RESEARCH ARTICLE

Reforming the provision of cross-border medical care: Evidence from Spain

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Abstract

Cross-border medical care, defined as care facilitated by a local health provider under pre-established regional agreements, as in the case of European Union (EU) citizens accessing care within EU countries, has been on the rise. Unlike medical tourism, typically sought by patients through their own volition and paid for out-of-pocket, cross-border medical care is often reimbursable or paid for directly by the responsible government. Yet, because nations vary in the extent of health coverage offered to their residents, these expenditures are often only partially reimbursed. The resulting financial burden for some countries can be large and not reciprocal, straining regional and country-level finances. We analyze the effectiveness of a legislative measure adopted by a Spanish region in January 2012 with the purpose of curbing cross-border medical care. Using a comprehensive administrative dataset of all medical procedures performed in the country between 2008 and 2015, we find that the measure led to a drastic drop in the number of foreigners' hospitalizations and a reduction of 4.8 million euros/trimester in costs. Finally, the decrease in hospitalizations did not disproportionally affect patients based on their gender, age, or origin, although it fostered a reduction in readmissions.

KEYWORDS
cross-border medical care, EU, health care regulation, Spain

JEL CLASSIFICATION
H51, I12, I18

1 | INTRODUCTION

Medical travel, broadly defined as those individuals traveling to another country to receive medical care, has been on the rise. The rationale for seeking medical treatment in a country other than their own varies, including shorter wait lists, unobtainable treatment in the origin country's public health care system, quality of care, and lower costs (Escuela de Organización Industrial, 2013). Although it is hard to estimate its magnitude, some estimations point to approximately 20 to 24 million patients worldwide spending an average of 3410 U.S. dollars annually, sizing the market at 65–87.5 billion U.S. dollars (Woodman, 2020). Much of this medical travel is what is often referred to as "medical tourism", which is

typically characterized by patients seeking care elsewhere through their own volition, often against the advice of their local health provider, and paying out-of-pocket.[1] However, a growing share of medical travel is to obtain what is referred to as "cross-border medical care." Unlike medical tourism, cross-border medical care is often reimbursable or paid for directly by the responsible government under pre-established regional agreements. Yet, because nations vary in the extent of health coverage offered to their residents, these expenditures are rarely fully reimbursed. The resulting financial burden for countries providing the care can be large and not reciprocal, straining regional and country-level finances. Our focus in this study is on the so-called "cross-border medical care", even though the terms "medical tourism" and "cross-border medical care" are often used interchangeably by the public, official reports, and even some of the literature.

In Spain, most medical travel is cross-border medical care originating from countries in the European Union (EU). In the EU context, nationals from any of the 27 EU countries, Iceland, Liechtenstein, Norway, and Switzerland visiting another of these countries, are entitled to the same health care treatment as nationals from those countries. Within Europe, Spain ranks second, after France, in the number of medical interventions performed on foreigners, with 700,000 non-resident patients originating primarily from the United Kingdom, Germany, the Netherlands, and Belgium seeking treatment in 2012 (Escuela de Organización Industrial, 2013). In principle, the cost associated with treating these patients –initially covered by the Spanish social security system– should be reimbursed by the patients' governments. However, many times it is not. As of December 31, 2009, unreimbursed costs amounted to 138 million euros (de Cuentas, 2012). Close to 40% of the medical costs incurred by non-residents from other EU countries was incurred in just one Spanish region –namely, Valencia (de Cuentas, 2012). In view of these developments, in 2012, Valencia adopted a new policy according to which non-resident individuals treated in one of its hospitals would be directly charged for the incurred costs (i.e., Law 9/2011 on fiscal measures, administrative and financial management, and organization of the Generalitat). The purpose was to ensure upfront payment for the health services, independently of whether the patient could later seek reimbursement by her/his home country.[2]

Our *primary* aim is to examine the effectiveness of the new policy in curbing cross-border medical care hospitalizations and total costs. A *second* related aim is to learn about the channels through which the policy might be operating, by identifying the components of cross-border care being impacted –namely, types of intervention (e.g., type of surgical procedures, including hip implants, pacemaker implants, and cataracts), anticipated nature, duration of treatment/ length of hospital stay, readmissions, mortality; as well as changes in patient characteristics (i.e., gender, age, and origin).

Medical travel is a relatively unexplored topic in the health literature due to difficulties in finding adequate data. A 2010 review of the literature on the effects of medical travel in destination and origin countries concluded that "additional primary research on the effects of medical tourism is needed if the industry is to develop in a manner that is beneficial to citizens of both departure and destination countries" (Johnston et al., 2010). Thus far, most of the literature has presented descriptive evidence on the direction of medical tourism flows and on its determinants, including the availability, quality, and relative cost of medical treatments (Forgione & Smith, 2007; Guy et al., 2015; Hanefeld et al., 2014; Johnston et al., 2010; Lunt & Carrera, 2010; Lunt & Carrera, 2011; Mathijsen, 2019; Padilla-Melédez & Del Águilla Obra, 2016; Ramírez de Arellano, 2007; Runnels & Carrera, 2012).[3] This study extends our current understanding of travel for medical care by providing causal evidence, using various methodological approaches that provide consistent results, on the effectiveness of policy aimed at managing the financial burden imposed by cross-border medical care on some regions.

To this end, we make use of administrative data on the universe of hospitalizations taking place between 2008 and 2015 –that is, 4 years prior to and 4 years after the reform, from the Ministry of Health, Consumption and Social Welfare –namely, the Spanish Minimum Set of Basic Data (MSBD). This database gathers information directly from public hospitals and contains detailed medical records on all hospitalizations at discharge.[4] Specifically, for each entry, we have information on individual and hospital characteristics (including the region of hospitalization), estimated cost, diagnosis, whether it involved surgery or was previously scheduled, length of hospital stays, readmissions, and mortality. We focus on hospitalizations of non-residents 18 years of age and older who are not pregnant, given the free access to medical care of minors and pregnant women.[5] Using a quasi-experimental approach, we exploit the fact that the policy was adopted by one of the 19 regions (also referred to as autonomous communities) in Spain to assess its impact on cross-border medical care hospitalizations and total costs. Subsequently, we zoom in to learn about the mechanisms at play –focusing on changes in treatments or interventions, patients' demographic traits, and the specifics of each case (as captured by its estimated resource consumption, anticipated nature, duration of treatment/length of hospital stay, readmissions, mortality, and cost incurred).

