 2017. Panel B limits the analysis to individuals between the ages of 45 and 64 at the end of 2017. All columns exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.IX
Effect of Intervention on Medicaid Enrollment by Income and Expansion State

	(1)	(2)	(3)	(4)	(5)	(6)
	All States		Expansion States		Non-Expansion States	
	FPL $\leq$ 138	FPL $>$ 138	FPL $\leq$ 138	FPL $>$ 138	FPL $\leq$ 138	FPL $>$ 138
Panel A: All Ages						
Treated	0.132	0.044	0.278	0.090	-0.045	-0.006
	(0.029)	(0.012)	(0.042)	(0.018)	(0.037)	(0.014)
Control mean	5.625	2.634	7.121	3.513	3.748	1.661
Observations	1,253,207	3,830,958	696,786	2,012,580	556,421	1,818,378
Panel B: Middle Age Adults						
Treated	0.168	0.044	0.307	0.084	-0.003	0.003
	(0.049)	(0.015)	(0.075)	(0.026)	(0.036)	(0.010)
Control mean	3.750	1.583	5.750	2.587	0.894	0.394
Observations	234,874	1,124,109	137,725	608,419	97,149	515,690

Notes. The table reports the effect of the intervention on Medicaid coverage by household income and Medicaid expansion state status. The outcome is the number of months of Medicaid coverage enrolled in during 2017-18. Columns 1, 3, and 5 limit the analysis to individuals with 2015 household income less than or equal to 138% of the applicable Federal Poverty Line, which corresponds to the threshold for Medicaid eligibility in Medicaid expansion states. Columns 2, 4, and 6 limit the analysis to individuals with 2015 household income in excess of that threshold. Columns 3 and 4 limit the sample to individuals who in 2015 resided in states that expanded Medicaid under the Affordable Care Act; columns 5 and 6 limit the sample to individuals who in 2015 resided in states that had not. Medicaid expansion state status is measured as of 2017. Panel B limits the analysis to individuals between the ages of 45 and 64 at the end of 2017. All columns exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.X
Effect of Intervention on Non-Medicaid Enrollment by Income and Expansion State

	(1)	(2)	(3)	(4)	(5)	(6)
	All States		Expansion States		Non-Expansion States	
	FPL $\leq$ 138	FPL $>$ 138	FPL $\leq$ 138	FPL $>$ 138	FPL $\leq$ 138	FPL $>$ 138
Panel A: All Ages						
Treated	0.181	0.181	0.121	0.187	0.255	0.176
	(0.025)	(0.017)	(0.033)	(0.024)	(0.038)	(0.025)
Control mean	4.330	7.084	4.273	7.312	4.401	6.832
Observations	1,253,207	3,830,958	696,786	2,012,580	556,421	1,818,378
Panel B: Middle Age Adults						
Treated	0.409	0.291	0.314	0.303	0.539	0.276
	(0.050)	(0.028)	(0.062)	(0.038)	(0.082)	(0.041)
Control mean	4.193	6.392	3.791	6.385	4.767	6.401
Observations	234,874	1,124,109	137,725	608,419	97,149	515,690

Notes. The table reports the effect of the intervention on non-Medicaid coverage by household income and Medicaid expansion state status. The outcome is the number of months of all forms of coverage enrolled in during 2017-18 that were not Medicaid. Columns 1, 3, and 5 limit the analysis to individuals with 2015 household income less than or equal to 138% of the applicable Federal Poverty Line, which corresponds to the threshold for Medicaid eligibility in Medicaid expansion states. Columns 2, 4, and 6 limit the analysis to individuals with 2015 household income in excess of that threshold. Columns 3 and 4 limit the sample to individuals who in 2015 resided in states that expanded Medicaid under the Affordable Care Act; columns 5 and 6 limit the sample to individuals who in 2015 resided in states that had not. Medicaid expansion state status is measured as of 2017. Panel B limits the analysis to individuals between the ages of 45 and 64 at the end of 2017. All columns exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XI
Coverage Effect Heterogeneity

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Men	Women	Married	Unmarried	Self-Prepared Returns	Professionally Prepared Returns	Successful Exchange Rollout	Challenges with Exchange Rollout
Panel A: All Ages								
Treated	0.223	0.247	0.276	0.205	0.165	0.266	0.336	0.201
	(0.018)	(0.022)	(0.030)	(0.017)	(0.026)	(0.019)	(0.033)	(0.018)
Control mean	8.921	10.345	9.496	9.521	10.144	9.190	10.863	9.121
Observations	2,977,632	2,106,533	1,922,724	3,161,441	1,713,767	3,370,398	1,140,923	3,943,242
Panel B: Middle Age Adults								
Treated	0.366	0.346	0.415	0.314	0.250	0.398	0.410	0.341
	(0.031)	(0.037)	(0.044)	(0.032)	(0.049)	(0.031)	(0.057)	(0.029)
Control mean	7.370	8.373	7.718	7.852	8.299	7.602	9.052	7.423
Observations	783,582	575,401	585,626	773,357	376,210	982,773	310,621	1,048,362

Notes. The table reports heterogeneity in the effect of the intervention on coverage across the specified dimensions. The outcome is the number of months of coverage enrolled in during 2017-18. Marital status and return preparation method are measured from the 2015 tax return. Successful exchange rollout refers to states that did not experience major technical problems during the rollout of their health insurance marketplace; challenges with exchange rollout refers to states that did experience such problems. The latter category includes all states that adopted the federal marketplace. Panel B limits the analysis to individuals between the ages of 45 and 64 at the end of 2017. All columns exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XII
Coverage Effect Heterogeneity - Combined Model

