NBER WORKING PAPER SERIES

THE RELATIONSHIP BETWEEN CERTIFICATE OF NEED LAWS AND MORTALITY

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Working Paper 34403
http://www.nber.org/papers/w34403

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
October 2025

We thank Xiaoyu Yang, Jesse Bowman, and law librarians at UCLA and Northwestern University for excellent research assistance. We thank David Powell for generously providing his code and data to flag cancer deaths in the National Vital Statistics System. We thank Christine Eibner and Paul Koegel for providing important feedback. We also thank Mohan Ramanujan and Carla Tokman at the NBER for help accessing data. We thank the National Institute on Aging for supporting this research via grant R01AG073286 (PI: Whaley). The views in this paper represent the opinions of the authors and neither the NIH nor any institutions with which they are affiliated. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

At least one co-author has disclosed additional relationships of potential relevance for this research. Further information is available online at http://www.nber.org/papers/w34403

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NBER Working Paper No. 34403
October 2025
JEL No. I0, I1, I11, I18

ABSTRACT

Certificate of Need (CON) laws regulate entry and capital investments in healthcare with the goal of containing costs while preserving access and quality. This paper examines the relationship between these laws and overall mortality as well as leading causes of mortality: cancer and cardiovascular disease. Using county-level death records, we conducted an event-study analysis comparing mortality rates in states that repealed their CON laws to states that did not between 1979 and 2004. The repeal of CON laws was associated with short-run reductions in cancer mortality, primarily from reductions in lung cancer mortality. Cardiovascular mortality and all-cause mortality rates were unchanged.

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I. Introduction

For the last fifty years, certificate of need (CON) laws have required health care providers to obtain approval from the state—often a state health planning agency—before opening new facilities, expanding capacity, or offering new service lines (Ho 2020; Horwitz and Polsky 2015). Although policymakers designed CON laws primarily to control health care costs by managing the supply of services within a geographic region (Chiu 2021; Mitchell 2024), these laws can affect access to care, affordability, quality of care, and health outcomes.

Whether CON laws affect health outcomes is theoretically ambiguous. Several mechanisms might lead to CON improving quality of care and health. First, there has been considerable research demonstrating a relationship between volume and positive outcomes, and CON increases volume by centralizing care (Hentschker and Mennicken 2018; Luft et al. 1987; Cutler et al. 2010). Second, CON laws could prevent unnecessary care that could lead to a cascade of additional health care utilization that increase costs while potentially harming patients (Horwitz et al. 2025). Third, by granting incumbents market power, CON could preserve access to socially valuable but also unprofitable services for vulnerable populations such as rural or low-income urban communities (Mitchell 2024; Stratmann et al. 2024).

In contrast, CON might have negative effects. For example, since by design CON laws introduce obstacles to entry into health care markets, CON can decrease competition and, thereby, reduce access to regulated services. Moreover, by decreasing competition and by reducing adoption of new technologies, such as cardiac catheterization, imaging or robotic surgery systems, CON might negatively affect quality of care and health outcomes (Mitchell 2024; Chiu 2021; Miller 1980).

To further examine the relationship between CON and outcomes, this paper builds on previous empirical research examining the relationship between CON and mortality; see Conover and Bailey (2020) for a systematic review. Existing studies have largely focused on deaths from heart procedures and related conditions, several of which found a negative relationship between CON and mortality. Using data from 1979 through 2004--a long period of time during which the law was in flux--allows us to leverage the staggered *repeal* of CON laws. Moreover, our CON data are from updates to an original dataset constructed by legal researchers and confirmed through interviews with state regulations. To our knowledge, this is the first study to use this variation on a national dataset to evaluate the effect of CON repeal on all-cause mortality and multiple causes of mortality.

More specifically, we linked national death records from the National Vital Statistics System (NVSS) between 1979 and 2004, aggregated to the county-level, with CON laws over the same time period. Using an event-study research design, we compared changes in county-level outcomes in the 15 states that repealed CON laws to changes in counties in states that did not repeal CON during the same time period.

We first examined the effect of CON repeal on all-cause mortality rates and the two leading causes of death, cancer and heart disease, which account for approximately 40 percent of deaths in the U.S. (Murphy et al. 2024). We also disaggregate the outcomes into various kinds of cancer and heart disease. We found that repealing CON is not associated with a statistically significantly change in all-cause or heart-disease related mortality.

Repeal is associated with a statistically significant decrease of 2.2 cancer deaths per 100,000 residents or 1.5 percent in the first three years following repeal, but the decrease is less precise thereafter. We also found that CON repeal was associated with a reduction of 1.6 lung cancer deaths per 100,000 residents, which accounted for more than two-thirds of the overall decline in cancer mortality following the repeal of CON. We found no statistically significant decreases in mortality rates related to several other forms of cancer or of specific forms of heart disease. Given our overall mortality results, the reductions in lung cancer deaths related to CON repeals that we observed may have been offset by increases in other causes of mortality related to the repeals.

The remainder of our paper is structured as follows. Section 2 provides background on CON laws and prior research. Section 3 presents the research design. Section 4 describes the data sources used for our analysis. Section 5 reports results. The final section discusses the implications of the results and concludes.

II. Certificate of Need Laws and Prior Research

Certificate of Need Laws

In response to the Social Security Act of 1972 and the National Health Planning Resources Development Act (HPRDA) of 1974, which incentivized states to review large capital expenditures such as opening hospitals or introducing new services or technologies, nearly every state implemented a CON program (Horwitz et al. 2025). These laws were originally designed to control medical spending and improve quality (Mitchell 2024; Salkever 2000). Under CON laws, new facilities or capital investments from existing providers need to obtain approval from a state-appointed board. Congress repealed HPRDA in 1986, in part due to the perception that CON laws were ineffective (Horwitz and Polsky 2015), and many states repealed all or part of their CON laws. Most of these repeals occurred during the 1980s, but some states repealed their programs over the next two decades. Although we focus on CON laws in general, there is variation across states in the services they regulate (e.g., imaging, hospital beds, and nursing homes). In addition, in some states, CON applies to capital investments over a particular dollar threshold (Horwitz et al. 2025).