We find that the policy adopted by Valencia helped contain cross-border medical care hospitalizations and costs in public hospitals. These effects did not predate the reform, are long-lasting, and are not observed when alternative reform dates are used in placebo checks. The impacts also prove robust to changes in the composition of the control and

treated groups, to the time window used as reference, and to the methodology employed. Finally, the effectiveness of the reform in curtailing cross-border medical care and costs does not appear to stem from the reduction in a particular type of procedure or surgical intervention, such as those with a higher cost; nor does it appear to have significantly changed the duration of treatment, mortality, or patient demographic traits of individuals seeking care (such as age, gender, or origin). Rather, it seems to stem from widespread reductions in the number of non-residents seeking admission and readmission. Overall, the findings are informative of prospective patients' responses to health care regulations and, more specifically, of the impact of alike policies on the provision of cross-border medical care in the EU context and similarly regulated multinational agreements. This is important in light of the increase in cross-border medical care and the lack of a uniform health care coverage menu with the EU, which creates an incentive to seek care in other EU countries covering the treatment in question.

The rest of the paper is structured as follows. Section 2 describes the institutional framework. Section 3 presents the data used in the analysis and some descriptive evidence. Section 4 explains the methodology, whereas Section 5 discusses the main findings, heterogeneous effects, along with identification and robustness checks and Section 6 concludes.

2 | INSTITUTIONAL FRAMEWORK

According to the existing EU regulation (1408/71 of June 14, 1971, 574/72 of March 21, 1972, 883/2004 of first May 2010 and 987/2009 of first May 2010), nationals from any of the 27 EU countries, Iceland, Liechtenstein, Norway, and Switzerland are entitled to receive the same health care treatment in the same conditions as nationals from those countries when they are visiting. Since 2010 (1231/2010 of December 29, 2010), this rule has also applied to third country nationals who are legal residents in the EU (except in Denmark, Iceland, Liechtenstein, Norway, and Switzerland). Individuals insured by the health care system of one of the EU countries listed above are entitled to receive the same type of care as nationals from the country of destination, regardless of whether they are temporarily visiting or permanently residing in that host country (Directive 2011/24/EU of March 9, 2011).

Each country should reimburse other nations for the medical expenses incurred by its nationals. The Administrative Commission on Social Security for Migrant Workers is the European Commission's organism in charge of coordinating agreements and reimbursement procedures between member countries. However, problems arise when the medical treatment received in the destination country is not covered by the health care system of the origin country. For example, at the end of 2009, unreimbursed costs amounted to 138 million euros (de Cuentas, 2012) –a figure that typically excludes pharmaceutical services. As an example, during 2009, Valencia only issued 304 invoices including pharmaceutical services, that is, less than 1% of all invoices issued in Valencia that year. Estimates suggest that, in 2009, Spain required the reimbursement of 441,181,488 euros for medical treatments provided to citizens from the EU26, Iceland, Liechtenstein, Norway and Switzerland. In the same year, the Spanish government received claims from these countries that only amounted to 46,185,639 for the treatment received by Spanish citizens in one of these countries (de Cuentas, 2012). This large difference is because Spain is a net receiver of cross-border medical care and has a sizable community of foreign residents.[6]

In addition to the above-mentioned EU-wide regulations, there are bilateral international agreements. In 2012, Spain had 20 bilateral agreements signed with third countries.[7] Healthcare is included in seven of those 20 countries –namely, Andorra, Brazil, Chile, Ecuador, Morocco, Peru, and Tunisia.

Due to difficulties arising with the reimbursement of medical expenses incurred by foreigners, in January 2012, one of the 19 Spanish regions (i.e., Valencia) decided to directly charge non-residents treated in their hospitals.[8] The aim was to ensure payment of any medical procedures –an expense patients could later seek reimbursement for in their respective home countries. This eliminated the need to go through the European-wide reimbursement mechanism. The policy change was approved through the Law 9/2011 on fiscal measures, administrative and financial management, and organization of the Generalitat on December 26, 2011.[9] It was announced by the Vice-President of the regional government at that time in a press conference held on the same day of the measure's approval during which it was stressed that "medical tourism was over in Valencia".[10]

Valencia ranks among the top destinations for cross-border medical care in Spain. Close to 40% of all medical expenses incurred by the Spanish public health care system associated to the provision of cross-border medical care occurs in Valencia (de Cuentas, 2012). Within the region of Valencia, the province of Alicante receives the second largest flow of medical tourists in Spain, mostly from the United Kingdom, Nordic countries, The Netherlands, and France. The typical individual seeking cross-border medical care is familiar with the region (has vacationed or resided there, possibly

received health care before) and is advised by a firm that facilitates the provision of such services (Escuela de Organización Industrial, 2013).

In practical terms, European individuals seeking medical treatment in Spain should follow several steps, including checking with the Spanish hospital for available dates for the operation, processing any lab tests needed prior to the procedure and discussing the intervention with their home country general practitioner, among other things.[11] Additionally, for some specific types of operations, individuals might need to ask for authorization from the home-country National Health Service. Typically, this information is available online for most European country members.[12] However, due to the language and bureaucratic barriers that individual patients may encounter when arranging a medical intervention abroad, a number of companies have started to market cross-border medical care packages that include trip, accommodation, needed paperwork, lab work, and medical intervention for a price that, in many occasions, is still substantially lower than the cost of the same procedure in the home country.[13]

3 | DATA

To evaluate the impact of the reform on cross-border medical care, we use data on hospitalizations from the Spanish MSBD. The MSBD is a clinical-administrative database provided by the Ministry of Health, Consumption and Social Welfare. It gathers data directly from public hospitals and contains administrative and detailed medical records on hospitalizations at discharge. We use data from 2008 to 2015 –namely, from 4 years prior to and 4 years after the reform. For each entry, the database provides information on some basic individual and hospital characteristics, length of hospital stays, diagnosis, procedures, mortality and estimated cost.[14]

