Austerity, Healthcare Provision, and Health Outcomes in Spain

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Abstract

The recession that started in the United States in December 2007 has had a significant impact on the Spanish economy through a large increase in the unemployment rate and a long recession which led to tough austerity measures imposed on public finances. Taking advantage of this quasi-natural experiment, we use data from the Spanish Ministry of Health from 1996 to 2015 to provide novel causal evidence on the short-term impact of healthcare provision on health outcomes. The fact that regional governments have discretionary powers in deciding healthcare budgets and that austerity measures have not been implemented uniformly across Spain helps isolate the impact of these policy changes on health indicators of the Spanish population. Using Ruhm's (2000) fixed effects model, we find that medicalstaff and hospital bed reductions account for a significant increase in mortality rates from circulatory diseases and external causes, but not from other causes of death. Similarly, mortality rates do not seem to be robustly affected by the 2012 changes in retirees' pharmaceutical co-payments and access restrictions for illegal immigrants. Our results are robust to changes in model specification and sample selection and are primarily driven by accidental and emergency deaths rather than in-hospital mortality, which suggests a larger role for decreases in accessibility rather than decreases in healthcare quality as impact channels.

Keywords: Healthcare provision; Mortality; Health cuts.

JEL: I10, I18

1. Introduction

Usually, recessions cause unemployment, poverty, and changes in the distribution of resources. In many cases recessions also call for changes in government expenditures, regulations, and the provision of public goods. All these factors have important consequences for individuals' health status. Economists, however,have mainly focused on studying the impact of macroeconomic conditions on health outcomes, disregarding the analysis of how healthcare policy influences outcomes.[1] Given thathealthcareis a potential determinant of individuals' health status, knowing the extent to which health resources affect health is crucial for assessing the adequacy of additional investments in healthcare provision.

We can think of at least two channels through which cuts in healthcare services may impact health outcomes: service quality and healthcare accessibility. Reduced provision may give rise to hospital congestion,lower hospital nurse/patient ratios, and increased hospital staff workloads, with the result of lower service quality, including discharging patients before they are fully recovered and higher hospital readmission and in-hospital mortality rates[2]. Cutbacks in healthcare provision may also impair access to healthcare:First, reduced healthcare resources may increase waiting lists and average waiting times for elective or semi-elective surgery, with the potential result of adverse health outcomes[3], [4]; and second, when reduced healthcare spending involves hospital closures, increased travel times or distance to hospitals may lead to worse health outcomes, especially higher mortality ratesin emergency situations[5], [6].

The austerity measures imposed by the financial needs of the state and regional treasuries during the recent crisis constitute a quasi-experimental variation in healthcare resources. In this paper we study the short-term impact of changes in the provision of healthcare services exogenously imposed by budget cuts on health outcomes in Spain from 1996 to 2015.

We use data from the Spanish Ministry of Health on different health outcomes (mortality, sex-specific mortality, cause-specific mortality, and age-specific mortality) together with data on the quality of healthcare provision (health workers and hospital beds) and health reform indicators for both the pharmaceutical co-payment and access restrictions for illegal immigrants for the different Spanish regions during the years 1996-2015. Changes in healthcare provision and regulations are assumed to be exogenously determined by austerity measures and not driven by population needs. In particular, given that regional governments have discretionary powers in deciding healthcare budgets, ouridentification strategy is based on the time and cross-region variation in the data, including the different levels of implementation of national healthcare policies in different regions. We isolate the effect of health cuts on health outcomes using Ruhm's[1], [7]fixed effects model which identifies the effect of changes in healthcareprovision through within-region variation in mortality rates, relative to changes in other regions and after controlling for the socio-demographic composition of the population and the effect of the business cycle.

[1]A recent burgeoning literature has analysed the health impact of business cycles. The pro-cyclical nature of mortality has been found for instance for the United States[1], [7], [30], Germany[31], Spain[32], and OECD countries[33].

We find that health cuts have had a significant, though small and specific, impact on Spanish health outcomes. In particular,staff reductions of 0.2doctors per 1,000 inhabitants (the average in our sample from 2009 to 2013)are associated with increases in the circulatory problems mortality rate of about 0.6 percent,andreductions of 0.2 beds per 1,000 inhabitants (average in our sample) correspond to an external-cause mortality rate increase of almost 4percent.These results prove robust to changes in model specification and after accounting fordifferent trendstowards privatisation of healthcare in Spanish regions.Neither the introduction of retirees' pharmaceutical co-payment nor the implementation of immigrants' access restrictions have had any robust impact on cause- or cause and sex-specific mortality rates.

We also explore the channels through which decreased healthcare supply might have affected health outcomes. We show that our results are driven by deaths in emergency situations, especially accidental deaths, involving traffic accidents and other unintentional injuries. We also show that neither in-hospital mortality rates nor readmission rates were significantly and robustly affected. Lengths of hospital stays, however, increased about 0.3 days due to the introduction of the pharmaceutical co-payment. All in all, our results suggest that reduced accessibility to healthcare, probably due to hospital and hospital ward closures,rather than diminished in-hospital quality of care,must have been behind worsening health outcomes.

Our work contributes to the literature that relates health determinants to health indicators, estimating basically aggregate versions of Grossman's[8] health investment model. Studies such as Or[9] mainly use data from the OECD and focus on the impact of health expenditure on health, controlling for characteristics of different health systems. More recently, the models have also been estimated at the sub-national level, for instance for the 26 states in India[10], the 23 local health authorities in England[11], and the 20 regions in Italy[12]. In comparison, our study uses staff employed in hospitals and operational hospital beds as measures of healthcare provision. The use of non-monetary measures of healthcare provision avoids the problems of comparing the purchasingpower of monetary magnitudes across different regions.

Our work also contributes to the scarce literature that analyses the effects of different healthcare reforms on health outcomes. Most studies consider hospital mortality rates as indicators of quality of care and study the health impact of either hospital closures, hospital proximity, and hospital density[5], [13],or introducing competition in healthcare markets[14], [15], or changes in minimum staff ratios[16]. Most of these studies use hospital-level information and face adverse patient selection problems, as worse patients may choose to go to better equipped hospitals. When considering aggregate regional-level data this problem is considerably reduced because this sort of 'health' migration between regions, although possible, is plausibly much less common than between hospitals in the same location.

To our knowledge, our work is also the first analysis of the impact of health cuts motivated by the Great Recession on health outcomes in an OECD country which, along with indicators of healthcare provision, includes indicators related to changes in health policies such as the pharmaceutical co-payment and the access restrictions to the Spanish National Health Service (NHS) introduced in 2012. The Spanish case is especially relevant in this respect given the severity of the Spanish crisis and the quantitative importance of the Spanish health cuts.

The second section describes the institutional framework. Section three presents the data and estimating methods. Section four describes the results. Section fivediscusses the potential mechanisms explaining the main findingsand section sixpresentsconclusions.

2. Institutional Background

In Spain healthcare services are provided universally through a National Health System publicly controlled and operated by public organizations and financed through taxes[17].From its inception in 1986 the system was a decentralised entity. Initially only the historical regions of Catalonia, the Basque Country and Andalusia had healthcare responsibilities and a centrally managed agency, the INSALUD, organised healthcare services in the remaining regions[18]. During the following two decades healthcare responsibilities were gradually transferred – devolved – to other regional governments[19] and by the turn of the century, it could be considered'a system of regional health services'[18][2].