	(1)	(2)	(3)	(4)
	All Ages		Ages 45-64	
	Months of Coverage	Any Coverage	Months of Coverage	Any Coverage
Treatment	0.102	0.527	0.226	1.326
	(0.035)	(0.173)	(0.055)	(0.291)
Treatment × Male	-0.019	0.031	0.029	0.130
	(0.024)	(0.118)	(0.043)	(0.224)
Treatment × Married	0.085	0.386	0.127	0.630
	(0.035)	(0.171)	(0.054)	(0.281)
Treatment × Income/FPL % ≤ 138	0.109	0.607	0.260	1.127
	(0.036)	(0.178)	(0.067)	(0.349)
Treatment × Expansion State	0.080	0.233	0.101	0.183
	(0.036)	(0.176)	(0.060)	(0.310)
Treatment × Successful Rollout	0.088	0.079	-0.005	-0.087
	(0.043)	(0.203)	(0.073)	(0.368)
Treatment × Self-Prepared Returns	-0.067	-0.372	-0.129	-0.363
	(0.032)	(0.158)	(0.058)	(0.298)
Treatment × Age ≥ 45	0.158	0.938		
	(0.030)	(0.153)		
Male	-1.574	-7.068	-1.079	-4.566
	(0.022)	(0.109)	(0.040)	(0.208)
Married	0.219	-0.578	-0.059	-1.682
	(0.032)	(0.159)	(0.050)	(0.261)
Income/FPL % ≤ 138	-0.204	-1.111	-0.264	-1.855
	(0.034)	(0.165)	(0.062)	(0.324)
Expansion State	2.372	10.250	2.224	10.833
	(0.033)	(0.163)	(0.055)	(0.287)
Successful Rollout	0.463	1.723	0.428	1.814
	(0.040)	(0.189)	(0.068)	(0.341)
Self-Prepared Returns	0.912	4.541	0.821	3.967
	(0.030)	(0.147)	(0.054)	(0.276)
Age ≥ 45	-2.284	-13.223		
	(0.028)	(0.142)		
Control Mean	9.512	58.525	7.795	48.753
Observations	5,084,165	5,084,165	1,358,983	1,358,983

Notes. The table reports heterogeneity in the effect of the intervention on coverage across the specified dimensions. In columns 1 and 3, the outcome is the number of months of coverage enrolled in during 2017-18. In columns 2 and 4, the outcome indicates enrollment in one or more month of coverage during 2017-18; units are percentage points (0-100). Columns 3 and 4 limit the analysis to individuals between the ages of 45 and 64 at the end of 2017. Marital status and return preparation method are measured from the 2015 tax return. Successful exchange rollout refers to states that did not experience major technical problems during the rollout of their health insurance marketplace; challenges with exchange rollout refers to states that did experience such problems. The latter category includes all states that adopted the federal marketplace. All columns exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XIII
Coverage Effect by Treatment Arm

	(1)	(2)	(3)	(4)
	All Ages		Ages 45-64	
	Months of Coverage	Any Coverage	Months of Coverage	Any Coverage
Treatment	0.233	1.190	0.389	2.039
	(0.019)	(0.095)	(0.032)	(0.167)
Treatment × Early	0.094	0.245	0.135	0.484
	(0.017)	(0.085)	(0.029)	(0.149)
Treatment × Non-Personalized	-0.061	-0.385	-0.138	-0.766
	(0.016)	(0.079)	(0.027)	(0.139)
Treatment × Exemption Info	-0.002	-0.028	-0.022	-0.080
	(0.016)	(0.079)	(0.027)	(0.139)
Treatment × Spanish	-0.007	-0.047	-0.034	-0.166
	(0.012)	(0.058)	(0.020)	(0.101)
Control mean	9.512	58.525	7.795	48.753
Observations	5,084,165	5,084,165	1,358,983	1,358,983

Notes. The table reports the effect of the intervention on coverage based on which treatment arm a taxpayer was assigned. The base treatment contained a personalized estimate of the 2017 household penalty for lacking coverage, was sent during the mid-January mailing, and did not include information about applying for an exemption. Treatment × Early indicates being sent a letter during the late-November mailing. Treatment × Non-Personalized indicates being sent a letter without a personalized 2017 penalty estimate. Treatment × Exemption Info indicates being sent a letter with information about applying for an exemption from the penalty. Treatment × Spanish indicates that the letter included a Spanish language translation. Sample letters, corresponding to the different treatment arms, are contained in Appendix Figure A.II. In columns 1 and 3, the outcome is months of coverage during 2017-18. In columns 2 and 4, the outcome indicates enrollment in one or more month of coverage during 2017-18; units are percentage points (0-100). Columns 3 and 4 limit the analysis to individuals between the ages of 45 and 64 at the end of 2017. All columns exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XIV
Summary Statistics for Previously Uninsured and Middle Age Samples

	(1)	(2)	(3)
	Experimental	Prior-Year Uninsured	
	Sample	All Ages	Ages 45-64
Individual characteristics			
Female	0.450	0.414	0.423
Age	31.1	34.3	53.2
0 - 18	0.271	0.161	0.000
19 - 26	0.136	0.148	0.000
27 - 45	0.349	0.412	0.000
45 - 64	0.230	0.267	1.000
65 or older	0.014	0.012	0.000
Household characteristics			
Married	0.414	0.378	0.431
Household income	42,709	40,448	44,256
Income $<$ 138% FPL	0.267	0.246	0.173
Household size	2.74	2.50	2.19
Self-Prepared Returns	0.341	0.337	0.277
Local characteristics			
High school degree or higher	0.835	0.834	0.839
BA degree or higher	0.249	0.249	0.252
Expansion state	0.560	0.533	0.549
State-based marketplace	0.222	0.209	0.211
Penalty			
Claimed 2014 exemption	0.175	0.181	0.158
Paid 2014 penalty	0.425	0.463	0.524
2014 penalty if penalized	257	264	290
Claimed 2015 exemption	0.063	0.053	0.035
Paid 2015 penalty	1.000	1.000	1.000
2015 penalty if penalized	528	552	610
Projected 2017 annualized penalty	1,526	1,426	1,414
2015 coverage (Jan-Dec)			
Any coverage	0.586	0.347	0.243
Covered months	5.30	2.48	1.60
Full-year coverage	0.283	0.071	0.033
2016 coverage (Jan-Nov)			
Any coverage	0.638	0.366	0.262
Covered months	6.02	2.29	1.60
Full-year coverage	0.428	0.000	0.000
Observations			
Individuals	8,893,653	5,084,165	1,358,983
Households	4,526,717	2,940,819	884,467

Notes. The table contains summary statistics for the overall experimental sample (column 1) and individuals that were not enrolled in coverage in one or more of the first 11 months of 2016 (columns 2 and 3). Column 3 is limited to individuals between the ages of 45 and 64 at the end of 2017. All statistics are calculated at the individual level. Age refers to the individual's age at the end of 2015. Local characteristics are imputed based on the zip code corresponding to the individual's 2015 tax return. Households correspond to the individuals listed on a tax return.