Our sample excludes children and pregnant women because these populations enjoy free access to care.[15] In addition, we remove hospitalizations due to traffic or work accidents, since they should not be considered cross-border medical care, as well as those with unknown or wrong diagnostic coding.[16] We use information on the patient's region of residence to identify non-resident hospitalizations for each region. We work with 17 of the 19 Spanish regions as we cannot include Navarra and La Rioja since the database does not allow us to identify non-resident hospitalizations.[17] In addition, although in robustness checks we experiment with including it, we exclude the region of Andalucía from the main analysis. Although there is no policy that has been specifically introduced in Andalucía to charge patients for incurred hospitalization costs, as in the case of Valencia, there is evidence in some media outlets that some hospitals in the region directly charging non-residents for procedures. Based on media outlets, these changes occurred around 2012.[18] Therefore, as there seems to be evidence of a non-formalized change in charging behavior in that region, we conduct our analysis excluding Andalucía from both the treated and the control groups, to later include it in the treated group in robustness checks. In sum, since the request of direct payment for services from non-residents was only officially introduced in Valencia, that region constitutes the *treated* region, which we compare to the rest of *control* regions included in the study.[19]

4 | METHODOLOGY

Thus far, we have provided descriptive evidence of the impact of the reform on cross-border hospitalizations and related costs. In what follows, we conduct a more thorough analysis relying on a quasi-natural experimental approach that compares changes in both outcomes (non-resident hospitalization and costs) before and after the policy change, across treated and control regions, while accounting for regional and temporal fixed-effects, as well as linear or treated-region specific time trends. To that end, we estimate the following benchmark model:

$$y_{\text{rqy}} = \beta_0 + \beta_1 \text{Post}_{qy} + \beta_2 \text{Treated}_r + \beta_3 \left(\text{Post}_{qy} \ x \ \text{Treated}_r \right) + \mu_r + \delta_q + \lambda_y + \varepsilon_{\text{rqy}} \tag{1}$$

where y_{rqy} is the outcome of interest (number or hospitalizations or total cost) in region r, quarter q and year y. Post_{qy} is a dummy variable equal to 1 after the reform; that is, the first quarter of 2012 onward. Treated_r is an indicator for the treated region –namely, Valencia.[20] The model includes region fixed effects (μ_r), quarter fixed effects (δ_q) and year fixed effects (λ_y). To account for within-region dependence, standard errors should be clustered at the regional level. Given the limited number of regions (17), standard errors are bootstrapped e.g., Cameron et al. (2008).

The causal effect of the reform would be captured by β_3, which can be interpreted as the change in non-residents' hospitalizations and their corresponding cost induced by the reform. Note that the specification already controls for changes over time in the dependent variable, as well as for average differences between non-resident patients across treated and control regions. The identification assumption is that trends in the two outcomes would have been the same in treated and control regions in the absence of the policy change. We thus include either region-specific time trends (r^*t) or treated region-specific time trend ($Treat_r^*t$). Note that this allows for identification to stem from over time changes within a region. Additionally, in an event study, we will explore if the trends in non-resident hospitalizations and costs already differed in Valencia, when compared to the control regions, prior to the change in the billing policy.

5 | DID THE REFORM REDUCE CROSS-BORDER MEDICAL CARE?

5.1 | Main findings

Our primary goal is to learn about the effectiveness of the reform in reducing cross-border medical care costs by ensuring the upfront payment for services provided to non-residents. We begin by providing some graphical evidence on these effects. Panel A of Figure 1 shows the number (dots) of non-resident hospitalizations for each trimester *before* and *after* the reform in Valencia (left panel) versus the remaining regions (right panel). We fit a linear trend to the pre-reform and post-reform observations to graphically identify any break in the trend in response to the policy adoption (shaded areas capture 95% confidence intervals). There was a clear reduction in the number of hospitalizations in Valencia following the policy implementation from an average of 750/trimester to close to 50/trimester –a 90% drop. In contrast, in the control regions, hospitalizations did not significantly change from before to after the policy change implemented by Valencia.

At this juncture, a couple of facts are worth pointing out. First, there was no apparent "race to the bottom" –that is, other Spanish regions did not legislate a policy similar to the one adopted by Valencia, despite their ability to do so. Second, there was no apparent spillover impacts on the remaining Spanish regions, which could have prompted other regions to follow on Valencia's steps (see Figure A, both Panel A and B, in Appendix). A potential reason for the lack of spillover impacts can be found in patients' self-reports when asked about the factors driving their decision to seek cross-border care, which point to their familiarity with the region as a primary driver. For instance, survey data from the Flash Eurobarometer administered by the European Commission in 2007 shows that Europeans are much more likely to travel abroad to receive medical treatment if they have already received some medical assistance in that location before (Flash Eurobarometer, 2007). Similarly, lack of familiarity with the destination is identified as an important factor discouraging individuals from seeking medical care abroad. This suggests that many of those seeking care in Valencia were probably familiar with the area and only considered seeking care in that location, not necessarily in other Spanish regions they might be unfamiliar with.

In consonance with the results in Panel A of Figure 1, there is a significant reduction in the cost associated to the hospitalization of non-residents in Valencia after the policy was implemented from 5 million euros in the first quarter of 2011 to half a million euros right after (Panel B of Figure 1). In contrast, in the remaining Spanish regions, total costs per quarter remained roughly unchanged. Overall, the descriptive evidence in Figure 1 hints on the policy effectiveness in curtailing non-resident hospitalizations and costs.

From a public health point of view, it is important to identify which treatments and costs were responsible for the observed response. The MSBD contains detailed information on diagnostics, which allow us to determine the most treated diseases and the estimated cost of treatment. In Table 1, we use that information to descriptively examine changes in hospitalizations from *before* to *after* the first quarter of 2012, in *Valencia* versus the *control* regions, according to Mayor Diagnostic Category.[21] Hospitalizations due to diseases and disorders related to the musculoskeletal, circulatory, digestive, respiratory and nervous systems all experienced very large reductions. Together, they accounted for 70% of the decrease in hospitalizations.