Spain officially entered into a recession in the last quarter of 2008, after gross domestic product shrank for two consecutive quarters. Unemployment rates soared to 25 percent. In the banking sector, BANKIA required a 22 billion euro bailout. Risk premiums on national debt hit over 5 percentage points. The austerity measures implemented from 2010 onwards particularly affected the Spanish public healthcare sector, which bore a disproportional share of the financial adjustment to the crisis[20]: whereas current total government spending fell by 6 percent between 2009 and 2014, public spending in healthcare dropped by 13 percent[21]. The first measures were horizontally applied across the Spanish regions and mainly affected staffing,through reduced wages and reductions in the rate of replacement of retired workers, and investments, through reductions in the purchase of new equipment and the closure of hospital wards. The second set of measures came in the form of a royal decree (Royal Decree Law 16/2012, of 20 April) and had two main implications[22][23]: first, non-residents were denied access to healthcare services;and second, pensioners were required to make co-payments on their medications which were previously obtained for free.

Given that regional governments have discretionary powers in deciding healthcare budgets, depending on their financial situation, different regions implemented the first set of government measures differently[24]. The measures decided by the royal decree were even more unequally executed. Some regions provided aids for pensioners to face co-payments and some others went even as far as not to impose any access restrictions to healthcare services[23], [25]. As a result, regional disparities in public healthcare provision increased during the crisis.

[2]The transfer of health care competencies to the autonomous regions followed the following schedule: 1981 (Catalonia); 1984 (Basque Country and Andalusia); 1987 (Valencia); 1990 (Galicia and Navarre); 1994 (Canary Islands); 2001 (Aragón, Asturias, Balearic Islands, Cantabria, Castile La Mancha, Castile León, Extremadura, La Rioja, Madrid and Murcia).

3. Data and Methods

This study uses data on healthcare indicators from the Statistical Site of the Spanish NHS merged to mortality rates and socio-demographic data from the Spanish Statistical Institute (Instituto Nacional de Estadística-INE) at the regional (autonomous community) level from 1996 to 2015. We have information on the 17 autonomous communities over 20 years (340 observations) merged at the region-year level.[3]

The health outcome variables used in this paper are the overall mortality rate, sex-specific, cause-specific and sex and cause-specific mortality rates.We consider cause- and sex and cause-specific mortality rates for the four most common causes of death within the International Classification of Diseases (ICD-10) chapters. We consider Neoplasms (Chapter II), Diseases of the circulatory system (Chapter IX), Diseases of the respiratory system (Chapter X), and External causes (Chapters XIX and XX).[4]Table A.1 presents descriptive statistics for all outcome variables. The analysis of cause-specific mortality rates requires comparing the 9th International Classification of Diseases (ICD-9), used between 1981 and 1998, and ICD-10, used since 1999. We use the correspondence between both classifications officially provided by INE. However, we use broad causes of death for which equivalence concerns are arguably smaller[7].

Our main measures of healthcare provision are the number of operational hospital beds per 1,000 inhabitantsand the number ofhealthcare workers per 1,000 inhabitants. Figure 1 shows the geographical variation in each average indicator and in its change from 2009 to 2015. Even if northern regions show higher levels of both hospital beds and healthcare workers, austerity measures reducing healthcare provision did not follow any clear pattern. From 2012 onwards the cuts also involved access restrictions tohealthcare of undocumented immigrants and increases in co-payments for drugs (see Section 2). As the policies were implemented differently by the different regional governments we also include dummies for these variables[25]. Table A.2 presents descriptive statistics for our main independent variables.

To isolate the impact of healthcare supply changes we additionally control for the impact of the business cycle by including regional unemployment rates and percapita gross domestic product levels. We also include demographic composition controls including young and aged dependency ratios, and the share of the regional population who are immigrant, female, disabled, university educated, and aged 65 years old or over.To control for different paths in the devolution of health budgets to regional governments, we include a dummy for since when the

[3] We investigated the possibility of using healthcare data from the National Catalogue of Hospitals, available also from the NHS Statistical Site and amenable to provincial, instead of regional, disaggregation. Data on doctors and nurses was only available from 1995 to 2009, however. Moreover, in Spain, health policy was transferred to the autonomous communities from 1981 to 2002[19] and is therefore decided at the regional level. Besides, as defended by Lindo[34], given that our identification method is based on the within-location variation of healthcare provision indicators and mortality rates, potential spillovers could mean that more disaggregated analysis would severely understate the impact of healthcare provision on health outcomes. In addition, the potential problem of adverse patient selection emphasized by Gaynor et al.[35], which arises under medically-driven migration, is also mitigated by the use of larger geographical units.Using the region of residence meant leaving a very small number of deaths (less than 0.5 percent) out of the analysis, involving non-residents and for which no information on population and economic controls could be attached.

[4]We conducted the analysis for the following 3 most common causes but found no significant impacts.

devolution took place and an additional dummy for the two regions with full fiscal capacity: Navarre and Basque Country[26]. See definitions and summary statistics of controls also in Table A.2 in the Appendix.

Following Ruhm (2000, 2015) we use the following regression equation:

$$H_{jt} = HC_{jt}\beta + X_{jt}\delta + \alpha_j + \mu_t + \theta_{jt} + \varepsilon_{jt} \quad (1)$$

where $H_{jt}$is the measure of health (the log mortality rate) for region j inyear t, HC is a vector of healthcare provision including the number of hospital beds and healthcare workers per 1,000 inhabitants and the indicators for changes in the pharmaceutical co-payment and the access to the National Health Service. X is a vector of time-varying controls. α_j are region fixed-effects that account for those determinants of deaths that differ across regions but are time-invariant (such as persistent lifestyle disparities between residents of Madrid and Andalusia).μ_t are time fixed effects and hold constant determinants of death that vary uniformly across locations over time, especially widely spread advances in medical technologies. ε_{jt} is the error term.[5] Since the supplementary time-varying state characteristics (Xjt) do not necessarily control for alltime-varying determinants of death, we also includeθjt region-specific time trends.In this model, the impact of changes in healthcare provision is identified from within-region variations in mortality rates, relative to changesin other regions and after controlling for demographic and socio-economic characteristics, the business cycle, and region-trends.

A priori we expect a negative relationship between mortality rates and changes in healthcare provision and positive impacts for changes in the pharmaceutical co-payment and access restrictions on mortality. However, if healthcare supply responds to healthcare demand, for instance because sicker patients require more intensive care and patient severity is unobserved, the estimated relationship between healthcare inputs and outputs in equation (1) will be biased downwards, in absolute terms.Our results can thus be considered conservative estimates of the impact of healthcare provision on health outcomes.

4. Results

Table 1 presents the results on the impact of changes in healthcareinputs and policy on the logarithm of mortality. Column 1 shows estimation results from estimating the model in Equation 1 for general male-and-female mortality rates; columns 2and 3 report results for male- and female-specific mortality rates.