Table A.XV
Effect of Intervention on Mortality - Alternative Age Cutoffs

	(1)	(2)	(3)	(4)	(5)	(6)
	35-64	40-64	45-64 (Main Sample)	50-64	55-64	All Ages
Treated	-0.029	-0.039	-0.063	-0.063	-0.047	-0.010
	(0.016)	(0.020)	(0.025)	(0.033)	(0.047)	(0.008)
p-value	0.069	0.044	0.010	0.052	0.319	0.252
Control Mean	0.717	0.838	1.007	1.212	1.478	0.428
Observations	2,321,377	1,791,670	1,358,983	937,776	551,814	5,084,165

Notes. The table reports the effect of the intervention on mortality using alternative age thresholds for which individuals to include in the analysis. Columns indicate the ages of the taxpayers included in the analysis. Age is measured as of the end of 2017. In all columns, the outcome indicates mortality during 2017-18. Units are percentage points (0-100). The reported p-value corresponds to the null hypothesis that the effect of the intervention on mortality is zero. All columns exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XVI
Effect of Intervention on Middle Age Mortality - No Exclusion for Prior-Year Insured

	Mortality
Treated	-0.045
	(0.021)
p-value	0.027
Control Mean	1.052
Observations	2,047,778

Notes. The table reports the effect of the intervention on mortality without excluding individuals that had coverage during each of the first 11 months of 2016. The outcome indicates mortality during 2017-18. Units are percentage points (0-100). The reported p-value corresponds to the null hypothesis that the effect of the intervention on mortality is zero. The analysis includes individuals with and without full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XVII
Effect of Intervention on Middle Age Mortality: Alternate Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	LDV (with Controls)	LDV (with Controls)	Logit	Logit	Cox Proportional-Hazard	Cox Proportional-Hazard	Log-Rank Test
Treated	-0.064	-0.066	-6.580	-6.631	-6.555	-6.594	
	(0.025)	(0.025)	(2.492)	(2.498)	(2.480)	(2.479)	
Marginal Effect			-0.063	-0.052			
			(0.025)	(0.020)			
p-value	0.009	0.008	0.008	0.008	0.008	0.008	0.008
Controls	×	×		×		×	
Observations	1,358,983	1,358,905	1,358,983	1,358,983	1,355,773	1,355,773	1,355,773

Notes. The table reports the effect of the intervention on mortality under alternative specifications. In all columns, the outcome indicates mortality during 2017-18. Units are percentage points (0-100). Column 1 reports results from a linear dependent variable model that controls for the demographic and geographic covariates described in the notes to Appendix Table A.IV. Column 2 reports results from a linear dependent variable model that controls for randomization strata indicators described in the notes to Appendix Table A.V. Columns 3 and 4 report the results of a logit model, with and without the control variables included in Column 1. The reported marginal effect is calculated at covariate means. Columns 5-7 report results from duration models, analyzed at the month-level for individuals alive at the start of 2017. Columns 5 and 6 report results from a Cox Proportional-Hazard model, with and without the control variables included in Column 1. In Columns 1-6, the reported p-value corresponds to the null hypothesis that the treatment variable does not enter into the model. Column 7 reports a log-rank test; the p-value corresponds to the null hypothesis of equality between the survival curves for individuals in the treatment and control group. All columns exclude individuals with full coverage in January through November of 2016 and are limited to individuals between the ages of 45-64 at the end of 2017. Standard errors, reported in parentheses are clustered by household.

Table A.XVIII
Indirect Budgetary Costs of the Intervention for Middle Age Taxpayers

	(1)	(2)	(3)
	Per-Month Cost ($/Month)	Intervention Effect (Months)	Contribution to Costs Per Treated Individual ($)
2017			
Premium Tax Credit	427.04	0.15	65.57
Cost-Sharing Reductions	125.71	0.21	12.72
Individual Penalty	.	.	5.25
Medicaid	361.77	0.05	16.95
ESI Tax Exclusion	79.57	0.00	0.15
2018			
Premium Tax Credit	318.74	0.12	37.86
Cost-Sharing Reductions	0.00	0.00	0.00
Individual Penalty	.	.	4.16
Medicaid	365.23	0.02	8.14
ESI Tax Exclusion	67.69	0.01	0.85
Total	.	.	151.65

Notes. The table provides a rough estimate of the indirect state and federal budgetary costs of the intervention for 45-64 year-olds that were uninsured during the prior year. The estimates account for costs arising from claiming of the Premium Tax Credit (PTC); Cost Sharing Reductions (CSR); federal and state costs of Medicaid coverage; foregone federal tax revenue from reductions in the individual mandate penalty that were paid; and foregone federal and state tax revenue from income tax exclusions for employer-provided health insurance. For each cost category, Column 1 reports the average per-month cost. Column 2 reports the estimated effect of the intervention for the corresponding behavior or coverage type for the relevant year. Unless noted, all intervention effect estimations are derived from regressions that limit the sample to 45-64 year-olds that were uninsured during at least one of the first 11 months in 2016. We focus on effects of the intervention on individual coverage and/or behavior, although the responses of others in the same household could also affect the amount of PTC, CSR, penalty, and ESI tax exclusion. Column 3 reports the estimated effect of the intervention on each cost source. The average per-month costs reported in Column 1 are calculated as follows. PTC: Total PTC is the amount of advanced PTC associated with primary filers aged 45-64 years-old plus additional PTC claimed on returns minus repayments reported on returns. The average per-month cost is obtained by dividing total PTC costs by the total number of months of exchange coverage among 45-64 years old. The intervention effect refers to the effect of the intervention on months of Exchange coverage. CSR: In 2017, cost sharing reductions resulted in individuals with lower incomes being able to purchase higher actuarial values (AV) policies at the same price as the regular 70 AV. The upgraded AV plans were 94% AV for individuals below 150% FPL, 87% AV for individuals between 150-200% FPL, and 73% AV for individuals between 200-250% FPL. Since regular silver plans are 70% AV, we impute cost sharing as the product of total payments for Second Lowest Cost Silver Plans (SLCSP) on the Form 1095A and the increase in AV for the specific FPL group relative to 70% AV, all divided by 70%. For example, the cost for taxpayers below 150% FPL was calculated as total SLCSP*(94%-70%)/70%. We then obtain the average CSR cost per month by summing up the total CSR as described before and dividing it by the number of people between ages 45-64 under 250% FPL. We also obtained the intervention effect using the eligible population (45-64 under 250% FPL). In 2018, CSR was not paid and therefore had a budgetary cost of zero. The coverage effect refers to the effect of the intervention on months of Exchange coverage among individuals with income below the 250% FPL. Contribution to costs (Column 3) is the product of Columns 1 and 2, the share of 45-64 year-olds eligible for cost-sharing because of income below 250% FPL (approximately 0.545), and a 90% CSR take-up rate reported in DeLeire et al. (2017). Penalty: The contribution of the penalty to costs comes directly from a regression of the reported penalty on the intervention among 45-64 year-olds that were uninsured during at least one of the first 11 months of 2016. Medicaid: Annual Medicaid costs for 2017 and 2018 are calculated from average annual Medicaid costs for adults by state in 2014, reported by KFF (2017), inflated by the percent growth between 2014 and 2017 or 2018 in per-person Medicaid costs reported by NHE (2019). Medicaid per-month costs are obtained by dividing the average annual cost by 12. Employer exclusions: The federal and states costs of an increase in ESI coverage is due to a reduction in taxable income. For this calculation we assume that employers are indifferent between providing coverage or giving employees' wages implying that the incidence fall entirely on employees. Because ESI premiums are excluded from income and payroll taxes, the lost tax revenue equals the product of the premium amount and the applicable marginal tax rate. We exclude payroll taxes from this calculation because changes in government revenue from this source are offset by reductions in future Social Security payments. For purposes of this analysis, we rely on the average cost of ESI premium per enrollee reported in NHE (2019). The average per-month cost of the ESI exclusion is then obtained by multiplying this premium by a combined federal and state marginal tax rate of 17% in 2017 and 14% in 2018, and dividing by 12.