Table 2 repeats the same exercise, although focusing on the estimated average cost (in thousands of euros) of each hospitalization. The largest savings originate from diagnoses responsible for most hospitalizations, such as diseases and disorders related to the musculoskeletal, circulatory, digestive, respiratory and nervous systems. They accounted for 67% of the cost savings. The most expensive diagnoses (pre-MDC and human immunodeficiency/virus infections) only lowered the total number of hospitalizations by 1.1% (Table 1);[22] however, they reduced total costs by 5.4% (Table 2).

(a) **Hospitalizations**
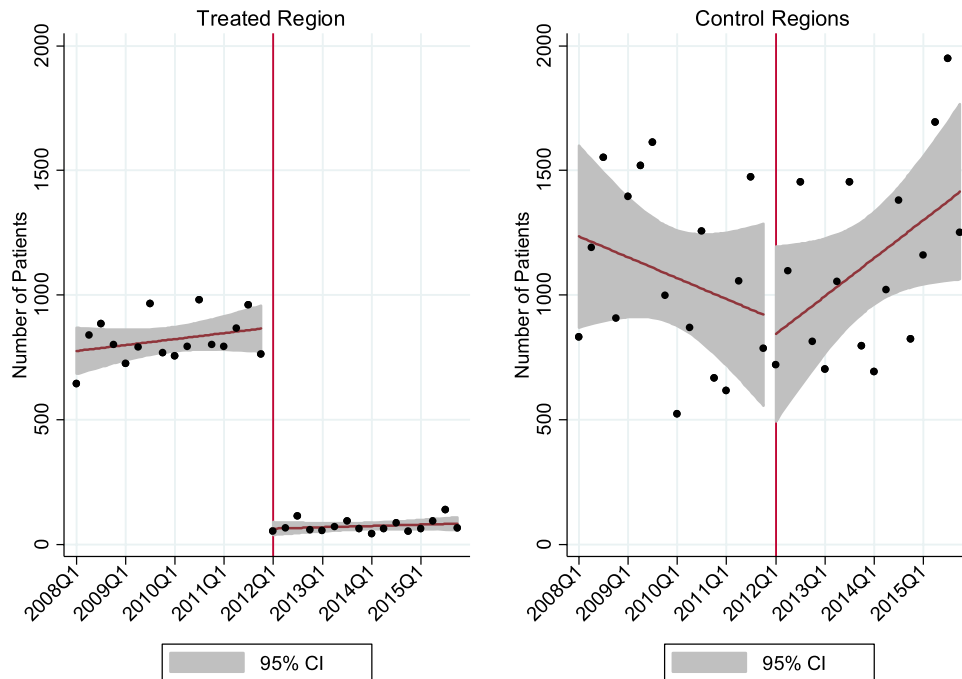
(b) **Total Cost (in 1,000 euros)**
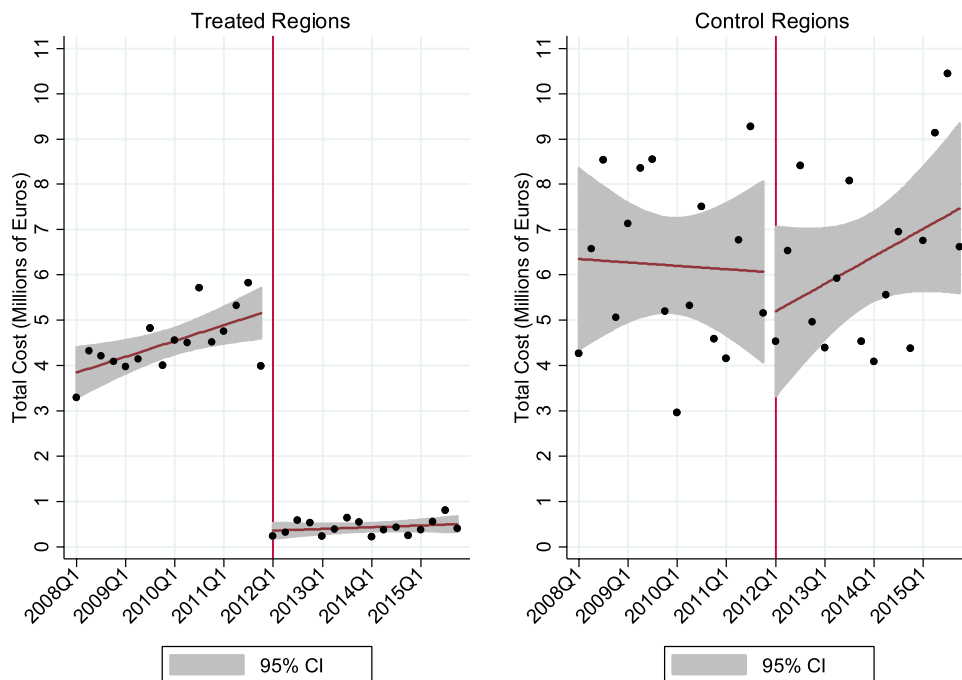
F I G U R E 1   Cross-border Medical Care (2008-2015). *Source*: CMBD 2008-2015 and own elaboration [Colour figure can be viewed at wileyonlinelibrary.com]

In sum, the graphical evidence presented in Figure 1 and Table B in the appendix uncover significant reductions in non-resident hospitalizations and costs in Valencia, when compared to other regions, after 2011. In addition, Table 1 and Table 2 document how the observed reduction in non-resident hospitalizations and costs did not disproportionly impact a few diagnoses.