Prior Research

Our paper contributes to the understanding of CON in several respects. First, we add to research about the effects of CON on mortality rates; Conover and Bailey (2020) systematically reviewed the literature of the impact of CON on mortality and found mixed findings. Except for Bailey (2018), which used cross-sectional variation in the stringency of CON between 1992-2011 and found no effect on all-cause mortality rates, existing studies have focused on deaths from heart procedures (e.g., CABG, Percutaneous Transluminal Coronary Angioplasty). For example, Robinson et al. (2001) and Cutler et al. (2010) leveraged Pennsylvania's CON repeal to examine the impact on CABG mortality. Robinson et al. (2001) found no impact on mortality in the three years after the CON repeal. Cutler et al. (2010) did not directly measure the impact of repeal on mortality but found that the repeal of CON laws increased the market share of surgeries performed by higher-quality surgeons, translating into reduced mortality. Similarly, Vaughan-Sarrazin et al. (2002) and Ho et al. (2009) used national data Medicare data to study the impact of CON on deaths from CABG, finding opposite effects. Ho et al. (2009) attributed their findings that CON repeal reduced CABG deaths to using a difference-in-differences approach leveraging CON repeals in the 1990s, as opposed to using cross sectional variation. More recently, Chiu (2021) used border discontinuity and difference-in-differences designs to evaluate the effect of CON *enactment* on heart attack mortality between 1968 and 1982, finding CON led to a rise in AMI deaths three years after the policy is enacted. Stratmann (2022) found similar results by using cross-border differences in CON. Our paper builds upon this literature by examining the effects of CON on cancer mortality, the other major leading cause of death, and re-examining the effects on all-cause and cardiovascular mortality leveraging previously unused variation in repeals between 1979 and 2004.

Second, this paper complements a literature studying the effects of CON on entry, utilization, costs of various health care services, and non-mortality quality-of-care measures (see Conover and Bailey 2020 for a full systematic review). Studies have examined the effects of CON for imaging (Perry 2017, Horwitz and Polsky 2015, Horwitz et al. 2025), ambulatory surgery centers (Stratmann et al. 2024; Yu 2023), hospitals (Melo et al. 2024; Sigaud 2025), nursing homes (Fayissa et al. 2020; Grabowski et al. 2003), dialysis clinics (Rosenkranz 2025), and long-term care hospitals (Melad and Bjoerkheim 2025). In general, these papers fixed mixed results on market expansion, costs, and quality of care. For example, for imaging, Horwitz et al. (2025) examined CON laws for imaging and found that CON reduces entry of magnetic resonance imaging (MRI) and computed tomography (CT) scanners and utilization, driven by reductions in low-value imaging such as low-back pain scans. In contrast, for hospital CON, Sigaud (2025) found that the hospital CON laws led to reductions in preventative care (receiving flu shots, mammograms, pap smears, and having cholesterol measured).

Third, despite several analyses of CON laws, quasi-experimental analyses are limited by data. Our primary contribution is to construct a 25-year panel between 1979 and 2004 that allows us to measure the effects of state-level changes to CON laws. Few data resources exist to longitudinally estimate the impact of CON law repeals on health outcome because the majority of repeals occurred in the 1980s. In addition, to our knowledge, no studies to date have used difference-in-differences approaches to estimate CON law repeals on all-cause mortality and cancer mortality.

III. Research Design

To study the relationship between CON and mortality, we used a difference-in-differences research design the staggered timing of CON repeals. We considered an observation to be treated at the beginning of the first year the state repealed its CON and all years following. We estimated event studies of the following form:

$$y_{ist} = \alpha_i + \beta_t + \sum_{\tau \neq -1} \delta_\tau 1\{t - RepealYear_s = \tau\} + \varepsilon_{ist}, \qquad (1)$$

where i indexes the unit of analysis (e.g., county), s indexes state, t indexes year, and τ indicates the year relative to the repeal year. Our main outcomes of interest y_{ist} were all-cause mortality per capita (per 100,000 residents) in each county. All regressions included unit of analysis (i.e. county) and calendar year fixed effects to account for invariant county features and aggregate trends over time. The coefficients δ capture trends before repeal and the average effect of CON repeal. The omitted category is one year prior to when the repeal becomes effective.

The identification assumption is "parallel trends." That is, absent repeal, outcomes would have trended similarly to states that did not repeal CON laws. CON laws are voluntary, so states may choose to drop them in response to the specific health needs of their population. In addition, there may be differences in the scope of CON laws across states which leads to variation in how these laws are enforced. For example, depending on the state a decision to grant a CON law can be enacted by a board appointed by the state's governor, or by governor-appointed officials. We addressed these concerns in our sensitivity checks by controlling for time-varying control variables potentially correlated with mortality (e.g., median age, household income, education, the unemployment rate, and cigarette tax policies), varying the control group, and including a county-specific linear trend.

We estimated our main specification using ordinary least squares. Recent econometric literature has also raised concerns about staggered adoption designs and that, when repeal effects are heterogeneous, traditional two-way fixed effect estimates may yield a non-convex average of true repeal effects (Goodman-Bacon 2021; Baker et al. 2022). To address this concern, we also estimated models using methods proposed by Callaway and Sant'Anna (2021) to obtain group-time average treatment effects. We found similar results to those generated by our primary specification. Although there might be within-state variation in the exposure to CON laws (e.g., see Perry 2017), we conservatively clustered all standard errors at the state level.

IV. Data

a. CON Regulations

Data on state CON laws were from a recently updated original database that improves on prior, publicly available data. These data were constructed over several years by law-student research assistants supervised by Horwitz and JD-Law Librarians, used in previous publications (Horwitz et al. 2025; Horwitz and Polsky 2015), and they were again updated and verified for this study. For each state, the researchers analyzed state statutes, related regulations, and secondary sources, and conducted interviews with state regulators in every state to determine whether extant law accurately reflected the regulatory environment. These data contained information on whether states had a general CON law, as opposed to service-specific regulations and, if any, the repeal date. Figure 1 plots a map displaying generally applicable CON laws by states and the year of repeal we used for this study.

Ideally, we would like to understand the relationship between CON laws regulating a particular health care service on both overall and cause-specific mortality. However, collecting data on whether repeal states enforced a service-specific CON law at the time of repeal is challenging. Historical sources documenting service-specific CON regulations by state often do not exist. Moreover, regulators often do not know when a particular service was regulated and whether any such regulation was enforced in prior decades. Hence, our main analysis used the timing of the repeal of the entire CON law for identification. Since the control group for our main specification uses states that continually have a generally applicable CON law between 1979 and 2004, our approach likely underestimated the true impact of a service-specific CON law repeal on mortality. Some states would not experience any change in entry or capital investment after a CON law repeal because the law was not enforced prior to repeal.