The results in Panel A in Table 1 show no significant impacts of healthcareinputs and policy indicators on total and sex-specific mortality rates. So, overall, health budget austerity measures had no impact. Panels B to E present results for cause- and sex and cause-specific mortality rates. Limiting our comments to impacts significant at least at the 5 per cent level, the general picture

[5]Robust standard errors clustered at the region level used. As noted by Cameron and Miller[36], using few clusters may understate the standard errors. We additionally estimated results with simple White robust standard errors. Estimated standard errors were systematically lower than those reported in the tables and thus are not reported.

is again that changes in healthcare inputs and policy had no effect on cause-specific mortality rates; with two important exceptions, however. First, reductions in hospital personnel are responsible for significant increases in mortality due to circulatory problems. For the average drop of 0.2 staffing per 1,000 inhabitants, Column 1 in Panel C shows an almost 1 percent (0.2*3percent) increase in mortality, mainly driven by female rates (Column 3). And second, reductions in the number of available beds significantly increased mortality due to external causes.Column 1 in Panel E shows that the average reduction of 0.2 beds per 1,000 inhabitants in our sample from 2009 to 2015 increased the external-cause mortality rate about 3percent (0.2*19percent), mainly driven by male mortality rates (Column 2).

According to both national and international data, younger persons die disproportionately from external causes while older individuals disproportionately die from cancer and heart disease[1], [7]. Table A.3 in the Appendix additionally shows results for 10 decennial age-specific mortality rates and reveals that with the exception of 25-34-year-old mortality, negatively associated with hospital beds per 1,000 inhabitants - like mortality rates from external causes-, and 55-64-year-old mortality, negatively associated with medical staff per 1,000 inhabitants - like mortality rates from circulatory problems-, changes in healthcareinputs and policy had no significant impact on age-specific mortality rates.

4.1. Robustness Checks

In Table 2 we assess the sensitivityof our findings in the previous section to a) different specifications of the model and b) alternative samples that exclude regions relying on private healthcare provision to a larger extent, and show that our results remain robust.

In Columns 1 to 6 in Table 2, we explore the robustness of the impact of changes in healthcare provision on mortality rates by modifying two very common features of the model in equation (1): specifying the dependent variables in levels, instead of using the semi-log specification (Columns 1 to 3) and excluding the region-specific trends from the controls (Columns 4 to 6). The results of these exercises provide evidence that the estimated effect of healthcare provision on mortality is not an artifact of specification choice. For instance, as shown in Panel C reductions in hospital personnel of about of 0.2 staffing per 1,000 inhabitants correspond to between 0.6 percent (Column 1) and 0.5 percent (Column 4) increases in mortality from circulatory problems.Similarly, as shown in Panel E, reductions in the number of available beds of about 0.2 beds per 1,000 inhabitants in ourcorrespond to increases in the external-cause mortality rate between 4 percent (Column 1) and 3 percent (Column 4).

Several authors have argued that privatization has been one of the regional governments' responses to health budget cuts[20], [27].[6]Columns 7 to 9 in Table 2 show that our results remain virtually the same after dropping from the analysis the three autonomous communities with higher reliance in private provision of healthcare: Catalonia, Navarre, and Balearic Islands. Reductions in hospital personnel of about of 0.2 staffing per 1,000 inhabitants are associated with increases in mortality from circulatory problems of about 0.6 percent (Column 7 in Panel C) and reductions in the number of available beds of about 0.2 beds per 1,000 inhabitants are

[6]A break in the series in 2010 prevents us from replicating the analysis controlling for the proportion of hospital beds privately operated.

associated with increases in the external-cause mortality rate of about 5 percent (Column 7 in Panel E). We can therefore conclude that the estimated effect of healthcare provision on mortality is not an artifact of sample choice either.[7]

5. Potential Mechanisms

Thus far, we have seen that the changes in healthcare inputs and policies brought about by the financial crisis have mainly impacted mortality rates due to circulatory problems and external causes. In what follows we investigate whether the likely channels of these impacts are related to service quality or to healthcare accessibility.

Following Evans and Kim[2], Table 3 presents results for the impact of changes in healthcare provision on in-hospital mortality rates, readmission rates, average length of stay, and post-infarction mortality rates, as indicators of service quality. If health budget cuts had an impact on quality, we would expect total and post-infarction in-hospital mortality and readmissions to increase, and average stays to decrease, as a result of reductions in healthcare workers and/or hospital beds.The available evidence in Table 3 suggests that qualityreductions wereprobably not important. According to our estimateswe cannot point to any significant impact of decreases in healthcare workers or hospital beds on any quality indicator in the direction stated.[8]Interestingly, however, the introduction of co-payments led to an unanticipated increase in the average length of stay of about 4 percent (0.3 days). Chandra et al.[28]find similar offset effects (increased hospital utilization) in response to higher co-payments for prescription drugs in California, the rationale being that patients that economize on drugs for chronic illness need to be hospitalized later.

Regarding healthcare accessibility, we lack data on waiting times or waiting lists to assess the impact of changes in healthcare provision on elective procedures, as in Nikolova et al. [4].[9] However, we can evaluate whether changes in access to healthcare in emergency situations are driving our results by looking at mortality due to ischemic heart problems (such as acute myocardial infarction), cardiovascular problems (such as strokes), and accidental causes[5], [6], [29]. We would expect the short-term impact of reductions in healthcare provision on mortality to be larger in emergency situations such as heart or cerebral infarctions and accidents.

Columns 1 to 3 in Panel A of Table 4 showestimation results of our main specification for mortality rates from three mutually exclusive and exhaustive categories of circulatory problems[10]: ischemic disease, cerebrovascular disease, and other circulatory diseases and reveal

[7]Dropping the observations of one of the 17 regions at a time also yielded virtually identical estimated impacts in all the seventeen exercises. Results available upon request.

[8]If anything, we find that medical personnel cuts led to slightly longer, not shorter, lengths of stay.

[9] The Spanish Ministry of Health stopped inquiring about waiting lists in 2009. Using a different methodology, it has started offering waiting lists for first visits and elective surgery interventions disaggregated by region since 2012.

[10]Ischemic heart diseases include (ICD-10 code in parenthesis): angina pectoris (I20), acute myocardial infarction (I21), subsequent myocardial infarction (I22), complications following acute myocardial infarction (I23), other acute ischemic diseases (I24), and chronic ischemic heart diseases (I25). Cerebrovascular diseases include subarachnoid, intracerebral and other non-traumatic intracranialhaemorrhage (I60-63), cerebral infarction and stroke (I64-I65), occlusion and stenosis of precerebraland cerebral arteries (I66-I67), and other cerebrovascular diseases (I67-I69).

that the estimated impact of reductions of hospital personnel on mortality from circulatory problems is driven by cerebral strokes rather than heart infarctions or other circulatory problems. In particular, the average drop of 0.2medical staffing per 1,000 inhabitants is associated with a 1 percent increase in the number of deaths due to due to cerebrovascular disease.

Columns 4 and 5 in Panel A of Table 4 show corresponding estimation results for accidental and non-accidental deaths, the two mutually exclusive and exhaustive categories of death from external causes.[11]Results show that the estimated impact of changes in the availability of hospital beds on mortality from external causes is driven by accidental rather than non-accidental deaths. While the average decrease of 0.2 hospital beds per 1,000 inhabitants increases the fatality rate due to accidents by almost 5 percent, it does not display a significant impact on fatalities due to other external causes.