TABLE 1 Hospitalizations by type of diagnosis

Mayor diagnostic category	Percent Distribution	Treated region			Non-treated regions			DD (DT-DC)	Reduction/ Total
		Pre	Post	DT	Pre	Post	DC		
Diseases and disorders of the musculoskeletal system and connective tissue	16%	2092	168	−1924	2801	2877	76	−2000	15.7%
Diseases and disorders of the circulatory system	16%	2474	206	−2268	2593	2654	61	−2329	18.2%
Diseases and disorders of the digestive system	12%	1530	127	−1403	2121	2320	199	−1602	12.5%
Diseases and disorders of the respiratory system	12%	1573	130	−1443	2167	2126	−41	−1402	11.0%
Diseases and disorders of the nervous system	11%	1607	172	−1435	1802	1959	157	−1592	12.5%
Diseases and disorders of the hepatobiliary system and pancreas	5%	782	57	−725	894	945	51	−776	6.1%
Diseases and disorders of the kidney and urinary tract	5%	470	43	−427	774	954	180	−607	4.8%
Diseases and disorders of the skin, subcutaneous tissue and breast	3%	294	31	−263	591	517	−74	−189	1.5%
Mental diseases and disorders	3%	342	43	−299	436	528	92	−391	3.1%
Diseases and disorders of the ear nose, mouth and throat	2%	268	21	−247	428	335	−93	−154	1.2%
Injuries, poison and toxic effect of drugs	2%	214	39	−175	342	389	47	−222	1.7%
Infectious and parasitic DDs (systemic or unspecified sites)	2%	249	28	−221	280	374	94	−315	2.5%
Diseases and disorders of the endocrine, nutritional and metabolic system	2%	213	18	−195	314	288	−26	−169	1.3%
Diseases and disorders of the female reproductive system	2%	175	12	−163	311	291	−20	−143	1.1%
Pre-MDC	1%	130	18	−112	271	226	−45	−67	0.5%
Myeloproliferative DDs (poorly differentiated neoplasms)	1%	104	5	−99	186	166	−20	−79	0.6%
Factors influencing health status and other contacts with health services	1%	72	9	−63	154	212	58	−121	0.9%
Diseases and disorders of the blood and blood forming organs and	1%	109	5	−104	162	165	3	−107	0.8%
Human immunodeficiency virus infection	1%	60	7	−53	152	182	30	−83	0.6%
Diseases and disorders of the male reproductive system	1%	73	5	−68	131	186	55	−123	1.0%
Alcohol/drug use or induced mental disorders	1%	111	13	−98	134	96	−38	−60	0.5%
Diseases and disorders of the eye	1%	87	3	−84	102	121	19	−103	0.8%
Multiple significant trauma	0%	66	3	−63	52	103	51	−114	0.9%
Burns	0%	32	3	−29	48	44	−4	−25	0.2%
All	100%	13,127	1166	−11,961	17,246	18,058	812	−12,773	100%

Note: Savings/Total is calculated as the reduction in the number of hospitalizations (DD) over the total (12,773).

Abbreviations: DC, difference control group (Post-Pre); DD, difference in differences (DT-DC); DT, difference treated group (Post-Pre).

Source: CMBD 2008–2015 and own elaboration.

TABLE 2   Total Cost of Hospitalizations by Type of Diagnosis (in thousands of €)

Mayor diagnostic category	Average cost per patient	Treated region			Non-treated regions			DD (DT-DC)	Savings/ Total
		Pre	Post	DT	Pre	Post	DC		
Diseases and disorders of the musculoskeletal system and connective tissue	5	10,711	781	−9931	13,463	14,999	1536	−11,467	17.1%
Diseases and disorders of the circulatory system	5	12,649	1062	−11,586	14,012	14,268	256	−11,842	17.6%
Diseases and disorders of the digestive system	5	7499	557	−6943	9598	10,242	644	−7587	11.3%
Diseases and disorders of the respiratory system	4	6261	510	−5751	9112	9144	32	−5783	8.6%
Diseases and disorders of the nervous system	6	8407	1057	−7350	10,820	11,449	630	−7980	11.9%
Diseases and disorders of the hepatobiliary system and pancreas	5	3730	273	−3457	4070	4576	506	−3963	5.9%
Diseases and disorders of the kidney and urinary tract	4	1704	135	−1569	2707	3510	803	−2372	3.5%
Diseases and disorders of the skin, subcutaneous tissue and breast	4	1061	112	−949	2203	1876	−327	−622	0.9%
Mental diseases and disorders	6	1863	324	−1539	2396	3974	1578	−3117	4.6%
Diseases and disorders of the ear nose, mouth and throat	3	799	53	−746	1410	1026	−385	−361	0.5%
Injuries, poison and toxic effect of drugs	5	1008	155	−852	1574	1771	198	−1050	1.6%
Infectious and parasitic DDs (systemic or unspecified sites)	6	1625	160	−1466	1628	2308	680	−2146	3.2%
Diseases and disorders of the endocrine, nutritional and metabolic system	4	934	69	−865	1346	1220	−126	−739	1.1%
Diseases and disorders of the female reproductive system	4	637	33	−604	1119	1069	−50	−554	0.8%
Pre-MDC	57	8785	1116	−7669	16,077	11,049	−5027	−2642	3.9%
Myeloproliferative DDs (poorly differentiated neoplasms)	8	966	29	−938	1345	1370	25	−963	1.4%
Factors influencing health status and other contacts with health services	4	167	31	−135	699	1013	313	−449	0.7%
Diseases and disorders of the blood and blood forming organs and	4	436	20	−417	652	642	−10	−407	0.6%
Human immunodeficiency virus infection	17	1089	119	−971	2844	2886	42	−1013	1.5%
Diseases and disorders of the male reproductive system	3	234	11	−223	432	659	226	−450	0.7%
Alcohol/Drug use or induced mental disorders	4	404	60	−344	439	462	24	−368	0.5%
Diseases and disorders of the eye	4	357	10	−347	386	394	8	−355	0.5%
Multiple significant trauma	8	375	84	−291	433	913	480	−771	1.1%
Burns	11	288	40	−247	589	480	−109	−138	0.2%
All	5	71,991	6799	−65,191	99,354	101,301	1947	−67,138	100%

Note: Savings/Total is calculated as the reduction in the cost (DD) over the total (67,138).

Abbreviations: DC, difference control group (Post-Pre); DD, difference in differences (DT-DC); DT, difference treated group (Post-Pre).

Source: CMBD 2008–2015 and own elaboration.