Nonetheless, in various sensitivity tests in Section V, we have also collected cross-sectional data on whether a state regulates specific technologies, specifically regulation of high-tech imaging (as of 2023) and cardiac procedures (as of 2015). In these tests, we used these data to vary the control group states based on contemporaneous information on service-specific CON for computed tomography (CT) scans and cardiac services (open heart surgery and catheterization).

b. Mortality Rates

To measure mortality, we used the Multiple Cause-of-Death Mortality Data from the National Vital Statistics System (NVSS) of the National Center of Health Statistics (NCHS) from 1979 to 2004. These data contain individual-level mortality records from death certificates submitted to state vital statistics offices. Causes-of-death were coded using the International Disease Classification (ICD) codes. The NVSS also contains information on demographics of the decedent, such as age, sex, and race. We supplemented the NVSS data with population data from the National Cancer Institute (NCI), which produces annual county-level population estimates, and interpolated demographic data from decennial Censuses between 1970 and 2000. We combined these datasets with the NVSS data to construct all-cause and cause-specific mortality rates per capita (100,000 residents) at the county- and year-level. This rate is constructed as the total number of deaths divided by the total county population estimate (100,000s) in each year. We reported the ICD codes used to identify causes of death for cancer and heart disease in Appendix Table 2.

There are several limitations to the data. First, we used the Federal Information Processing Standards (FIPS) code to identify counties, which is only available starting in 1982. For data prior to 1982, we used a crosswalk to map NCHS county codes to county FIPS codes. This mapping is imperfect, but less than 2 percent of deaths between 1979-1981 could not be assigned a FIPS county. Second, several data years represented only a 50 percent sample and the NCHS-produced automatically adjusts for this sampling concern, likely increasing uncertainty of mortality rates for those years. Third, starting in 1982, the NVSS stopped reporting data for counties with populations of less than 100,000 residents, effectively limiting our sample to urban counties and a single "rest-of-state" geographic unit that represents an aggregate of rural counties. Therefore, our analysis sample included counties continuously reported between 1979 to 2004 with a catch-all "rest-of-state" county. Fourth, between 1999 and 2004, the classification of cause of death changed from the ICD-9 to ICD-10 standard. In our sensitivity tests, we estimated our primary specification dropping these years. Finally, we did not use data after 2004 as the public-use files did not contain state identifiers needed for our analysis.

V. Results

a. Summary Statistics

Table 1 reports summary statistics of demographic characteristics and morality rates per 100,000 residents in CON law repeal and non-CON law repeal counties in 1982. We focused on a single cross-section of the data from 1982, which predated any CON law repeals. The first and second columns report the means for non-CON law repeal and CON law repeal counties, respectively. The third column reports the p-values from the difference-in-means test. On average, counties in CON law repeal states tended to be larger, and they have slightly younger and higher percentages of non-white residents than counties in states that did not repeal their CON law; these differences are statistically significant. Levels of education, incomes, gender mix, and unemployment rates were similar in both repeal and non-repeal counties. Counties in CON law repeal states also tended to have lower mortality rates for any cause or for leading causes of death such as heart disease and cancer. To address these potential baseline differences, all our specifications included county fixed effects.

b. Mortality

All-Cause and Leading Causes of Mortality

Figure 2(a)-(c) graph the coefficient estimates on the leads and lags of the relative year from repeal indicator variables in equation (1) estimated using ordinary least squares or Callaway and Sant'Anna (2021). Panel (a) presents the effects on county-level all-cause mortality rates. Following repeal county-level all-cause mortality rates declined by 2.1 per capita residents in the first three years after CON law repeal and increased to zero in subsequent years. The coefficients were not statistically significantly different from zero. We could, however, reject the hypothesis that CON repeals increased county-level mortality rates per capita by more than 1 percent and decreased county-level mortality rates per capita by less than 1.1 percent with 95 percent confidence. The magnitude of the effect is practically small.

Panel (b) of Figure 2 presents the effects of CON law repeal on county-level cancer mortality per capita, which included deaths from all malignant and non-malignant neoplasms. In the first three years after repeal, county-level cancer mortality rates per capita fell by around 2-4 deaths per 100,000 or about 1-2 percent of county-level cancer mortality rates per capita. The decline took about 2 years to fully materialize. After the third year after CON law repeal, the estimates of the effect on county-level cancer mortality rates per capita were quantitatively similar, but were no longer statistically significant, indicating increasing uncertainty.

Panel (c) of Figure 2 displays the effect of CON law repeal on the county-level ischemic heart disease mortality rate per capita. The coefficients on county-level heart disease mortality rate per capita were close to zero, but increased starting three years after the repeal. Whether the coefficients are statistically significant depended on the estimation technique used, but we interpret these results as null effects.

Table 2 reports the pooled event study estimates for the effect of CON law repeal on county-level all-cause mortality rate per capita, cancer mortality rate per capita, and heart disease mortality rate per capita. By construction, these results mirror the event study estimates presented in Figure 2. The table reveals that none of the specifications show strong evidence of a pre-trend. The decline in county-level cancer mortality rate per capita was statistically significant in the first three years following CON law repeal but not afterwards. However, the estimates remained relatively stable even after the CON law repeal.

Cancer Mortality by Type

The effects of CON law repeal on the county-level mortality rate per capita for specific types of cancer could be heterogeneous. Table 3 reports the estimates of the effects of CON law repeal on county-level lung cancer mortality rate per capita, colorectal cancer mortality rate per capita, breast cancer mortality rate per capita, prostate cancer mortality rate per capita, pancreatic cancer mortality rate per capita, and leukemia mortality rate per capita. These six cancer sites are responsible for almost 50 percent of cancer deaths (NCI). Following CON law repeal, the county-level lung cancer mortality rate per capita declined by 1.6 deaths per 100,000 residents in years 0-2 following repeal or about 3.4 percent of lung cancer deaths per capita. The estimated effect on the county-level lung cancer mortality rate per capita explained over two-thirds of the decline in the cancer mortality rate per capita. Like the overall effect on cancer mortality, the reduction in lung cancer mortality rate per capita, the statistical significance diminished in the longer run.

Effects on the county-level colorectal cancer mortality rate per capita, breast cancer mortality rate per capita, prostate cancer mortality rate per capita, pancreatic cancer mortality rate per capita, and leukemia mortality rate per capita are presented in subsequent columns. In general, we did not find statistically significant decreases in county-level cancer mortality rate per capita. However, the point estimates were negative and contributed to the total county-level cancer mortality per capita decline immediately following CON law repeal. Pre-trends were not statistically significantly different from zero. For county-level lung cancer mortality rate per capita, the negative point estimate suggests that controlling for county-specific trends would lead to larger mortality declines. Figure 3(a)-(f) graph the event study coefficients from -6 to 5 for the county-level cancer mortality rate for each cancer type in Table 3. The figures show that the results are robust to using methods from Callaway and Sant'Anna (2021).