Panel B of Table 4 additionally reveals that the results in Panel A are robust to using different healthcare provision indicators: the number of working operating rooms per 100,000 inhabitants and the average number of hospitals in the province. Interestingly, mortality from cerebrovascular diseases responds to the number of working operating rooms, an indicator arguably related to personnel availability, andaccidental deaths respond to the number of available hospitals, an indicator arguably related to distance to the nearest service provider. Consistent with previous evidence from Buchmueller et al.[5] and Bertoli and Grembi[6], this result emphasizes the role of hospital proximity in emergency situations.

6. Conclusion

Healthcare provision and policies are considered important for health outcomes, though not many studies quantify this relationship. We provide causal evidence on the short-term impact of changes in the provision of healthcare on health outcomes by applying a fixed effects model to Spanish data spanning from 1996 to 2015. We find that reduced healthcare provision accounts for a significant increase in mortality rates due tocirculatory problems and external causes. The size of the impact is, however, small, of between 0.6 and 4percent increases in these mortality measures for the average reduction of 0.2 medical staff and 0.2 beds per 1,000 inhabitants, respectively, during the recession. Mortality rates do not seem robustly affected by the 2012 changes in retirees' pharmaceutical co-paymentsandmigrants' access restrictions to the Spanish NHS.

Other circulatory diseases include: acute rheumatic fever (I00-I02), chronic rheumatic heart diseases (I05-I09), hypertensive diseases (I10-I15), pulmonary heart disease (I26-I28), other forms of heart disease (I30-I52), diseases of arteries, arterioles and capillaries (I70-I79), other diseases of veins and unspecified disorders of the circulatory system(I80-I99). The use of broad categories of death causes minimizes risks of misclassification (see note 5 above).

[11] Accidental causes include (ICD-10 code in parenthesis): transport accidents (V00-V99), burns (X00-X19), poisoning (X40-X49), falls (W00-W19) and drowning (W65-W84) and other accidents (W19-W64, W85-W99, X19-X40, X49-X59). Non-accidental causes include: suicide(X60-X84), homicide (X85-Y09), and other external causes (Y10-Y89). The use of broad categories of death causes minimizes risks of misclassification (see note 5 above).

We also show that, while neither in-hospital mortality rates nor readmission rates were affected by health provision cuts,our results for mortality from circulatory problems are driven by cerebral infarctions, and our results for deaths from external causes are driven by accidents deaths,pointing at accessibility rather than service quality as the likely channel through which cuts in healthcare services have impacted health outcomes. We also unveil a significant increase in average length of hospital stays of about 4 percent due to the introduction of the pharmaceutical co-payment.

Taken together, our analyses suggest that short-term impacts of decreases in healthcare provision on mortality are significant but small.

[1] C. J. Ruhm, “Are Recessions Good for Your Health?,” *Q. J. Econ.*, vol. 115, no. 2, pp. 617–650, May 2000.

[2] W. N. Evans and B. Kim, “Patient outcomes when hospitals experience a surge in admissions,” *J. Health Econ.*, vol. 25, no. 2, pp. 365–388, 2006.

[3] G. Moscelli, L. Siciliani, and V. Tonei, “Do waiting times affect health outcomes? Evidence from coronary bypass,” *Soc. Sci. Med.*, vol. 161, pp. 151–159, 2016.

[4] S. Nikolova, M. Harrison, and M. Sutton, “The Impact of Waiting Time on Health Gains from Surgery: Evidence from a National Patient-reported Outcome Dataset,” *Health Econ.*, vol. 25, no. 8, pp. 955–968, Aug. 2016.

[5] T. C. Buchmueller, M. Jacobson, and C. Wold, “How far to the hospital?,” *J. Health Econ.*, vol. 25, no. 4, pp. 740–761, 2005.

[6] P. Bertoli and V. Grembi, “The life-saving effect of hospital proximity,” *Heal. Econ. (United Kingdom)*, vol. 26, no. November 2016, pp. 78–91, 2017.

[7] C. J. Ruhm, “Recessions, healthy no more?,” *J. Health Econ.*, vol. 42, pp. 17–28, 2015.

[8] M. Grossman, “On the Concept of Health Capital and the Demand for Health,” *J. Polit. Econ.*, vol. 80, no. 2, pp. 223–255, Mar. 1972.

[9] Z. Or, “Determinants of Health Outcomes in Industrialised Countries: A Pooled, Cross-Country, Time-Series Analysis,” *OECD Econ. Stud.*, no. 30, pp. 53–77, 2000.

[10] M. Farahani, S. V. Subramanian, and D. Canning, “The effect of changes in health sector resources on infant mortality in the short-run and the long-run: A longitudinal econometric analysis,” *Soc. Sci. Med.*, vol. 68, no. 11, pp. 1918–1925, 2009.

[11] S. Martin, N. Rice, and P. C. Smith, “Does health care spending improve health outcomes? Evidence from English programme budgeting data,” *J. Health Econ.*, vol. 27, no. 4, pp. 826–842, 2008.

[12] D. Golinelli *et al.*, “Health Expenditure and All-Cause Mortality in the ‘Galaxy’ of Italian Regional Healthcare Systems: A 15-Year Panel Data Analysis,” *Appl. Health Econ. Health Policy*, vol. 15, no. 6, pp. 773–783, Dec. 2017.

[13] C. Kelly, C. Hulme, T. Farragher, and G. Clarke, “Are differences in travel time or distance to healthcare for adults in global north countries associated with an impact on health outcomes? A systematic review,” *BMJ Open*, vol. 6, no. 11, pp. 1–9, 2016.

[14] Z. Cooper, S. Gibbons, S. Jones, and A. Mcguire, “Does hospital competition save lives? Evidence from the English NHS patient choice reforms,” *Econ. J.*, vol. 121, no. 554, pp. 228–260, 2011.

[15] M. S. Gaynor, C. Propper, and R. Moreno-Serra, “Death by Market Power: Reform, Competition and Patient Outcomes in the National Health Service,” *SSRN Electron. J.*, vol. 5, no. 4, pp. 134–166, 2012.

[16] A. Cook, M. Gaynor, M. Stephens, and L. Taylor, “The effect of a hospital nurse staffing mandate on patient health outcomes: Evidence from California’s minimum staffing regulation,” *J. Health Econ.*, vol. 31, no. 2, pp. 340–348, 2012.

[17] J. Pons Pons and M. Vilar Rodríguez, *El seguro de salud privado y público en España : su análisis en perspectiva histórica*. .

[18] G. Lopez-Casasnovas, J. Costa-Font, and I. Planas, “Diversity and regional inequalities in the Spanish ‘system of health care services,’” *Health Econ.*, vol. 14, no. SUPPL. 1, pp.

221–235, 2005.

[19] J. Costa-Font and G. Turati, “Regional healthcare decentralization in unitary states: equal spending, equal satisfaction?,” *Reg. Stud.*, vol. 52, no. 7, pp. 974–985, 2018.

[20] B. G. Lopez-Valcarcel and P. Barber, “Economic Crisis, Austerity Policies, Health and Fairness: Lessons Learned in Spain,” *Appl. Health Econ. Health Policy*, vol. 15, no. 1, pp. 13–21, 2017.

[21] *National Accounts of OECD Countries, Volume 2018 Issue 2*. OECD, 2018.