Next, we provide a more formal analysis of the effects and a detailed quantification of those effects. Table 3 shows the difference-in-difference estimate of the reform on those two outcomes based on three model specifications of Equation (1) that progressively add controls. Specification (1) includes regional, trimester and year fixed-effects; specification (2) adds a treated region-specific time trend and specification (3) adds region-specific time trends to the first model specification –allowing us to check the common trends assumption. Results are rather consistent, regardless of the model specification being used. Based on the last and most complete model specification, the reform lowered hospitalization costs associated

TABLE 3 Difference-in-difference estimates of the effect of the reform on cross-border medical care

Outcome:	Hospitalizations			Total cost (in 1000 euros)		
Column:	(1)	(2)	(3)	(4)	(5)	(6)
Post * treated	−750.946***	−800.107***	−800.107***	−4082.574***	−4786.445***	−4786.445***
	(18.657)	(41.806)	(54.378)	(177.211)	(344.845)	(343.969)
Observations	512	512	512	512	512	512
R-squared	0.871	0.871	0.896	0.879	0.880	0.901
Dep. Var mean	820.44	820.44	820.44	4499.42	4499.42	4499.42
Std. Deviation	(91.81)	(91.81)	(91.81)	(668.88)	(668.88)	(668.88)
% change	92	98	98	91	106	106
Region FE	Y	Y	Y	Y	Y	Y
Trimester FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Treated trend	N	Y	N	N	Y	N
Linear trend	N	N	Y	N	N	Y

Note: Bootstrap standard errors in parentheses.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

to non-residents by 4.8 million euros/trimester in Valencia, when compared to other autonomous communities (column 6). This substantial savings originated from a sharp reduction in hospitalizations among non-residents of roughly 800/trimester –a 98% drop (column 3).

5.2 | Heterogeneous impacts

Thus far, we have shown that the reform adopted by Valencia significantly curtailed non-resident hospitalizations and costs. The impacts did not predate the reform and proved long-lasting. In this section, we learn about the heterogeneous impact of the reform across medical procedures and patient demographics.

5.2.1 | Heterogenous impacts by type of intervention

Table 4 provides some insight into the impact of the reform across medical procedures. The first two columns differentiate according to whether the intervention required surgery.[23] As shown therein, both surgical and non-surgical medical attention dropped by similar percentages –between 94 and 99%, respectively. Further information on the type of intervention affected by the reform is provided in columns (3) through (9). There were similarly large and significant reductions in interventions related to the musculoskeletal and circulatory systems, including hip implants and pacemakers. Similarly, cataract procedures were cut by two and a half times.

In sum, the reform led to large reductions in all medical interventions, regardless of whether they involved surgery or not, as well as across the most typical procedures, including hip and pacemaker implants or cataracts.

5.2.2 | Heterogeneous impacts by patients' age, gender and country of origin

We next look at heterogeneous impacts of the reform by gender, age, or country of origin to learn if the policy change affected particularly more some demographics. As shown in Table 5, there were significant reductions among both male and female patients, as well as among younger and older patients.

We also look at the nationalities of treated patients –information that is unfortunately not available for most regions. Nevertheless, we do have the data for Valencia, which we use to tabulate changes in the origin of patients before and after the adoption of the reform (see Table 6). Once again, as in Tables 4 and 5, we observe large reductions across the

TABLE 4 DD estimates of the effect of the reform on frequent medical interventions

Category:	Surgery		Musculoskeletal system			Circulatory system			Eyes
Outcome:	Yes	No	All	With surgery	Hip implants	All	With surgery	Pacemaker implants	Cataract
Column:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Post * treated	−226.893***	−573.214***	−127.070***	−95.733***	−8.566***	−133.116***	−35.930***	−3.746***	−0.459*
	(15.703)	(27.951)	(8.119)	(6.993)	(1.552)	(6.796)	(3.558)	(0.747)	(0.236)
Observations	512	512	512	512	512	512	512	512	512
R-squared	0.880	0.896	0.877	0.884	0.747	0.908	0.894	0.515	0.238
Dep. Var mean	241.12	579.31	132.62	95.56	8.06	154.19	42.62	3	0.18
Std. Deviation	(34.10)	(65.76)	(19.30)	(15.27)	(2.26)	(14.60)	(6.5)	(1.71)	(0.40)
% change	94	99	96	100	106	86	84	125	255
Region FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Trimester FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Linear trend	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: Bootstrap standard errors in parentheses.

Abbreviation: FE, fixed effects.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 5 DD estimates of the effect of the reform by gender and age groups

Group:	By gender		By group of age			
Outcome:	Women	Men	18–34	35–54	55–74	+75
Post * treated	−318.460***	−481.653***	−95.959***	−168.546***	−378.569***	−157.034***
	(17.538)	(22.690)	(13.250)	(17.955)	(12.063)	(9.597)
Observations	512	512	512	512	512	512
R-squared	0.880	0.902	0.856	0.852	0.918	0.826
Dep. Var mean	324.37	496.06	106.87	168	391.19	154.37
Std. Deviation	(40.73)	(52.91)	(27.29)	(45.51)	(23.33)	(15.97)
% change	98	97	90	100	97	102
Region FE	Y	Y	Y	Y	Y	Y
Trimester FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Linear trend	N	Y	N	N	Y	N

Note: Bootstrap standard errors in parentheses.

Abbreviation: FE, fixed effects.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

board, even though most patients were originally coming from the U.K., Germany, and France. Prior to the reform, approximately 93% of patients in Valencia originated from Europe (see Figure D). After the reform, that share is not substantially different, at about 89%, even though the reductions occurred, primarily, among patients originating from Europe (Figure E).

In sum, the effectiveness of the reform did not rely on the selection of patients based on their gender, age, origin, nor on the type of intervention sought.

TABLE 6 Top 10 Hospitalizations by Country of Residence in Valencia (Number of hospitalizations per quarter)

Origin	Pre	Post	Var (%)
U.K.	268	19	−93%
Germany	115	6	−95%
France	95	9	−91%
Romania	53	2	−96%
Belgium	27	3	−90%
Norway	26	2	−92%
Netherlands	24	4	−84%
Sweden	24	2	−93%
Italy	20	3	−85%
Switzerland	14	2	−86%

Source: CMBD 2008–2015 and own elaboration.