Cardiovascular Disease Mortality by Type

We also estimated the effect of CON law repeal on specific types of cardiovascular deaths. The first two columns of Table 4 report the estimates for the county-level mortality rate per capita from AMI and heart failure. We found no evidence that CON law repeal has any impact on the county-level mortality rate per capita from AMI or heart failure. We could reject increases and decreases to AMI and heart failure mortality rates per capita by more than 2 percent in the first three years after CON law repeal. The estimates became substantially noisier in subsequent years. Figure 4(a)-(b) graphs the event study coefficients from -6 to 5 for AMI and heart failure. The figures show that the main results are robust to using alternative estimation strategies such as Callaway and Sant'Anna (2021).

b. Sensitivity Tests

We conducted several sensitivity tests and present them as single deviations from the main specification, as shown in Figure 5 for county-level all-cause, cancer, and lung cancer mortality rate per capita.

We considered sensitivity to the inclusion of time-varying state and county-level controls that may be correlated with mortality: median age, median household income, percent non-white, percent female, percent less than high school, the unemployment rate, cigarette taxes per pack (Centers for Disease Control and Prevention 2023), and minimum purchase age for cigarette purchases (Centers for Disease Control and Prevention 2025; Apollonio and Glantz 2016). This test ruled out that policies affecting cigarettes may have been correlated both with CON repeals and health outcomes. Empirically, we tested for the effects of cigarette tax rates and the minimum purchase age for cigarettes because there was variation in adoption of these policies over time and across states. However, our estimates were not sensitive to the inclusion of these policies. We also estimated the models with a linear county trend, finding similar results.

We did not find any changes in lung cancer screening guidelines coincident with CON repeals during the mid-1980s, but qualitative evidence suggests that there were no changes that were likely to affect our outcomes. Prior to 2002, the dominant types of lung cancer screening (i.e., non-CT: chest roentgenography and sputum cytology) were ineffective at reducing lung cancer mortality (Fontana 1986). Hence, lung cancer screening was not generally recommended (Eddy 1989). The U.S. Preventative Services Task Force did not begin recommending lung cancer screening via low dose CT until 2013. This recommendation followed results from the National Lung Screening Trial (NLST), which launched in 2002 with preliminary results published in 2010. The trial showed improvements in mortality following low dose CT. The USPSTF's prior recommendation in 2004 did not recommend any screening for asymptomatic individuals. Therefore, we do not believe changes to screening guidelines affected our findings.

Next, we conducted several tests to confirm that researcher choices were not driving the results. We re-estimated our models without 1999 to 2004 data, which uses ICD-10 codes rather than ICD-9 codes to flag diagnoses for causes of death. Then, we re-estimated models without the "catch-all" county that was created during data cleaning that combined deaths from censored counties (due to population size). By dropping these data, we effectively examined the impact of CON repeal on the county-level mortality rate per capita in urban counties. In all of the aforementioned sensitivity checks, our results are quantitatively and qualitatively similar.

We also varied the control group leveraging cross-sectional service-specific CON data. Control states may not have regulated investments similar to repeal states, but the investments subject to regulation in repeal states is unknown. As a result, our estimates may be sensitive to the definition of the control group. We consider two alternative control groups based on recent CON regulations: states that regulate CT scanners following Horwitz et al. (2025) and states regulate cardiac services (as of 2015). Our results are qualitatively and quantitively similar.

Finally, we iteratively dropped each treated state to see if any of the CON law repeal states explained our mortality outcomes. For brevity, we highlight four states: Pennsylvania, California, Texas, and Indiana. Pennsylvania repealed their CON law relatively late in 1996 compared to other states in the analysis. California and Texas are big states with the potential to be distinct. Indiana was particularly difficult to code; the vast majority of the CON law according to state register was repealed in 1987 though remnants of their CON remained until 1996 or 1999, depending on the information source. Analysis by the FTC (see Sherman 1988) also used 1987 as the sunset date for Indiana. Our results remained unchanged.

VI. Discussion and Conclusion

We found that CON law repeal was associated with short-run reductions in cancer mortality rates. These reductions were driven by reductions in lung cancer deaths of 1.6 deaths per 100,000 residents. On the other hand, CON repeals were not associated with statistically significant changes to all-cause mortality rates.

In addition, although data limitations preclude a full welfare analysis of CON, we can estimate the relationship between CON and the total number of cause-specific deaths. We estimated CON law repeals were associated with 1,289 fewer deaths from lung cancer per year, worth over $1.2 billion per year based on mean VSL estimates at age 67 (Ketcham et al. 2024). Extrapolating to the entire country, if regulated states had repealed their laws, we estimated a reduction of 2,499 deaths from lung cancer or about $2.3 billion per year.

However, a positive net social benefit of lung cancer mortality reductions depends on whether the regulations improved life expectancy for other causes or decreased spending. It is likely that these results were offset by changes to other services, perhaps related to positive effects of CON, given our results for overall mortality. Indeed, previous research shows that states without CON can have higher rates of imaging for low value services (Horwitz et al. 2025). Imaging can lead to increased cancer risk and therefore mortality (Brenner and Hall 2007).

Short-run reductions to lung cancer mortality are consistent with increased technological adoption of advanced imaging (i.e., CT), which was a growing trend between 1970 and 2000 (Brenner and Hall 2007). As noted above, lung cancer screening via low dose CT was found to greatly improve survival odds. Localized detection of non-small cell lung cancer has a 5-year survival rate of 67 percent while distant detection has a 5-year survival rate of 12 percent. However, these results were not published until the early 2000s and prior guidelines did not emphasize lung cancer screening due to the limited benefit from older imaging technologies.

CON repeal may have affected entry of imaging scanners, practice patterns, or both. CT scanners are used for head and body scans to diagnose tumors, blood clots, infections, and internal bleeding. According to the Office of Technology Assessment (1978), the first CT scanner was installed in the United States in 1973 and by 1976, there were over 360 scanners nationwide. At that time, hospitals accounted for 81 percent of scanners. Since the OTA report, there has been limited data collection on the number of CT scanners, but there is aggregate data on the location of imaging centers.[2] As of 2025, estimates suggest that there are over 15,000 imaging centers in the United States, which includes around 6,000 hospitals, indicating the

[2] Imaging centers often have multiple scanners, which could include or not include CT scanners.

increase in the relative importance of freestanding facilities. Utilization of CT experienced significant increases in the 1980 and 1990s, driven by adoption of more advanced scanners. Brenner and Hall (2007) estimated that about 62 million CT scans are conducted in the United States annually in 2006, compared to just 3 million in 1980.