[22] M. Sánchez Bayle, *La contrarreforma sanitaria : análisis y alternativas a la privatización de la sanidad pública*. Catarata, 2013.

[23] J. Puig-Junoy, S. Rodríguez-Feijoó, and B. G. Lopez-Valcarcel, “Paying for formerly free medicines in Spain after 1 year of co-payment: Changes in the number of dispensed prescriptions,” *Appl. Health Econ. Health Policy*, vol. 12, no. 3, pp. 279–287, 2014.

[24] D. C. Prieto and S. Lago-Peñas, “Decomposing the determinants of health care expenditure: The case of Spain,” *Eur. J. Heal. Econ.*, vol. 13, no. 1, pp. 19–27, 2012.

[25] A. Bacigalupe, U. Martín, R. Font, Y. González-Rábago, and N. Bergantiños, “Austeridad y privatización sanitaria en época de crisis: ¿existen diferencias entre las comunidades autónomas?,” *Gac. Sanit.*, vol. 30, no. 1, pp. 47–51, Jan. 2016.

[26] D. Jiménez-Rubio, “The impact of fiscal decentralization on infant mortality rates: Evidence from OECD countries,” *Soc. Sci. Med.*, vol. 73, no. 9, pp. 1401–1407, 2011.

[27] A. Bacigalupe, S. Esnaola, and U. Martín, “The impact of the Great Recession on mental health and its inequalities: The case of a Southern European region, 1997-2013,” *Int. J. Equity Health*, vol. 15, no. 1, pp. 1–10, 2016.

[28] A. Chandra, J. Gruber, and R. Mcknight, “American Economic Association Patient Cost-Sharing and Hospitalization Offsets in the Elderly,” *Source Am. Econ. Rev.*, vol. 100, no. 1, pp. 193–213, 2010.

[29] D. Avdic, “Improving efficiency or impairing access? Health care consolidation and quality of care: Evidence from emergency hospital closures in Sweden,” *J. Health Econ.*, vol. 48, pp. 44–60, 2016.

[30] B. D. L. Miller, M. E. Page, and A. H. Stevens, “Why Are Recessions Good for Your Health ?,” no. 2000, pp. 122–127, 2009.

[31] E. Neumayer, “Recessions lower (some) mortality rates:: evidence from Germany,” *Soc. Sci. Med.*, vol. 58, no. 6, pp. 1037–1047, Mar. 2004.

[32] J. A. T. Granados, “Recessions and Mortality in Spain, 1980–1997,” *Eur. J. Popul. / Rev. Eur. Démographie*, vol. 21, no. 4, pp. 393–422, Dec. 2005.

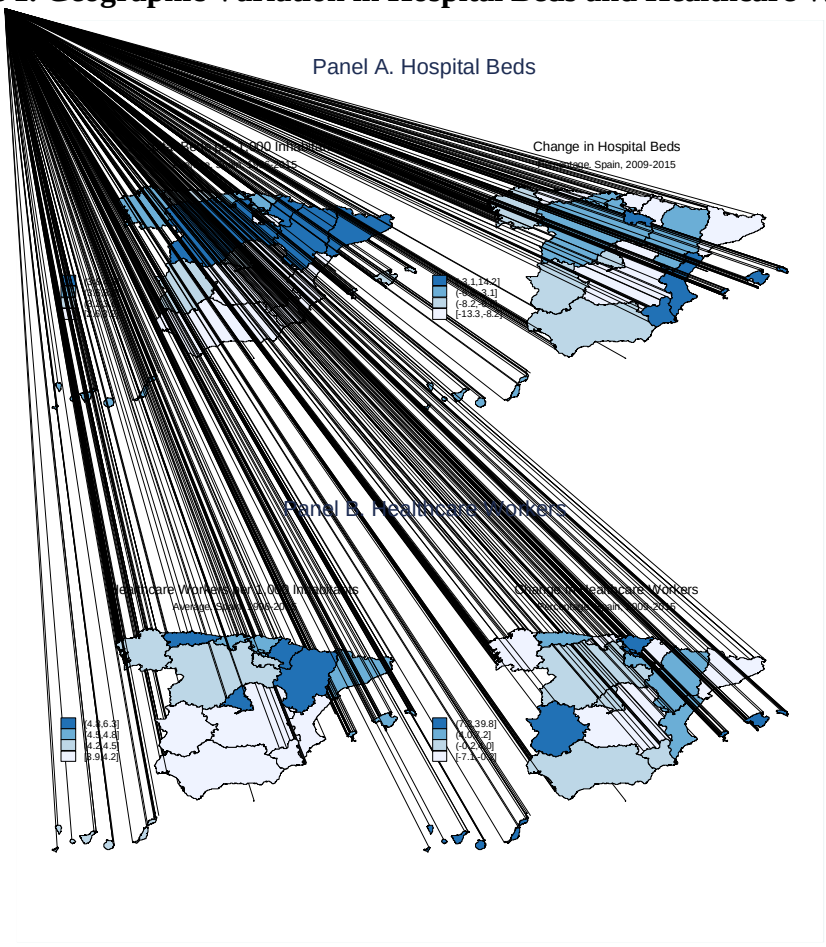
[33] U. G. Gerdtham and C. J. Ruhm, “Deaths rise in good economic times: Evidence from the OECD,” *Econ. Hum. Biol.*, vol. 4, no. 3, pp. 298–316, 2006.

[34] J. M. Lindo, “Aggregation and the estimated effects of economic conditions on health,” *J. Health Econ.*, vol. 40, pp. 83–96, 2015.

[35] M. Gaynor, K. Ho, and R. J. Town, “The Industrial Organization,” *J. Econ. Lit.*, vol. 53, no. 2, pp. 235–284, 2015.

[36] A. Colin Cameron and D. L. Miller, “A Practitioner’s Guide to Cluster-Robust Inference,” *J. Hum. Resour.*, vol. 50, no. 2, pp. 317–372, Apr. 2015.

Figure 1. Geographic Variation in Hospital Beds and Healthcare Workers



Source: Spanish NHS Statistical Site andSpanish Statistical Institute.

Table 1 Impact of health care provision on total, sex-, cause-, and cause and sex- specific mortality