TABLE 7 Mechanisms #3: Difference in Differences (DD) estimates of the effect of the reform on based on individual case traits

Outcome	Cost	Resources	Scheduled hospitalizations	Readmissions	Duration	Mortality
Post * treated	0.812*	0.155	−0.017	−0.044***	−0.340	−0.003
	(0.454)	(0.105)	(0.012)	(0.010)	(0.497)	(0.009)
Observations	49,594	49,594	49,594	49,594	49,594	49,594
R-squared	0.007	0.006	0.070	0.009	0.020	0.021
Dep. Var mean	5.48	1.20	0.06	0.06	6.68	0.05
Std. Deviation	(7.91)	(1.66)	(0.24)	(0.23)	(8.52)	(0.21)
% Change	15	13	28	73	5	6
Age, gender	Y	Y	Y	Y	Y	Y
Region FE	Y	Y	Y	Y	Y	Y
Trimester FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Linear trend	Y	Y	Y	Y	Y	Y

Note: Total cost in thousands of euros. Bootstrap standard errors in parentheses.

Abbreviation: FE, fixed effects.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

5.2.3 | Heterogeneous impacts by intervention attributes

Finally, with the purpose of learning about the demographics being primarily impacted by the reform, we use the individual level data on the resources associated to the treatment/intervention sought by non-residents, its anticipated nature, duration of treatment, readmissions, mortality, as well as individual intervention costs to further understand which intervention parameters were impacted by the reform. Uncovering this information sheds some light on selective changes and, in turn, on the mechanisms at play.

To that end, we re-formulate the model in Equation (1) to gauge the effect of the reform on non-residents' choice of treatment/intervention, duration of treatment, length of hospital stays, readmissions, mortality and expenditures incurred using case level data, as follows:

$$y_{\text{irqy}} = \beta_0 + \beta_1 \text{Post}_{qy} + \beta_2 \text{Treat}_r + \beta_3 \left(\text{Post}_{qy} \; x \; \text{Treat}_r \right) + \mu_r + \delta_q + \lambda_y + \varepsilon_{\text{irqy}} \qquad (2)$$

The regressors, now referred to individual patients, coincide with those in Equation (1). The dependent variable denotes the outcomes noted above. Table 7 displays the results after including a treated region-specific time trend. Standard errors are bootstrapped.

The reform only marginally increased the per unit cost of sought procedures, but not the estimated consumption of resources, scheduled hospitalizations, the duration of hospitalizations, or mortality. The implemented change in billing seems to have only lowered readmissions (by 73%).

All in all, the regression estimates in Tables 4, 5 and 7, along with the descriptive statistics in Table 6 and Figures A,B in the appendix, reveal the broad reduction in cross-border medical care, which did not concentrate among certain demographics (as captured by gender, age, origin) nor on specific medical interventions. Similarly, declines occurred for all sorts of medical procedures (i.e., with or without surgery, as well as with higher or lower estimated resource consumption) without significantly altering the duration of treatment or mortality. Rather, non-citizens became 75% less likely to be readmitted in the hospital.

5.3 | Identification

The estimates in Table 3 rely on a difference-in-difference estimation that assumes that the outcomes being examined were no different prior to the adopted measures in treated versus control region. To gauge the parallel pre-trends assumption, as well as to evaluate outcome dynamics following the reform, we conduct an event study for each outcome – namely, the number of non-resident hospitalizations in the region and its associated cost. To that end, we estimate the following equation:

$$y_{rqy} = \beta_0 + \sum_{qy=-15}^{15} \beta_{1,qy} \text{Trim}_{qy} + \beta_2 \text{Treat}_r + \sum_{qy=-15}^{15} \beta_{3,qy} (\text{Trim}_{qy} \ x \ \text{Treat}_r)_{rqy} + \mu_r + \varepsilon_{rqy} \qquad (3)$$

where y_{rqy} continues to stand for the number of hospitalizations or total cost in region r, quarter q and year y. We examine the existence of pre-trends up to 15 trimesters prior, as well as outcome dynamics up to 15 trimesters after the reform. Figure 2 displays the coefficients from the event study (β_3), along with 95 percent confidence intervals. All estimates for the periods prior to the reform are close to zero, strongly supporting the assumption of no differential pre-trends. In addition, there is a clear break in the trend in both the number of hospitalizations (Panel A), as well as in its total cost (Panel B), surrounding the adoption of the policy. Both significantly drop and stay down thereafter. The persistence of the reform's impacts is suggestive of its effectiveness in curtailing cross-border medical care and its cost in the medium- and long-run.

To dissipate additional identification concerns, we also conduct a series of placebo checks. The equation for the placebo tests is Equation (1). The only difference is the values taken by the *post* dummy. Instead of reflecting the true post-reform period, we experiment with shifting the adoption of the policy by one trimester at a time. Figure 3 illustrates the distribution of the new point estimates (the two panels (a)), as well as the cumulative distribution of t-values from those regressions (the two panels (b)) when compared to a zero-mean normal distribution. As shown therein, the point estimates from the placebo interventions are almost always lower than our estimated effect (indicated by the dashed vertical line) and as expected, centered around zero. Furthermore, a Kolmogorov-Smirnov test of normality of the empirical distribution of the placebo t-values cannot be rejected at conventional significance levels. As such, the placebo reforms would have no significant impact on either non-resident hospitalizations or their associated cost.

5.4 | Robustness checks

We next perform several robustness checks aimed at gauging the reliability of the estimates in Table 3 to changes in the sample period, the control group, the treated group, and the estimation methodology. Columns (1) and (2) of Table 8 display the results from our *first* robustness check, where we experiment with restricting the sample to *a 3-year period around treatment* to better gauge the impact of the adopted measures. Results prove remarkably robust. Estimates become, if anything, slightly larger, lowering regional medical costs by 5.3 million euros/trimester (vs. 4.8 million) as hospitalizations drop by 909/trimester (vs. 800) in Valencia.