There are several limitations to our study. First, we were unable to use variation in the repeal of service-specific CON laws. This limitation likely led to underestimating of the effect of CON on mortality. Second, we also did not look at adoption or utilization of medical care services which would be the likely mechanism for the mortality reductions. It was not possible to obtain nationally representative data on medical care utilization for the study period. In addition, there is limited county-level data on the number of hospital-based, freestanding, and mobile CT scanners that would allow us to adopt a similar research design. Future research could use Medicare or other commercial claims combined with restricted-use CDC vital statistics data to study utilization together with mortality, but unlikely be able to use this identifying variation. There are also limitations to the external validity of these results. Although repeal states did not look particularly distinct from non-repeal states based on observable characteristics, the bulk of repeals occurred over 40 years ago which had different policy environment. Therefore, more recent CON repeals could have different mortality effects. For example, although Chiu (2021) found that CON enactments in the 1960s increased AMI, we did not find a corresponding decline in AMI mortality after repeal using data from two decades later.

On the one hand, our results demonstrate that there may be disease-specific benefits to free entry and capital investment in health care technologies, leading to decreased mortality for diseases often targeted by these technologies. On the other hand, the value of mortality reductions could be offset by increases to spending or increased risk from other causes of death, which also may be related to CON repeal.

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Tables and Figures

Table 1. Summary Statistics (1982)

Variable	**No Repeal**	**Repeal**	**p-value for diff. in means**
Baseline Demographics			
Population	520,696	559,882	0.66
Age	31	30	<0.01
% Female	0.51	0.51	<0.01
% Nonwhite	0.15	0.20	<0.01
% Medicare	0.11	0.11	0.12
% Less than high school	0.30	0.29	0.14
% At least 4-year degree	0.17	0.17	0.56
Median household income	57,666	56,617	0.35
Unemployment rate	0.09	0.09	0.13
Mortality per 100,000 residents			
All-Cause	824.03	784.07	0.04
Heart Disease	233.96	205.10	<0.01
Cancer	189.73	172.13	<0.01
Lung	49.16	42.78	<0.01
Colorectal	23.36	21.04	<0.01
Pancreatic	9.15	8.39	0.02
Breast	16.34	14.55	<0.01
Leukemia	7.04	6.66	0.16
Number of analysis counties	293	143	

Notes: This table reports means of demographic and outcome variables in 1982 in states that repeal and do not repeal CON. The p-value from a t-test comparing means between repeal and non-repeal states is reported in the final column.
Source: Multiple Cause-of-Death Mortality Data from the National Vital Statistics System of the National Center of Health Statistics, 1970-2000 Census.

Table 2. Effects of CON Repeal on All-Cause Mortality

	All-Cause	Cancer	Heart Disease
Event Window			
Years 0 to 2	-2.939	-2.209**	-0.118
	(3.855)	(1.046)	(1.370)
Years 3 to 5	-1.286	-1.949	4.130
	(9.036)	(3.219)	(3.432)
Pre-Trend (Year -6 to -2)	6.961	2.182	0.388
	(6.579)	(1.929)	(1.535)
Mean at Year t = -1	809.3	184.5	191.7
Number of Observations	11336	11336	11336

Notes: This table displays coefficients from event study regression of general CON repeal on all-cause and cause-specific mortality per 100,000 residents. Standard errors, clustered by state, reported in parentheses. * p <.1 ** p <.05 *** p <.01

Sources: Vital Statistics 1979-2004, US Census, SEER County Population Estimates.

Table 3. Effects of CON Repeal on Cancer Mortality

	Lung	Colorectal	Breast	Prostate	Pancreatic	Leukemia
Event Window						
Years 0 to 2	-1.612***	-0.315	-0.156	-0.015	-0.163	-0.018
	(0.359)	(0.275)	(0.173)	(0.160)	(0.201)	(0.137)
Years 3 to 5	-1.529	0.164	-0.285	-0.149	0.036	-0.087
	(1.069)	(0.483)	(0.286)	(0.188)	(0.325)	(0.178)
Pre-Trend (Year -6 to -2)	0.454	0.280	0.274	0.281	-0.096	0.067
	(0.846)	(0.271)	(0.183)	(0.225)	(0.256)	(0.189)
Mean at Year t = -1	47.5	21.3	15.5	10.8	9.2	7.2
Number of Observations	11336	11336	11336	11336	11336	11336

Notes: This table displays coefficients from event study regression of general CON repeal on cancer mortality per 100,000 residents. Standard errors, clustered by state, reported in parentheses. * p <.1 ** p <.05 *** p <.01

Sources: Vital Statistics 1979-2004, US Census, SEER County Population Estimates.

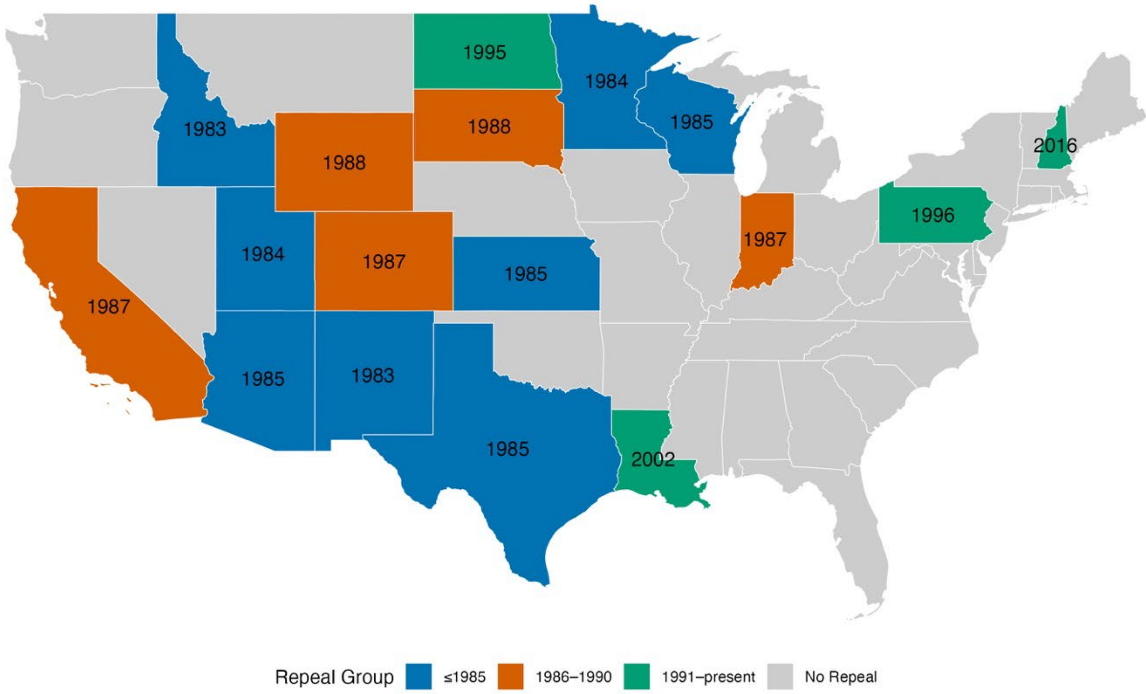
Table 4. Effects of CON Repeal on Specific Cardiovascular Mortality