	(1) Males and Females	(2) Males	(3) Females
Panel A. Dep variable: Log total mortality rate			
Hospital beds	-0.0027	-0.0195	0.0165
	(0.0136)	(0.0125)	(0.0188)
Healthcare workers	-0.0160*	-0.0156	-0.0164*
	(0.0085)	(0.0090)	(0.0089)
Copayment dummy	-0.0090	-0.0081	-0.0099
	(0.0099)	(0.0111)	(0.0135)
Access restrictions dummy	0.0008	0.0074	-0.0065
	(0.0089)	(0.0091)	(0.0138)
Mean of dep. var. (Std. dev.)	859.83 (239.66)	910.99 (254.40)	810.30 (227.23)
Panel B. Dep variable: Log neoplasms mortality rate (Chapter 2)			
Hospital beds	-0.0142	-0.0439***	0.0339
	(0.0141)	(0.0112)	(0.0252)
Healthcare workers	-0.0085	-0.0077	-0.0102
	(0.0083)	(0.0077)	(0.0126)
Copayment dummy	0.0040	-0.0019	0.0121
	(0.0163)	(0.0155)	(0.0197)
Access restrictions dummy	-0.0243	-0.0152	-0.0391*
	(0.0149)	(0.0135)	(0.0210)
Mean of dep. var. (Std. dev.)	245.55 (40.60)	310.70 (54.93)	182.46 (28.85)
Panel C. Dep variable: Log circulatory system mortality rate (Chapter 9)			
Hospital beds	0.0309	0.0312	0.0311
	(0.0224)	(0.0252)	(0.0232)
Healthcare workers	-0.0316**	-0.0242*	-0.0379***
	(0.0123)	(0.0136)	(0.0129)
Copayment dummy	-0.0205	-0.0090	-0.0306*
	(0.0171)	(0.0231)	(0.0145)
Access restrictions dummy	-0.0074	-0.0124	-0.0031
	(0.0135)	(0.0201)	(0.0135)
Mean of dep. var. (Std. dev.)	297.77 (58.69)	275.75 (52.64)	319.10 (65.69)
Panel D. Dep variable: Log respiratory system mortality rate (Chapter 10)			
Hospital beds	0.0549	0.0385	0.0808
	(0.0509)	(0.0613)	(0.0529)
Healthcare workers	0.0175	-0.0028	0.0450
	(0.0309)	(0.0236)	(0.0429)
Copayment dummy	0.0694	0.0489	0.0975
	(0.0616)	(0.0560)	(0.0761)
Access restrictions dummy	-0.0252	-0.0088	-0.0493
	(0.0445)	(0.0352)	(0.0637)
Mean of dep. var. (Std. dev.)	101.50 (20.52)	120.09(24.15)	83.47 (18.93)
Panel E. Dep variable: Log external causes mortality rate (Chapters 19 and 20)			
Hospital beds	-0.1890***	-0.1917***	-0.1550
	(0.0533)	(0.0403)	(0.0918)
Healthcare workers	-0.0279	-0.0179	-0.0400
	(0.0417)	(0.0393)	(0.0599)
Copayment dummy	-0.0391	-0.0232	-0.1000
	(0.0521)	(0.0381)	(0.1035)
Access restrictions dummy	-0.0061	0.0172	-0.0289
	(0.0555)	(0.0512)	(0.0788)
Mean of dep. var. (Std. dev.)	37.24 (7.78)	52.50(12.33)	22.43(5.98)
N	340	340	340

Notes:*** 99%, ** 95%, * 90% significance level. Each column in each panel comes from a different regression. The dependent variables are indicated in each panel. All specifications additionally control for regional unemployment rates, per capita gross domestic product levels, young and aged dependency rations, theshare of the regional population who are immigrant, female, disabled, university educated, and aged 65 or over, a devolution indicator, a fiscal autonomy indicator, region fixed effects, year fixed effects, and region-specific trends.
Source: Spanish NHS Statistical Site and Spanish Statistical Institute.

Table 2. Robustness Checks: Impact of health care provision on total, sex-, cause-, and cause and sex- specific mortality

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent variable in levels			Without region-specific time trends			Dropping regions with high private provision		
	Males and Females	Males	Females	Males and Females	Males	Females	Males and Females	Males	Females
Panel A. Dep variable: Log total mortality rate									
Hospital beds	45.91	31.42	60.83*	-0.0003	0.0008	-0.0015	-0.0620	-0.0798	-0.0406
	(32.91)	(35.82)	(32.32)	(0.0178)	(0.0154)	(0.0220)	(0.1585)	(0.1650)	(0.1518)
Healthcare workers	-28.71	-34.40	-23.23	-0.0102	-0.0112	-0.0085	-0.0579	-0.0615	-0.0541
	(19.02)	(21.09)	(17.63)	(0.0093)	(0.0096)	(0.0094)	(0.0377)	(0.0352)	(0.0413)
Copayment dummy	-8.23	-6.36	-10.06	0.0039	-0.0000	0.0083	0.1229	0.1191	0.1267
	(22.24)	(22.75)	(23.01)	(0.0109)	(0.0091)	(0.0142)	(0.1080)	(0.1079)	(0.1083)
Access restrict. dummy	-17.67	-10.04	-25.15	-0.0079	-0.0010	-0.0154	-0.1816	-0.1660	-0.1987
	(20.61)	(19.43)	(23.56)	(0.0195)	(0.0182)	(0.0222)	(0.1470)	(0.1439)	(0.1510)
Mean of dep. var.	859.8	910.9	810.3	859.8	910.9	810.3	860.0	912.8	809.0
(Std. dev.)	(239.6)	(254.4)	(227.2)	(239.6)	(254.4)	(227.2)	(240.7)	(255.6)	(228.4)
Panel B. Dep variable: Log neoplasms mortality rate (Chapter 2)									
Hospital beds	-2.60	-11.03***	5.95	-0.0001	-0.0099	0.0169	-0.0207	-0.0507***	0.0296
	(2.99)	(3.10)	(4.86)	(0.0221)	(0.0213)	(0.0275)	(0.0136)	(0.0102)	(0.0372)
Healthcare workers	-2.46	-3.44*	-1.64	-0.0017	0.0004	-0.0052	-0.0096	-0.0089	-0.0110
	(1.87)	(1.85)	(2.42)	(0.0124)	(0.0117)	(0.0149)	(0.0088)	(0.0084)	(0.0145)
Copayment dummy	0.12	-0.76	0.91	0.0078	0.0023	0.0152	0.0097	0.0045	0.0155
	(4.17)	(5.04)	(3.87)	(0.0178)	(0.0156)	(0.0233)	(0.0154)	(0.0140)	(0.0208)
Access restrict. dummy	-6.19*	-4.54	-7.88**	-0.0271	-0.0171	-0.0441*	-0.0362**	-0.0210	-0.0600**
	(3.32)	(3.83)	(3.67)	(0.0200)	(0.0200)	(0.0230)	(0.0149)	(0.0122)	(0.0247)
Mean of dep. var.	245.5	310.7	182.4	245.5	310.7	182.4	242.3	307.2	179.5
(Std. dev.)	(40.6)	(54.9)	(28.8)	(40.6)	(54.9)	(28.8)	(47.4)	(63.8)	(33.6)
Panel C. Dep variable: Log circulatory system mortality rate (Chapter 9)									
Hospital beds	6.52	8.58	4.57	0.0471	0.0745**	0.0243	0.0331	0.0480	0.0211
	(5.65)	(6.04)	(5.88)	(0.0332)	(0.0301)	(0.0369)	(0.0309)	(0.0302)	(0.0348)
Healthcare workers	-8.61***	-5.39*	-11.67***	-0.0256**	-0.0252*	-0.0259*	-0.0304***	-0.0135	-0.0454***
	(2.94)	(2.83)	(3.61)	(0.0119)	(0.0127)	(0.0126)	(0.0101)	(0.0118)	(0.0110)
Copayment dummy	-10.03*	-5.02	-14.84**	-0.0249	-0.0235	-0.0260	-0.0351*	-0.0271	-0.0416**
	(5.71)	(6.29)	(5.85)	(0.0264)	(0.0249)	(0.0290)	(0.0191)	(0.0243)	(0.0171)
Access restrict. dummy	0.55	0.02	0.98	-0.0202	-0.0223	-0.0191	0.0006	0.0125	-0.0101
	(4.60)	(6.31)	(4.71)	(0.0348)	(0.0331)	(0.0368)	(0.0162)	(0.0291)	(0.0113)
Mean of dep. var.	297.8	275.7	319.1	297.8	275.7	319.1	299.5	276.7	321.6
(Std. dev.)	(58.7)	(52.6)	(65.7)	(58.7)	(52.6)	(65.7)	(63.4)	(56.8)	(70.8)
Panel D. Dep variable: Log respiratory system mortality rate (Chapter 10)									
Hospital beds	2.48	2.99	2.13	-0.0030	-0.0092	0.0120	0.0631	0.0540	0.0791
	(4.30)	(6.40)	(3.62)	(0.0450)	(0.0410)	(0.0546)	(0.0692)	(0.0915)	(0.0591)
Healthcare workers	1.66	-2.16	5.35	-0.0012	-0.0136	0.0176	0.0401	-0.0140	0.1172*
	(2.83)	(2.97)	(3.48)	(0.0266)	(0.0235)	(0.0333)	(0.0344)	(0.0335)	(0.0572)
Copayment dummy	2.69	-1.16	6.41	0.0827**	0.0610	0.1128**	0.0552	-0.0025	0.1347**
	(5.93)	(7.28)	(5.36)	(0.0381)	(0.0355)	(0.0494)	(0.0797)	(0.0965)	(0.0614)
Access restrict. dummy	-0.46	1.89	-2.71	0.0128	0.0217	-0.0022	-0.0558	-0.0164	-0.1123**
	(3.38)	(3.93)	(3.67)	(0.0334)	(0.0328)	(0.0429)	(0.0544)	(0.0626)	(0.0468)
Mean of dep. var.	101.5	120.1	83.5	101.5	120.1	83.4	100.7	119.5	82.5
(Std. dev.)	(20.5)	(24.1)	(18.9)	(20.5)	(24.1)	(18.9)	(22.7)	(26.9)	(20.6)