Table A.XIX
Analyses Relating to Potential Exclusion Restriction Violations

	(1)	(2)	(3)	(4)	(5)	(6)
	Prior-Year Mortality (2016)	Mortality Among Prior-Year Insured	Average Penalty	ESI Coverage (2017)	ESI Coverage (2018)	First Year Mortality (2017)
Treated	-0.002	-0.010	-4.698	0.061	0.145	-0.033
	(0.012)	(0.037)	(1.608)	(0.113)	(0.117)	(0.017)
Control Mean	0.238	1.143	283.543	22.864	24.990	0.472
Observations	1,358,983	688,795	1,358,983	1,358,983	1,358,983	1,358,983

Notes: The table presents analyses relating to potential violations of the exclusion restriction. Column 1 reports the effect of the intervention on mortality during 2016. Column 2 reports the effect of the intervention on mortality during 2017-18 among individuals that were enrolled in coverage during each of the first 11 months of 2016. Column 3 reports the effect of the intervention on the reported individual mandate penalty, averaged over tax years 2017 and 2018 and winsorized at the 1st and 99th percentile. Columns 4 and 5 report the effect of the intervention on whether the individual enrolled in one month or more of employer-sponsored coverage during 2017 or 2018, respectively. Column 6 reports the effect of the intervention on mortality in 2017. In all columns other than columns 3, the units are percentage points (0-100). All columns are limited to individuals between the ages of 45-64 at the end of 2017. All columns other than column 2 exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XX
Effect of Intervention on Middle Age Mortality by Treatment Arm

	Mortality
Treatment	-0.033
	(0.030)
Treatment × Early	-0.043
	(0.026)
Treatment × Non-Personalized	-0.014
	(0.025)
Treatment × Exemption Info	-0.027
	(0.025)
Treatment × Spanish	-0.022
	(0.018)
Joint test (F-stat)	2.231
Joint test (p-value)	0.048
Control mean	1.007
Observations	1,358,983

Notes. The table reports the effect of the intervention on mortality based on which treatment arm a taxpayer was assigned. The outcome indicates mortality during 2017-18; units are percentage points (0-100). The base treatment contained a personalized estimate of the 2017 household penalty for lacking coverage, was sent during the mid-January mailing, and did not include information about applying for an exemption. Treatment × Early indicates being sent a letter during the late-November mailing. Treatment × Non-Personalized indicates being sent a letter without a personalized 2017 penalty estimate. Treatment × Exemption Info indicates being sent a letter with information about applying for an exemption from the penalty. Treatment × Spanish indicates that the letter included a Spanish language translation. Sample letters, corresponding to the different treatment arms, are contained in Appendix Figure A.II. The joint test corresponds to the null of equality in the mortality effect across treatment arms. The table limits the analysis to individuals between the ages of 45 and 64 at the end of 2017 and excludes individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XXI
Effect of Intervention on Plan Costs

	(1)	(2)	(3)	(4)
	Exchange Coverage	Exchange Premiums	ESI Coverage	ESI Premiums
Treated	0.027	-21.375	0.038	1.124
	(0.026)	(24.869)	(0.139)	(2.440)
Control mean	0.864	686.660	27.589	343.318
Observations	298,328	15,932	298,328	233,890

Notes: The table investigates the effect of the intervention on the cost of plans enrolled in, as a proxy for plan generosity. To avoid conflating changes in plan generosity with changes in enrollment, the analysis reported in the table is restricted to households in which all members were enrolled in full coverage during the prior year. Columns 1 and 3 confirm the lack of an observed effect of the intervention for this group on either ESI or Exchange enrollment. Columns 2 and 4 investigate whether the intervention affected plan cost and show no evidence that it did. All of the reported analyses are conducted at the tax return level. In columns 1 and 3, the outcome is months of the specified form of coverage during 2017-18. In columns 2 and 4, the outcome is the average premium amount of the specified type of coverage per household member. Plan premiums are averaged over 2017 and 2018. The number of household members is equal to the number of taxpayers plus the number of dependents reported on the 2017 or 2018 tax return. Columns 2 and 4 are restricted to households in which at least one household member is enrolled in the specified form of coverage. Exchange plan premiums are calculated by summing up total purchased premium based on Form 1095A reporting. ESI plan premiums are calculated by summing up total reported ESI premiums as reported in box 12 under code DD on the W-2. All columns are limited to households in which the primary filer is between the ages of 45-64 and in which all household members were enrolled in coverage during each of the first 11 months of 2016. Standard errors, reported in parentheses are clustered by household.

Table A.XXII
Household Spillovers

	(1)	(2)	(3)
	Coverage (Prior-Year Insured)	Coverage (Prior-Year Uninsured)	Mortality (Prior-Year Insured)
Treated	0.041	0.262	0.001
	(0.032)	(0.056)	(0.062)
Control mean	21.482	9.136	1.343
Observations	287,470	352,658	287,470

Notes. The table investigates the presence of within-household spillovers in the effect of intervention-induced coverage on mortality. The reported analyses are limited to households in which one household member was between the ages of 45 and 64 at the end of 2017 and was enrolled in coverage during each of the first 11 months of 2016, and in which another household member was not enrolled in coverage during one or more of the first 11 months of 2016. Columns 1 and 3 report results for individuals in the former category - i.e., 45-64 year-olds with full prior-year coverage. Column 2 reports results for individuals in the latter category - i.e., individuals of any age without full prior-year coverage. In columns 1 and 2, the outcome is months of coverage enrolled in during 2017-18. In column 3, the outcome is mortality in 2017-18; units are percentage points (0-100). Standard errors, reported in parentheses, are clustered by household.