	Acute Myocardial Infarction	Heart Failure
Event Window		
Years 0 to 2	0.255	-0.250
	(0.780)	(0.304)
Years 3 to 5	2.262	-0.510
	(2.042)	(0.740)
Pre-Trend (Year -6 to -2)	2.282	0.114
	(1.554)	(0.495)
Mean at Year t = -1	93.1	16.5
Number of Observations	11336	11336

Notes: This table displays coefficients from event study regression of general CON repeal on cardiovascular and cerebrovascular disease mortality per 100,000 residents. Standard errors, clustered by state, reported in parentheses. * p <.1 ** p <.05 *** p <.01

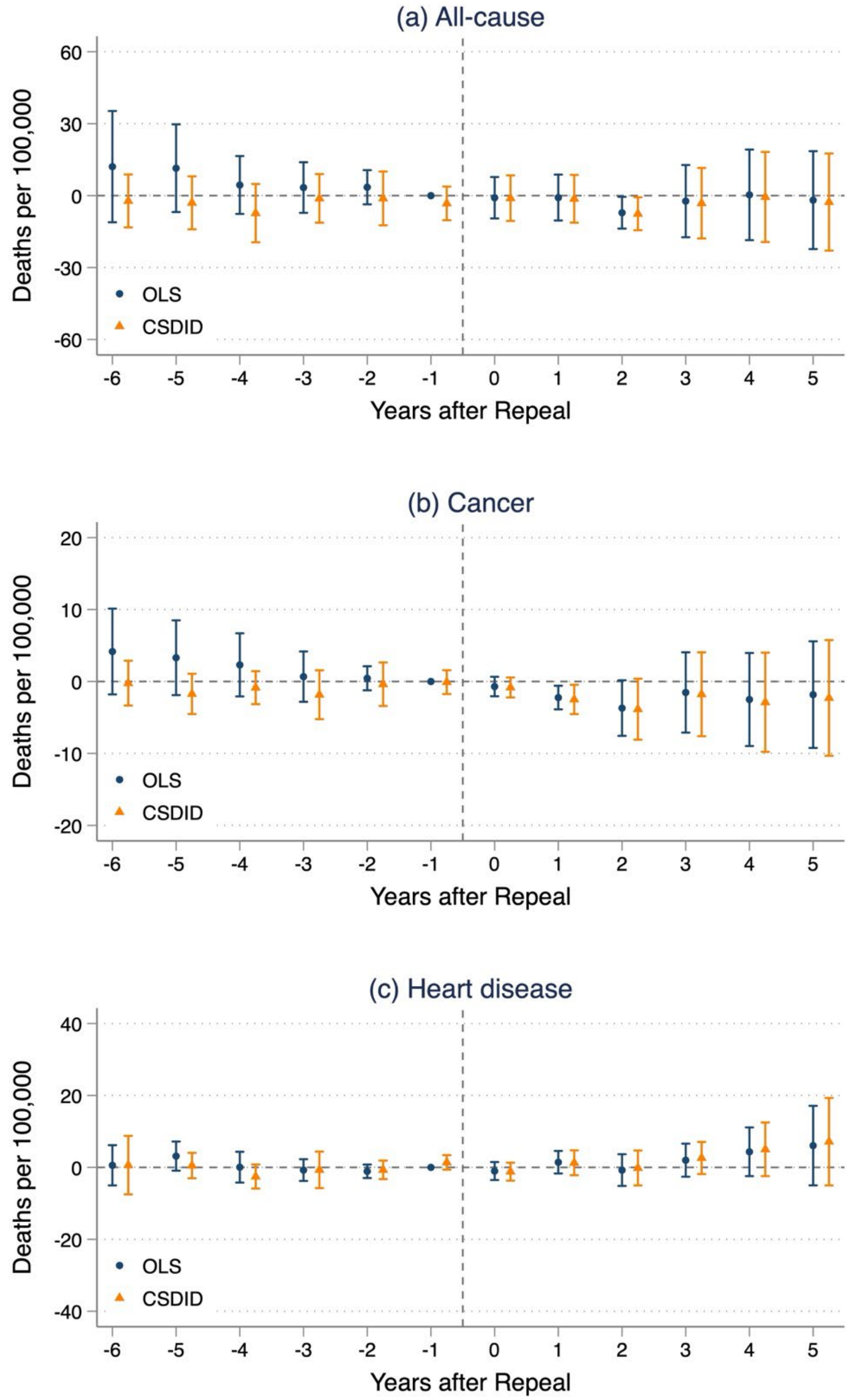
Sources: Vital Statistics 1979-2004, US Census, SEER County Population Estimates