Panel E. Dep variable: Log external causes mortality rate (Chapters 19 and 20)									
Hospital beds	-8.32***	-10.87***	-5.76**	-0.1424***	-0.1498***	-0.1073	-0.2875***	-0.2618***	-0.3292**
	(2.17)	(2.20)	(2.56)	(0.0451)	(0.0441)	(0.0668)	(0.0948)	(0.0784)	(0.1328)
Healthcare workers	-1.06	-1.70	-0.47	-0.0118	0.0001	-0.0197	-0.0391	-0.0684	0.0681
	(1.49)	(2.23)	(1.25)	(0.0374)	(0.0295)	(0.0538)	(0.0529)	(0.0673)	(0.0440)
Copayment dummy	-0.50	-0.13	-0.92	0.0456	0.0218	0.0740	0.0147	0.0334	-0.0662
	(1.82)	(1.68)	(2.49)	(0.0490)	(0.0368)	(0.0814)	(0.0596)	(0.0429)	(0.1175)
Access restrict. dummy	-0.23	1.09	-1.50	-0.0731	-0.0417	-0.1065	-0.0447	-0.0070	-0.1009
	(2.18)	(2.77)	(2.36)	(0.0545)	(0.0454)	(0.0800)	(0.0805)	(0.0788)	(0.1198)
Mean of dep. var.	37.2	52.5	22.4	37.24	52.5	22.4	36.4	52.0	21.4
(Std. dev.)	(7.8)	(12.3)	(6.0)	(7.8)	(12.3)	(6.0)	(8.7)	(13.3)	(6.5)
N	340	340	340	340	340	300	300	300	300

Notes:*** 99%, ** 95%, * 90% significance level. Each column in each panel comes from a different regression. The dependent variables are indicated in each panel. All specifications additionally control for regional unemployment rates, per capita gross domestic product levels, young and aged dependency rations, the share of the regional population who are immigrant, female, disabled, university educated, and aged 65 or over, a devolution indicator, a fiscal autonomy indicator, region fixed effects, year fixed effects, and region-specific trends.
Source: Spanish NHS Statistical Site and Spanish Statistical Institute.

Table 3Potential Mechanisms: Service Quality

	(1) Log in-hospital mortality	(2) Log re-admission rate	(3) Log average stay	(4) Log post-infarction mortality
Hospital beds	-0.0520	0.0534	0.0113	0.0738
	(0.0519)	(0.0441)	(0.0225)	(0.0845)
Healthcare workers	-0.0335	-0.0268	-0.0190**	-0.0965
	(0.0344)	(0.0216)	(0.0071)	(0.0903)
Copayment dummy	-0.0029	0.0659	0.0455**	0.0546
	(0.0236)	(0.0461)	(0.0213)	(0.0815)
Access restrictions dummy	0.0230	-0.0865*	-0.0339	0.0194
	(0.0299)	(0.0418)	(0.0208)	(0.0801)
Mean dep variable (Std. dev.)	8.13 (1.24)	6.97 (1.20)	7.51 (0.86)	22.52 (5.58)
N	323	323	323	323

Notes:*** 99%, ** 95%, * 90% significance level. Each column comes from a different regression. The dependent variables are indicated in each column. All specifications additionally control for regional unemployment rates, per capita gross domestic product levels, young and aged dependency rations, the share of the regional population who are immigrant, female, disabled, university educated, and aged 65 or over, a devolution indicator, a fiscal autonomy indicator, region fixed effects, year fixed effects, and region-specific trends.
Source: Spanish NHS Statistical Site and Spanish Statistical Institute.

Table 4Potential Mechanisms: Healthcare Accessibility

	(1)	(2)	(3)	(4)	(5)
	Circulatory disease			External causes	
	Ischemic heart disease	Cerebrovascular disease	Other circulatory disease	Accidental deaths	Non-accidental deaths
Panel A. Main specification					
Hospital beds	0.0585	0.0643	0.0568*	-0.2312***	-0.0816
	(0.0361)	(0.0502)	(0.0275)	(0.0654)	(0.0721)
Healthcare workers	-0.0086	-0.0516***	-0.0325	-0.0070	-0.0870
	(0.0294)	(0.0167)	(0.0191)	(0.0391)	(0.0635)
Copayment dummy	0.0402	-0.0356	-0.0057	-0.0460	-0.0057
	(0.0231)	(0.0458)	(0.0197)	(0.0569)	(0.0943)
Access restrictions dummy	-0.0273	0.0340	0.0070	0.0040	-0.0453
	(0.0309)	(0.0471)	(0.0256)	(0.0594)	(0.0887)
Mean of dep. var. (Std. dev.)	87.3 (19.7)	81.3 (22.73)	168.6 (1542.9)	26.8 (6.21)	10.4 (2.4)
	340	340	340	340	340
Panel B. Alternative specification					
Number of hospitals in province	0.0006	0.0004	0.0001	-0.0116***	0.0051
	(0.0022)	(0.0029)	(0.0019)	(0.0038)	(0.0149)
Working operating rooms	0.0086	-0.0327***	-0.0124*	-0.0091	0.0340
	(0.0070)	(0.0108)	(0.0063)	(0.0250)	(0.0902)
Copayment dummy	0.0433*	0.0002	0.0143	0.0043	-0.3122
	(0.0228)	(0.0459)	(0.0220)	(0.0628)	(0.2109)
Access restrictions dummy	-0.0234	0.0450	0.0139	-0.0146	-0.0188
	(0.0321)	(0.0448)	(0.0243)	(0.0643)	(0.1675)
Mean of dep. var. (Std. dev.)	87.3 (19.7)	81.3 (22.73)	168.6 (1542.9)	26.8 (6.21)	10.4 (2.4)
	323	323	323	323	323

Notes:*** 99%, ** 95%, * 90% significance level. Each column in each panel comes from a different regression. The dependent variables are indicated in each column. All specifications additionally control for regional unemployment rates, per capita gross domestic product levels, young and aged dependency rations, the share of the regional population who are immigrant, female, disabled, university educated, and aged 65 or over, a devolution indicator, a fiscal autonomy indicator, region fixed effects, year fixed effects, and region-specific trends.
Source: Spanish NHS Statistical Site, Spanish Statistical Institute, and Spanish National Catalogue of Hospitals.