Table A.XXIII
Effect of Coverage on Middle Age Mortality - Robustness Checks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Demographic Controls	Randomization Strata Controls	Ages 40-64	Ages 50-64	No Prior-Year Coverage Exclusion	No Prior-Year Coverage Exclusion	Multiple Instruments
Covered Months	-0.175	-0.177	-0.115	-0.170	-0.168	-0.178	-0.147
	(0.068)	(0.067)	(0.058)	(0.088)	(0.077)	(0.069)	(0.055)
Control mean	1.007	1.007	0.838	1.212	1.052	1.052	1.007
Observations	1,358,983	1,358,905	1,791,670	937,776	2,047,778	2,047,778	1,358,983

Notes. The table reports robustness checks relating to the IV estimate of coverage on mortality. In all columns, the outcome is mortality in 2017-18. Units are percentage points (0-100). In all columns, the variable that is instrumented for is months of coverage during 2017-18. Column 1 reports results from a two-stage least squares specification that controls for the demographic and geographic covariates described in the notes to Appendix Table A.IV. Column 2 reports results from a two-stage least squares specification that controls for the randomization strata indicators described in the notes to Appendix Table A.V; the specification omits 78 individuals in singleton randomization strata. Columns 3 and 4 limit the analysis to individuals, who, at the end of 2017, were between the ages of 40-64 and 50-64, respectively. Columns 5 and 6 but do not exclude individuals based on their 2016 coverage. Column 5 replicates the main IV analysis. Column 6 reports results from a two-stage least squares specification that controls for whether an individual was enrolled in coverage during each of the first 11 months of 2016 and that includes as an additional instrument for coverage an interaction between this indicator and the indicator for treatment group assignment. Column 7 reports results from a two-stage least squares specification that instruments for coverage with 8 binary indicators reflecting assignment to the 8 treatment arms. All columns other than 3 and 4 are limited to individuals between the ages of 45-64 at the end of 2017. All columns other than 5 and 6 exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XXIV
Heterogeneity in Effect of Coverage on Middle Age Mortality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Income/FPL < 138 %	Income/FPL > 138 %	Expansion State	Non-Expansion State	Men	Women	Married	Not Married
Covered Months	-0.022	-0.233	-0.127	-0.259	-0.142	-0.229	-0.170	-0.181
	(0.104)	(0.088)	(0.078)	(0.131)	(0.097)	(0.096)	(0.082)	(0.112)
Control mean	0.927	1.023	0.912	1.123	1.204	0.737	0.795	1.165
Observations	234,874	1,124,109	746,144	612,839	783,582	575,401	585,626	773,357

Notes. The table reports heterogeneity in the effect of coverage on mortality by conducting the IV analysis separately across the specified dimensions. In all columns, the outcome is mortality during 2017-18. Units are percentage points (0-100). In all columns, an indicator for treatment group assignment is used as an instrument for the months of coverage enrolled in during 2017-18. Columns 1 and 2 divide the sample based on whether an individual's 2015 household income exceeded the 138% Federal Poverty Line threshold for Medicaid eligibility. Columns 3 and 4 divide the sample based on whether the individual's 2015 residence was in a state that had expanded Medicaid under the Affordable Care Act by the start of 2017. Columns 5 and 6 divide the sample by gender. Columns 7 and 8 divide the sample based on the marital status reflected on the 2015 return. All columns are limited to individuals between the ages of 45 and 64 at the end of 2017 and exclude individuals with full coverage in January through November of 2016. Standard errors, reported in parentheses, are clustered by household.

Table A.XXV
Effect of Annual Coverage on Middle Age Mortality

	(1)	(2)	(3)	(4)
	Minimum Magnitude Effect of Annual Coverage	Maximum Magnitude Effect of Annual Coverage	Only First Coverage-Month Matters	Geometric Decay
Incremental Effect of Coverage-Month	β_m = -1.727 for $m \leq 2$ β_m = 0 for $m > 2$	β_m = -0.178 for all m	β_1 = -3.468 β_m = 0 for all $m > 1$	β_m = -0.73 $\times$ $0.81^{(m-1)}$
Effect of One Year of Coverage	-1.727	-2.131	-1.734	-1.909

Notes: The table presents estimates of the relationship between the number of coverage-months enrolled in during the outcome period and mortality. Units are percentage points (0-100). The incremental effect of the m_{th} coverage-month during the outcome period on mortality is given by β_m, for $m \in \{1,\ldots,24\}$. We compute the effect of enrolling in one full year of coverage by summing the coverage-month effects for each of the 24 months during the outcome period and dividing by 2 to obtain a 12-month average. The estimates reported in columns 1-3 satisfy equation (3), using the estimate of the ACR reported in column 4 of Table IV and the coverage-month weights derived from Appendix Figure A.XIII. The coverage-month effects reported in Columns 1 and 2 were obtained by selecting β_1, β_2, ... , β_{24} to minimize (Column 1) or maximize (Column 2) the magnitude of the sum of the incremental month effects ($\beta_1 + \beta_2 + \ldots \beta_{24}$) subject to the constraints that the effect of each coverage-month was non-positive, $\beta_m \leq 0$ for all m, and that the effect of each coverage-month was no larger in magnitude than that of the previous coverage-month, $\beta_m \leq \beta_{m-1}$ for all $m \in \{2,\ldots,24\}$. The coverage-month effects in Column 3 were obtained by solving equation (3) for β_1 after imposing β_m = 0 for all $m > 1$. To obtain the coverage-month effects in Column 4, we imposed the model of geometric decay described in Section V.D.1 and Appendix B.3, so that $\beta_m = \beta_1 \times \alpha^{m-1}$. We next estimated the ACR and coverage-month weights $\{w_m\}$ separately for each treatment arm by iteratively excluding individuals assigned to other treatment arms from the analysis. Because we pooled across treatments that did and did not include a Spanish translation, this yielded four versions of equation (3). Column 4 reports the (β_1, α) pair that minimizes the sum of squared errors from these four equations.