Figure 1. Certificate of Need Law Repeals



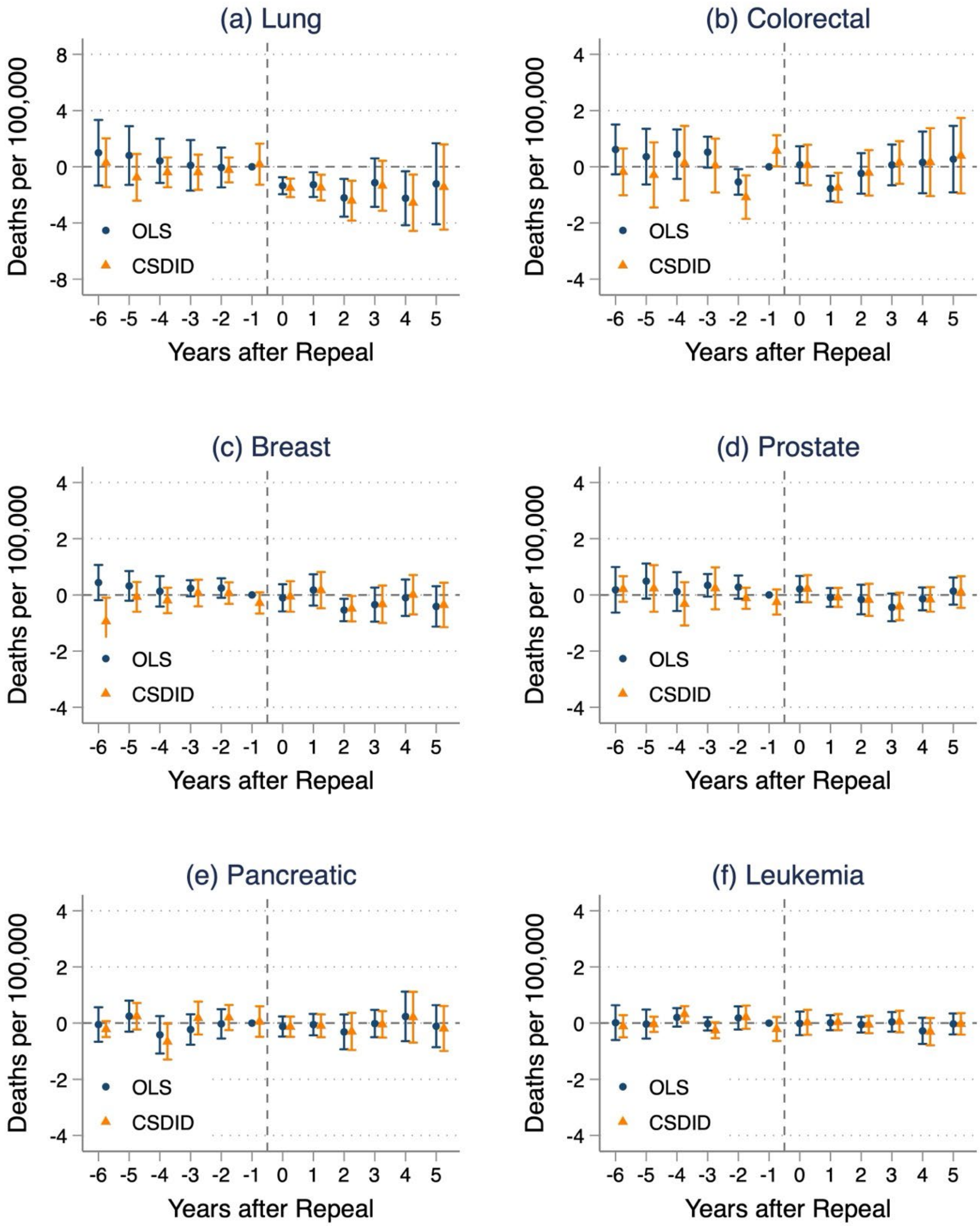
Note: This map displays states and year of CON repeal.
Sources: Horwitz and Polsky 2015, Horwitz et al. 2025.

Figure 2. Effect of CON Repeal on All-Cause, Cancer, and Heart Disease Deaths



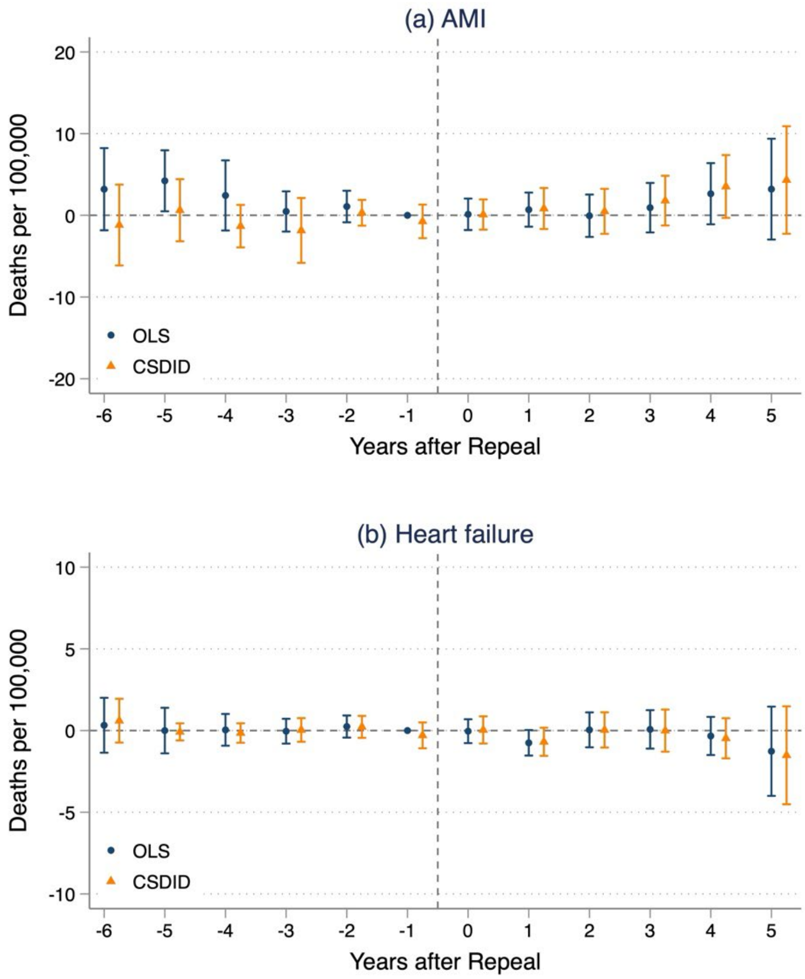
Note: Each figure plots coefficients from two-way fixed effects models with 95% confidence intervals; standard errors clustered by state. "OLS" indicates that model was estimated using ordinary least squares. "CSDID" indicates model was estimated using Callaway Sant'Anna (2021) to obtain group time average treatment effects.

Figure 3. Effect of CON Repeal on Specific Cancer Mortality



Note: Each figure plots coefficients from two-way fixed effects models with 95% confidence intervals; standard errors clustered by state. “OLS” indicates that model was estimated using ordinary least squares. “CSDID” indicates model was estimated using Callaway Sant’Anna (2021) to obtain group time average treatment effects.

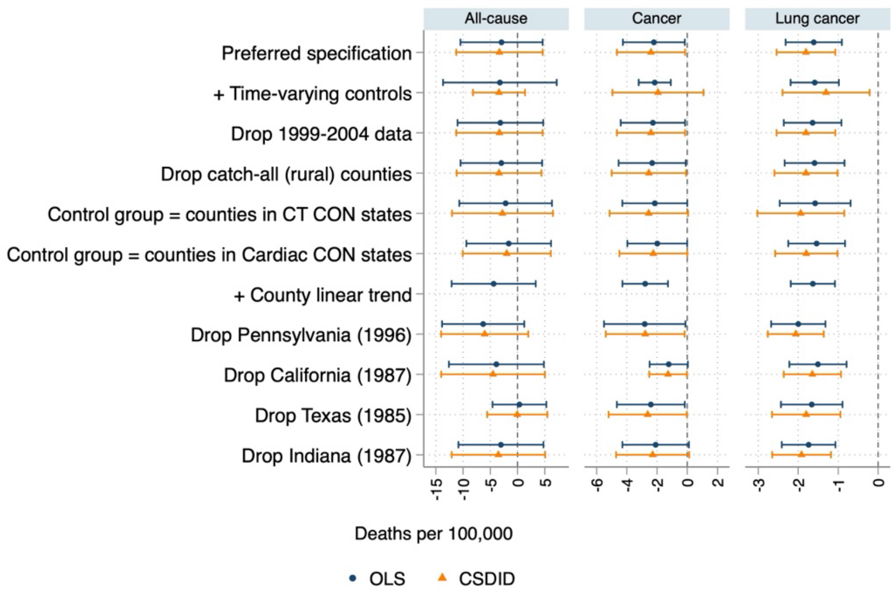
Figure 4. Effect of CON Repeal on AMI and Heart Failure Mortality