Appendix Tables

Table A.1 Summary stats of dependent variables

Variable	Description	mean	sd	min	max
Total rate	per 100,000 inhabitants	859.83	239.66	0.71	1224.14
Male total rate	per 100,000 inhabitants	910.99	254.40	0.74	1295.31
Female total rate	per 100,000 inhabitants	810.30	227.23	0.67	1166.76
Neoplasmsrate	per 100,000 inhabitants	245.55	40.60	169.38	348.13
Maleneoplasmsrate	per 100,000 inhabitants	310.70	54.93	214.82	450.31
Femaleneoplasmsrate	per 100,000 inhabitants	182.46	28.85	124.65	258.95
Circulatorydiseaserate	per 100,000 inhabitants	297.77	58.69	147.82	421.03
Malecirculatorydiseaserate	per 100,000 inhabitants	275.75	52.64	143.78	381.37
Femalecirculatorydiseaserate	per 100,000 inhabitants	319.10	65.69	143.52	467.06
Respiratorysystemrate	per 100,000 inhabitants	101.50	20.52	54.08	154.02
Malerespiratorysystemrate	per 100,000 inhabitants	120.09	24.15	67.78	190.26
Femalerespiratorysystemrate	per 100,000 inhabitants	83.47	18.93	39.43	133.15
External cause rate	per 100,000 inhabitants	37.24	7.78	14.18	56.11
Maleexternal cause rate	per 100,000 inhabitants	52.50	12.33	16.50	87.96
Femaleexternal cause rate	per 100,000 inhabitants	22.43	5.98	11.10	49.11
In-hospital mortalityrate	per 100 admissions	8.13	1.24	4.31	11.29
Readmissionrate	per 100 admissions	6.97	1.20	3.58	9.67
Averagestay	in days	7.51	0.86	5.75	10.94
Postinfarctionmortalityrate	per 100 infarctionadmissions	22.52	5.59	7.61	41.58
Ischemicdiseaserate	per 100,000 inhabitants	87.31	19.72	47.73	148.83
Cerebrovascular mortalityrate	per 100,000 inhabitants	81.32	22.73	29.69	142.11
Othercirculatorydiseaserate	per 100,000 inhabitants	168.63	39.28	84.26	256.04
Accidental deathsrate	per 100,000 inhabitants	26.83	6.21	12.17	42.69
Non-accidental deathsrate	per 100,000 inhabitants	10.41	2.41	2.01	18.20

Source. Spanish Statistical Institute and Spanish NHS Statistical Site.

Table A.2 Summary stats of independent and control variables

Variable	Description	mean	sd	min	max
Main independent variables					
Hospital beds	Operational hospital beds per 1000 inhabitants	3.49	0.59	2.17	4.91
Hospital workers	Doctors and nurses per 1000 inhabitants	4.61	0.80	2.96	7.48
Copayment dummy	=1 if change in copayment implemented	0.14	0.35	0.00	1.00
Access restrictions dummy	=1 if access restriction implemented	0.07	0.26	0.00	1.00
Controls					
Regional Unemployment Rate	percentage	15.17	7.22	4.10	35.67
Log real GDP percapita	Log of real regional Gross Domestic Product per capita	5.41	0.22	4.74	5.87
Population 65 years old or over	Share of population aged 65 years old or over	17.77	2.98	10.71	24.17
Female population	Share of female population	50.72	0.69	49.28	52.29
Immigrant population	Share of population born abroad	68.25	58.24	0.00	226.36
Disabled population	Share of population receiving dissability benefits	17.00	7.60	1.85	53.20
University population	Share of population with tertiary education	14.60	4.16	7.45	30.28
Young dependency ratio	Share of population under 16 over population aged aged 16-64 years old	23.33	3.27	15.97	32.56
Aged dependency	Share of population over 64 over population aged aged 16-64 years old	26.45	5.03	15.07	38.13
Devolution	=1 if region with competences in health expenditure and management	0.82	0.38	0.00	1.00
Fiscal	Regions of Basque Country and Navarra	0.12	0.32	0.00	1.00
For additional analyses					
Number of hospitals	Average number of hospitals in the province	22.10	18.73	6.00	90.00
Operating rooms	Active operating rooms per 100,000 inhabitants	8.69	1.27	5.57	11.60

Source. Spanish Statistical Institute andSpanish NHS Statistical Site.

Table A.3 Impact of health care provision on age-specific mortality

	(1) 15-24 rate	(2) 25-34 rate	(3) 35-44 rate	(4) 45-54 rate	(5) 55-64 rate	(6) 65-74 rate	(7) 74-85 rate
Hospital beds	-0.0543	-0.1472**	-0.1228	-0.0262	0.0436*	-0.0241	-0.0162
	(0.0794)	(0.0599)	(0.0764)	(0.0288)	(0.0248)	(0.0276)	(0.0132)
Healthcare staff	0.1443*	0.0186	-0.0083	-0.0237	-0.0300**	-0.0215	-0.0148
	(0.0714)	(0.0488)	(0.0205)	(0.0254)	(0.0137)	(0.0128)	(0.0090)
Copayment dummy	0.0926	-0.1309*	0.0110	-0.0384	-0.0112	-0.0099	0.0100
	(0.1104)	(0.0653)	(0.0388)	(0.0288)	(0.0137)	(0.0152)	(0.0113)
Access restrictions dummy	-0.0714	0.0949	0.0140	0.0392	-0.0337**	-0.0136	-0.0078
	(0.1080)	(0.0759)	(0.0505)	(0.0326)	(0.0145)	(0.0128)	(0.0104)
	39.7 (14.6)	60..4 (25.5)	118.3 (32.5)	287.0 (44.0)	653.1 (88.9)	1579.0 (279.6)	4671.2 (672.9)
N	340	340	340	340	340	340	340

Notes:*** 99%, ** 95%, * 90% significance level. Each column comes from a different regression. The dependent variables are indicated in each column. All specifications additionally control for regional unemployment rates, per capita gross domestic product levels, young and aged dependency rations, the share of the regional population who are immigrant, female, disabled, university educated, and aged 65 or over, a devolution indicator, a fiscal autonomy indicator, region fixed effects, year fixed effects, and region-specific trends.
Source: Spanish NHS Statistical Site and Spanish Statistical Institute.