Table A.XXVI
Baseline Mortality Among Middle Age Adults by Extensive-Margin Coverage Effect

(1)	(2)	(3)	(4)
Extensive-Margin Compliers		Extensive-Margin Never-Takers	
Share	Baseline Mortality	Share	Baseline Mortality
1.831	1.751	49.417	0.826

Notes. The table reports the estimated population share and baseline mortality rate for extensive-margin compliers and never-takers. Units are percentage points (0-100). Extensive-margin compliers refer to individuals that would enroll in zero months of coverage if assigned to the control and in positive months of coverage if assigned to the intervention. Extensive-margin never-takers refer to individuals that would enroll in zero months of coverage if assigned to the control or to the treatment. Baseline mortality refers to the share of the specified group that would die during 2017-18 if enrolled in zero months of coverage during that time period. For calculation details, refer to Online Appendix B.2. All columns are limited to individuals between the ages of 45 and 64 at the end of 2017 and exclude individuals with full coverage in January through November of 2016.

Table A.XXVII
Comparison to Estimated Mortality Effects from Prior Research

	(1)	(2)	(3)	(4)
	ACA Penalty (This Study)	Oregon Study	Oregon Study (Age-Weighted)	Medicaid Expansion
Intent-to-Treat	-0.063	-0.106	-0.170	-0.208
	(0.025)	(0.160)	(0.199)	
First Stage	0.358	2.726	2.728	1.092
	(0.026)	(0.187)	(0.194)	
IV Estimate	-0.178	-0.026	-0.041	-0.190
	(0.070)	(0.039)	(0.048)	
Overlapping CI		[-0.101,-0.041]	[-0.135,-0.041]	

Notes. The tables compares findings from the current study (column 1) to those derived from the Oregon health insurance study (columns 2 and 3) and from the ACA Medicaid expansion, as reported by Miller et al. (2019) (column 4). Column 1 reports analyses from the current study that are described in Table IV. The Oregon study results are calculated from the public-use replication data, downloaded from https://www.nber.org/oregon/4.data.html. We use the 20% subsample of the Oregon data that contains survey data on monthly enrollment, along with the corresponding survey weights. Column 3 adjusts the Oregon survey weights to reflect the age distribution of our mortality analysis sample. The standard errors reported in columns 2 and 3 are clustered by household. The Miller et al. results are calculated from estimates reported in the draft dated July 10, 2019. The coverage and mortality effect estimates are calculated from their Table 1 (columns 3 and 4) and reflect the event-study coefficients corresponding to Year 0 and Year 1 (post-expansion). We do not calculate standard errors or confidence intervals for the Miller et al. analysis because we lack the required microdata. The results from our study are drawn from the specifications with control variables. The intent-to-treat results correspond to the effects of the respective interventions on 1.5-yr mortality (columns 2 and 3) and 2-yr mortality (columns 1 and 4). The units are percentage points (0-100). The first stage results correspond to the effect of the respective interventions on months of coverage enrolled in during the first year post-intervention (columns 2 and 3) and during the first 2 years post-intervention (column 1 and 4). To make the Oregon IV results comparable to ours, the first stage is calculated using survey data on monthly enrollment in coverage. For the Miller et al. study, the first stage is calculated from the change in the share of uninsured individuals, under the assumption that each individual who obtains coverage because of the treatment does so for each month during the year. The IV estimate for each study is obtained by dividing the intent-to-treat by the first stage. Units are percentage points (0-100). For the Oregon results, the intent-to-treat is first scaled by 12/18 before dividing by the first stage so that both the intent-to-treat and first stage reflect a 12-month period. The row titled "Overlapping CI" presents the overlap between our estimated confidence interval for the effect of coverage on mortality and the confidence interval derived from the Oregon study results.

Appendix B.1: Role of Mortality in Explaining Observed Coverage Effect

This appendix section decomposes the overall effect of the intervention on coverage into effects due to: (1) inducing additional enrollment among those who would live, even absent the intervention, and (2) reducing mortality among those who would enroll in positive months of coverage were they to live. For simplicity, we assume for purposes of this analysis that coverage decisions are made once per year, at the start of the year.

Let $Z_i \in \{0,1\}$ indicate that individual i was assigned to the treatment group; $C_i^{17}(Z) \in \{0,1,...,12\}$ indicate the months of coverage i would enroll in during 2017 as a function of treatment; and $M_i^{17}(C^{17}) \in \{0,1\}$ indicate if i would die during 2017 if i were to enroll in C^{17} months of coverage during that year. Let $C_i^{18}(Z,M^{17}) \in \{0,1,...,12\}$ indicate the months of coverage i would enroll in during 2018 as a function of treatment and whether i died during 2017. For purposes of this analysis, we assume that individuals who die during 2017 enroll in no coverage during 2018: $C_i^{18}(Z,1) = 0$ for all Z and i. We also assume that the effect of the intervention on coverage is weakly positive for both years, $C_i^{17}(1) \geq C_i^{17}(0)$ and $C_i^{18}(1,0) \geq C_i^{18}(0,0)$ for all i. Finally, we assume that 2017 mortality is weakly decreasing in 2017 coverage, $M^{17}(c_1) \leq M^{17}(c_0)$ for $c_1 < c_0$. Hence, $M^{17}\left(C^{17}(1)\right) \leq M^{17}\left(C^{17}(0)\right)$.

The overall effect of the intervention on 2018 coverage is given by

$$E[C^{18}|Z=1] - E[C^{18}|Z=0] \tag{4}$$

Using the law of iterated expectations and the fact that treatment was randomly assigned, we can write

$$\begin{aligned} E[C^{18}|Z=1] = {} & Pr\left(M^{17}\left(C^{17}(1)\right)=1\right) E\left[C^{18}(1,1)|M^{17}\left(C^{17}(1)\right)=1\right] \\ & + Pr\left(M^{17}\left(C^{17}(0)\right)=0\right) E\left[C^{18}(1,0)|M^{17}\left(C^{17}(0)\right)=0\right] \\ & + Pr\left(M^{17}\left(C^{17}(1)\right) < M^{17}\left(C^{17}(0)\right)\right) E\left[C^{18}(1,0)|M^{17}\left(C^{17}(1)\right) < M^{17}\left(C^{17}(0)\right)\right] \end{aligned} \tag{5}$$

Similarly, we can write:

$$E[C^{18}|Z=0] = Pr\left(M^{17}\left(C^{17}(1)\right)=1\right)E\left[C^{18}(0,1)|M^{17}\left(C^{17}(1)\right)=1\right]$$
$$+Pr\left(M^{17}\left(C^{17}(0)\right)=0\right)E\left[C^{18}(0,0)|M^{17}\left(C^{17}(0)\right)=0\right]$$
$$+Pr\left(M^{17}\left(C^{17}(1)\right)<M^{17}\left(C^{17}(0)\right)\right)E\left[C^{18}(0,1)|M^{17}\left(C^{17}(1)\right)<M^{17}\left(C^{17}(0)\right)\right] \quad (6)$$