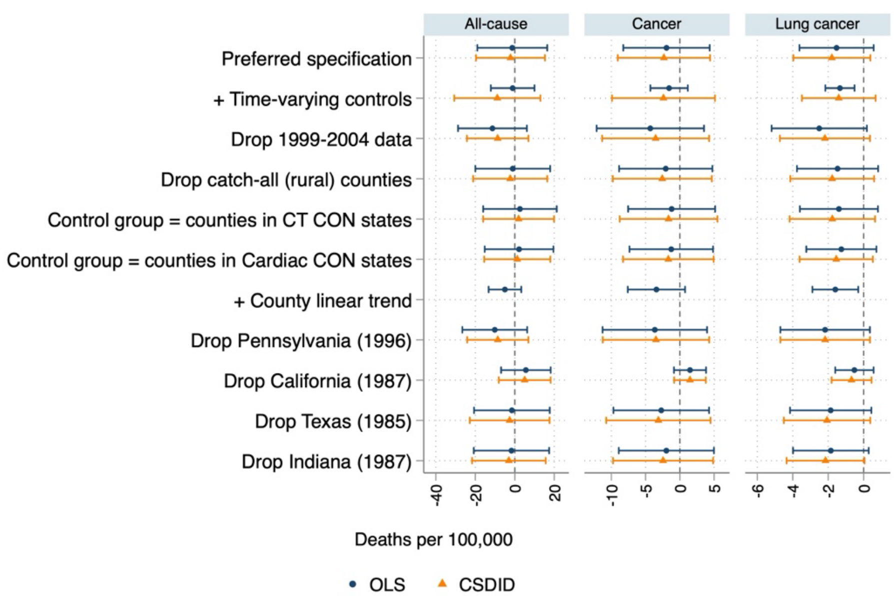
Note: Each figure plots coefficients from two-way fixed effects models with 95% confidence intervals; standard errors clustered by state. “OLS” indicates that model was estimated using ordinary least squares. “CSDID” indicates model was estimated using Callaway Sant’Anna (2021) to obtain group time average treatment effects.

Figure 5. Sensitivity Tests for Estimates of CON Repeal on Mortality

(a) $\tau = 0$ to $\tau = 2$



(b) $\tau = 3$ to $\tau = 5$



Note: Each figure plots pooled coefficients from two-way fixed effects models with 95% confidence intervals; standard errors clustered by state: (a) Years 0-2 and (b) Years 3-5 after CON repeal. "OLS" indicates that model was estimated using ordinary least squares. "CSDID" indicates model was estimated using Callaway Sant'Anna (2021) to obtain group time average treatment effects. CSDID does not allow for estimation of county-specific trends. Time-varying controls include median household income, median age, percent nonwhite, percent female, the unemployment rate, percent with less than high school education, total cigarette tax, and minimum legal purchasing age of cigarettes.

Appendix A. Supplemental Tables and Figures

Appendix Table 1. CON States

		CON Regulations as of 2004		
State	General CON Repeal Year	General CON	CT	Cardiac Procedures
Alabama	-	Yes	-	Yes
Arizona	1985	-	-	-
Arkansas	-	Yes	-	-
California	1987	-	-	-
Colorado	1987	-	-	-
Connecticut	-	Yes	Yes	Yes
Delaware	-	Yes	Yes	Yes
DC	-	Yes	Yes	Yes
Florida	-	Yes	-	-
Georgia	-	Yes	Yes	Yes
Idaho	1983	-	-	-
Illinois	-	Yes	-	Yes
Indiana	1987*	-	-	-
Iowa	-	Yes	Yes	Yes
Kansas	1985	-	-	-
Kentucky	-	Yes	-	Yes
Louisiana	2002	-	-	-
Maine	-	Yes	Yes	Yes
Maryland	-	Yes	-	Yes
Massachusetts	-	Yes	Yes	Yes
Michigan	-	Yes	Yes	Yes
Minnesota	1984	-	-	-
Mississippi	-	Yes	Yes	Yes
Missouri	-	Yes	Yes	Yes
Montana	-	Yes	-	-
Nebraska	-	Yes	-	-
Nevada	-	Yes	-	-
New Hampshire	-	Yes*	Yes*	Yes*
New Jersey	-	Yes	-	Yes
New Mexico	1983	-	-	-
New York	-	Yes	Yes	Yes
North Carolina	-	Yes	Yes	Yes
North Dakota	1995	-	-	-
Ohio	-	Yes	-	-
Oklahoma	-	Yes	-	-
Oregon	-	Yes	-	-
Pennsylvania	1996	-	-	-
Rhode Island	-	Yes	Yes	Yes
South Carolina	-	Yes	Yes	Yes
South Dakota	1988	-	-	-
Tennessee	-	Yes	Yes	Yes
Texas	1985	-	-	-
Utah	1984	-	-	-
Vermont	-	Yes	Yes	Yes
Virginia	-	Yes	Yes	Yes
Washington	-	Yes	-	Yes
West Virginia	-	Yes	Yes	Yes
Wisconsin	1985	-	-	-
Wyoming	1988	-	-	-

Notes: New Hampshire repealed law in 2016. Indiana's law was particularly difficult to code. In 1987, the Indiana state legislature repealed the vast majority of CON provisions, only leaving requirements for intermediate care facilities and specific hospital bed types.
Sources: Horwitz and Polsky 2015, Horwitz et al. 2025

Appendix Table 2. ICD9/ICD10 Codes for Cause-Specific Mortality

Condition	ICD-9 (1979-1998)	ICD10 (1999-2004)
Cancer	140-208, 210-239	C00-C97, D00-D48
Lung Cancer	162	C34
Colorectal Cancer	153, 154	C18, C19, C20, C21
Prostate Cancer	185	C61
Breast Cancer	174	C50
Pancreatic Cancer	157	C25
Leukemia	204-208	C91, C92, C93, C94, C95
Ischemic heart disease	410-414	I21-I25
AMI	410	I21
Heart failure	428	I50

Sources: International Classification of Diseases 9th and 10th editions.