From (5) and (6), and the fact that individuals who die during 2017 do not enroll in 2018 coverage, we can rewrite (4) as:

$$E[C^{18}|Z=1]-E[C^{18}|Z=0] = Pr\left(M^{17}\left(C^{17}(0)\right)=0\right)\left\{E\left[C^{18}(1,0)-C^{18}(0,0)\,|\,M^{17}\left(C^{17}(0)\right)=0\right]\right\}$$
$$+Pr\left(M^{17}\left(C^{17}(1)\right)<M^{17}\left(C^{17}(0)\right)\right)E\left[C^{18}(1,0)\,|\,M^{17}\left(C^{17}(1)\right)<M^{17}\left(C^{17}(0)\right)\right] \quad (7)$$

The first term in (7) reflects the contribution of individuals who would have survived to 2018 regardless of the intervention. The second term reflects the contribution of individuals who would not have survived to 2018 but for the additional 2017 coverage they enrolled in because of the intervention. The shares of the population in these categories, $Pr\left(M^{17}\left(C^{17}(0)\right)=0\right)$ and $Pr\left(M^{17}\left(C^{17}(1)\right)<M^{17}\left(C^{17}(0)\right)\right)$, are point-identified under the assumptions we will impose in Section V (i.e., the latter is the intent-to-treat effect of the intervention on 2017 mortality and the former is one minus the mean 2017 mortality rate among those assigned to the control). In contrast, additional assumptions would be required to point-identify the remaining two terms on the right-hand side of (7).

To obtain an upper bound on the share of the 2018 coverage effect that is due to the intervention reducing mortality, we assume that everyone whose life was extended into 2018 because of the intervention enrolled in a full year of 2018 coverage: $E\left[C^{18}(1,0)\,|\,M^{17}\left(C^{17}(1)\right)<M^{17}\left(C^{17}(0)\right)\right]=12$. Note that imposing the opposite assumption, i.e., $E\left[C^{18}(1,0)\,|\,M^{17}\left(C^{17}(1)\right)<M^{17}\left(C^{17}(0)\right)\right]=0$, would imply that the entire coverage effect is due to the first term in (7), regardless of the magnitude of the mortality effect.

Among the prior-year uninsured, the overall effect of the intervention on 2018 coverage was

0.09 months. We estimate the intervention reduced 2017 mortality among this group by 0.8 basis points. Substituting $E\left[C^{18}(1,0)\,|\,M^{17}\left(C^{17}(1)\right) < M^{17}\left(C^{17}(0)\right)\right] = 12$ into (7) therefore implies that, at most, approximately $\frac{(0.00008)(12)}{0.092}100 \approx 1.1\%$ percent of the overall effect of the intervention on 2018 coverage was driven through a reduction in mortality, or $\frac{(0.00008)(12)}{0.232}100 \approx 0.4\%$ of the effect on 2017-18 coverage. For middle age adults, the corresponding overall 2018 coverage effect was approximately 0.16 months and the estimated 2017 mortality reduction was 3.3 basis points. Similar reasoning therefore allows us to conclude that, at most, approximately $\frac{(0.00033)(12)}{0.155}100 \approx 2.6\%$ percent of the overall effect of the intervention on 2018 coverage was driven through a reduction in mortality, or $\frac{(0.00033)(12)}{0.358}100 \approx 1.1\%$ of the effect on 2017-18 coverage.

Appendix B.2: Identifying Complier Baseline Mortality

This appendix section describes how one can identify the baseline mortality rate among extensive-margin compliers under the same assumptions invoked to estimate the ACR. The result extends a similar proposition from Abadie (2002) to the case in which treatment is multi-valued.

As in the main text, let $Z_i \in \{0,1\}$ indicate whether individual i was assigned to the treatment group and let $C_i(Z) \in \{0,1,...,24\}$ denote the number of months of coverage in which i would enroll during the outcome period if assigned to treatment group Z. Let $Y_i(m) \in \{0,1\}$ indicate whether i would die during the outcome period if i was enrolled in m months of coverage. An extensive-margin complier refers to an individual who would enroll in non-zero coverage if and only if she is assigned to the treatment group, $C_i(1) > C_i(0) = 0$. Our goal is to estimate the average mortality rate among this group, in the state of the world in which they do not receive the intervention, i.e., $E[Y_i(0) \,|\, C_i(1) > C_i(0) = 0]$.

Claim: Under exogeneity, the IV exclusion restriction, and monotonicity:

$$E[Y_i(0) \,|\, C_i(1) > C_i(0) = 0] = \frac{\overline{Y}(0,0)\,\left(1-\overline{C}(0)\right) - \overline{Y}(0,1)\,\left(1-\overline{C}(1)\right)}{\overline{C}(1)-\overline{C}(0)}$$

where $\overline{Y}(c,z) = E[Y_i | C_i = c, Z_i = z]$ and $\overline{C}(z) = Pr(C_i > 0 | Z_i = z)$.

Proof: First, note that, $\overline{Y}(0,0) = E[Y_i(0) \,|\, C_i(0) = 0, Z_i = 0] = E[Y_i(0) \,|\, C_i(0) = 0]$, where the first equality follows from the exclusion restriction and the second follows from exogeneity. By the law of iterated expectations, we can write this expression as

$$\begin{aligned}\overline{Y}(0,0) = \quad & E\left[Y_i(0) \,|\, C_i(0) = 0, C_i(1) = 0\right] Pr(C_i(1) = 0 \,|\, C_i(0) = 0) \\ & + E\left[Y_i(0) \,|\, C_i(0) = 0, C_i(1) > 0\right] Pr(C_i(1) > 0 \,|\, C_i(0) = 0)\end{aligned}$$

or, using the definition of conditional probability,

$$\begin{aligned}\overline{Y}(0,0) = \quad & E\left[Y_i(0) \,|\, C_i(0) = 0, C_i(1) = 0\right] \tfrac{Pr(C_i(1)=0, C_i(0)=0)}{Pr(C_i(0)=0)} \\ & + E\left[Y_i(0) \,|\, C_i(0) = 0, C_i(1) > 0\right] \tfrac{Pr(C_i(1)>0, C_i(0)=0)}{Pr(C_i(0)=0)}\end{aligned} \tag{8}$$

Next, under monotonicity, $C_i(1) = 0 \implies C_i(0) = 0$, so $Pr(C_i(1) = 0, C_i(0) = 0) = Pr(C_i(1) =$

$0) = 1 - \overline{C}(1)$. In addition, monotonicity and the definition of $\overline{C}(Z)$ imply $\overline{C}(0) \equiv Pr(C_i(0) > 0) = Pr(C_i(0) > 0, C_i(1) > 0)$ and $\overline{C}(1) \equiv Pr(C_i(1) > 0) = Pr(C_i(1) > 0, C_i(0) = 0) + Pr(C_i(1) > 0, C_i(0) > 0)$. Subtracting $\overline{C}(0)$ from $\overline{C}(1)$ therefore yields

$$\overline{C}(1) - \overline{C}(0) = Pr(C_i(1) > 0, C_i(0) = 0)$$

Substituting these results into (8) and using the definition of $\overline{C}(Z)$ yields

$$\begin{aligned} \overline{Y}(0,0) = \quad & E\left[Y_i(0) \,|\, C_i(0) = 0, C_i(1) = 0\right] \tfrac{1-\overline{C}(1)}{1-\overline{C}(0)} \\ & + E\left[Y_i(0) \,|\, C_i(0) = 0, C_i(1) > 0\right] \tfrac{\overline{C}(1)-\overline{C}(0)}{1-\overline{C}(0)} \end{aligned} \tag{9}$$

Next, note that because $C_i(1) = 0$ implies $C_i(0) = 0$ under monotonicity, it follows that $E[Y_i(0) \,|\, C_i(0) = 0, C_i(1) = 0] = E[Y_i(0) | C_i(1) = 0] = E[Y_i | Z_i = 1, C_i = 0] \equiv \overline{Y}(0,1)$, where the second equality follows from independence and the third equality follows by definition. Substituting this result into (9) and rearranging yields the desired conclusion.■

Appendix B.3: Parameterizing the Dose-Response Relationship Between Coverage and Mortality

This appendix section provides additional details on our approach to point-estimating the effect of annual coverage on mortality.

We first assume that the effect of an incremental month of coverage on mortality declines geometrically at rate $\alpha \in [0,1]$, so that the effect of enrolling in m months of coverage during the outcome period rather than $m-1$ months of coverage during the outcome period is given by

$$\beta_m = (\alpha)^{m-1}\beta \tag{10}$$

for $\beta < 0$ and $m \in \{1,2,...,24\}$. For example, $\alpha = 1$ corresponds to the case in which mortality risk is linear in coverage-months (column 2 of Table A.XXV), whereas $\alpha = 0$ corresponds to the case in which only the first coverage-month affects mortality (column 3 of A.XXV).

To estimate α and β within this model, we exploit variation in the distribution of coverage-months induced by the various treatment arms of the intervention (see Appendix Figure (A.XIV). In particular, substituting (10) into (3) yields one equation of the following form for each treatment arm:

$$ACR^j = \sum_{m=1}^{24} w_m^j (\alpha)^{m-1}\beta$$

where j refers to the treatment arm, ACR^j is the ACR obtained from comparing individuals in treatment arm j to the control, and $\{w_m^j\}$ is the set of month weights for treatment arm j estimated from (2).[1] Because the system is over-identified, we select α and β to minimize the sum of squared errors.

The results of this exercise yields estimated values of $\alpha = 0.81$ and β= -0.73, implying that one full year of coverage would reduce mortality by 1.91 percentage points. Note that these estimates imply a substantial amount of concavity; the 12th month of coverage is associated

[1]Because the coverage effect does not appear to vary based on whether the treatment includes a Spanish translation, we pool across that source of variation for purposes of this exercise, leaving us with four equations of the following form. We obtain a very similar estimate for the effect of annual coverage when we repeat this exercise with 8 treatment arms, differentiating between treatment arms that did and did not include a Spanish translation.

with an effect that is only approximately 10% as important as the first month of coverage.

Appendix B.4: Comparison of Magnitudes with Prior Literature on Emergency Care Coverage Channel

This appendix section estimates the implied mortality reduction from new coverage induced by improvement in emergency care, using estimates of the effect of coverage on emergency department outcomes from Doyle (2005) and Card, Dobkin and Maestas (2009). For purposes of this comparison, we assume that the likelihood of an event requiring emergency care occurs is uniform over the outcome period and that what matters for treatment and survival outcomes is whether the individual is enrolled in coverage at the time the event occurs.

Using the Medical Expenditure Panel Survey (MEPS) and Healthcare Cost and Utilization Project (HCUP) datasets, we first estimate the average number of emergency department visits per individual in our middle age uninsured sample. Among 45-64 year-olds who lacked insurance during at least one month of 2015 or 2016 (the two years prior to our intervention), the average number of emergency department visits during this time period was 0.445, with 24.3% of individuals visiting the emergency department at least one time during this two-year period.

For our middle age previously uninsured population, the intervention increased coverage by an average of 0.358 months on a base of 7.795 months of coverage during the 24-month outcome period, constituting an approximately 4.6% increase in the probability of being covered during a given outcome period month.

Card, Dobkin and Maestas (2009) find that having coverage at the time of emergency department admission reduced mortality by approximately 1.1 percentage points.[2] Applying this effect to our population, the implied difference in mortality rates between the treatment and control groups due to having coverage at the time of an emergency department visit is $0.445 \times 0.046 \times 0.011 \approx 0.02$ percentage points, or approximately one-third of our estimated reduced form effect of the intervention on mortality. Similarly, Doyle (2005) finds that having coverage upon admission to an emergency department following a vehicle accident reduces mortality by approximately 1.5 percentage points, so that the implied reduced form effect of our intervention on mortality through this channel is $0.445 \times 0.046 \times 0.015 \approx 0.03$, or approx-

[2]More specifically, Card, Dobkin and Maestas (2009) considers mortality intervals ranging from 7-day to 365-day mortality following admission, which range from 1.0 to 1.2 percentage points under their main specification.

imately one-half of our observed effect.

We emphasize that these comparisons are quite rough. The population studied by Card, Dobkin and Maestas is at the older end of our age range, which likely implies a higher baseline mortality rate. On the other hand, their estimate does not account for the effect of coverage on mortality arising from changes in the composition of individuals who arrive (while alive) at the emergency department as opposed to dying at home or en route – as discussed in Section V.C, this channel can be significant if coverage affects individuals' willingness to seek prompt treatment after the onset of symptoms. These issues are likely at least as significant when applying the results from the Doyle study. In particular, the baseline mortality rate of individuals surviving vehicle accidents is likely to differ from that of individuals admitted to the emergency department for other reasons. Similarly, in the context of vehicle crashes, there is likely less room for judgment about whether to seek emergency care, suggesting a smaller potential role for coverage to affect delays in seeking treatment compared to other contexts.