Next, we experiment with *altering the control group*. Causal inference ultimately depends on having similar treated and control groups. To that end, we use data from the Hotel Occupancy Survey (National Institute of Statistics in Spain) and select regions that, as Valencia, have more than one million of travelers per year (see Appendix C). This exercise results in a different control group composed of the following regions: Cataluña, Balearic Island, Canary Island, Madrid,

FIGURE 2 Event study Figures.
Source: CMBD 2008-2015 and own elaboration [Colour figure can be viewed at wileyonlinelibrary.com]

(a) Hopitalizations
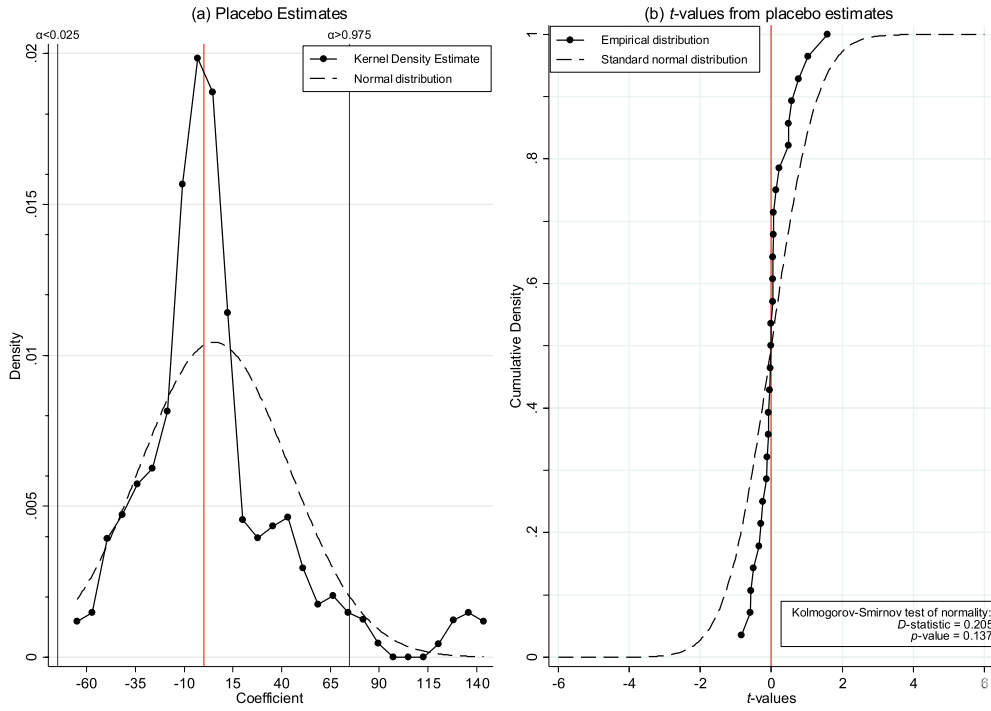
(b) Total Cost (in 1,000 euros)
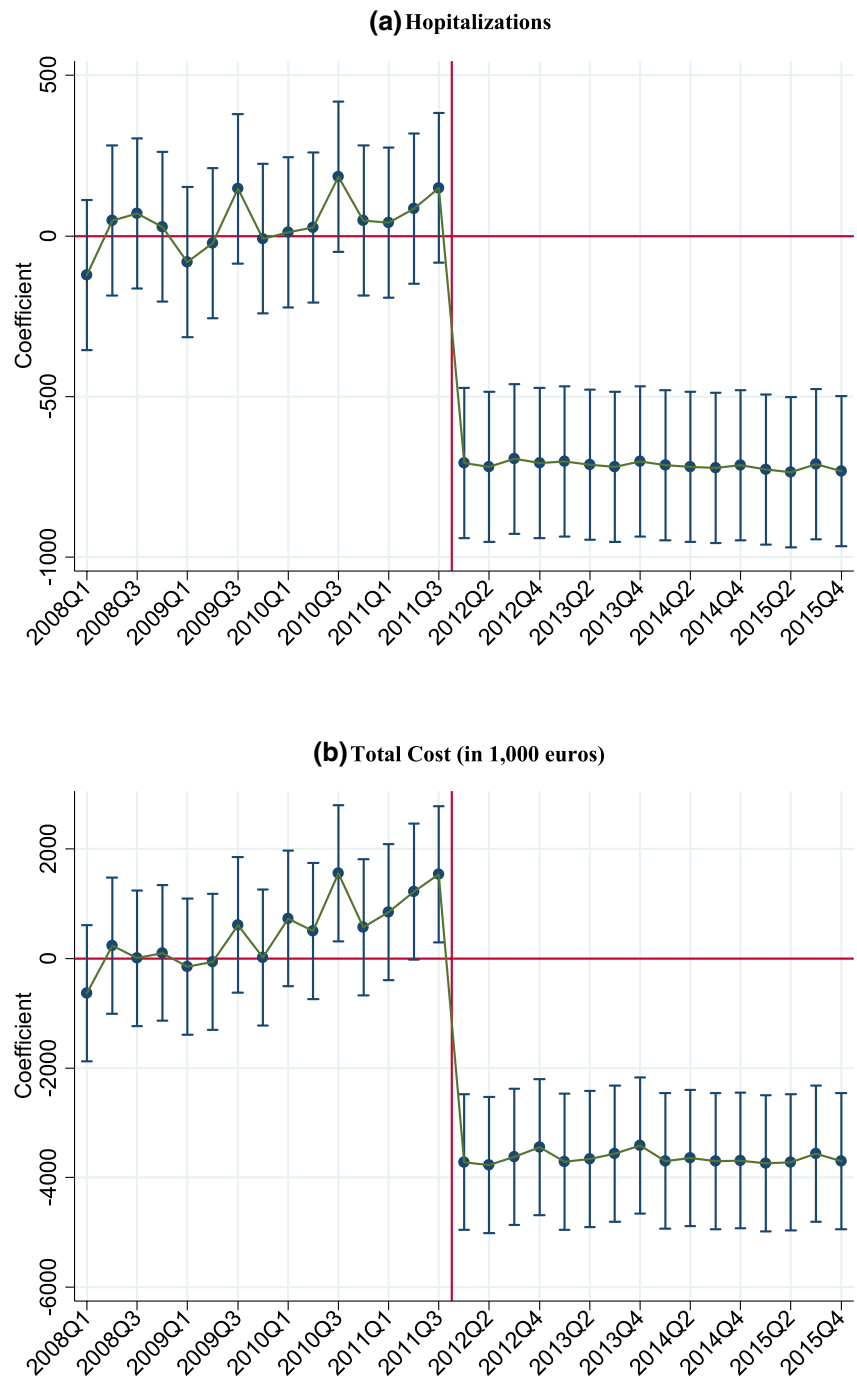
Galicia, Basque Country, and Castile-Leon. Using this new control group, we repeat our analyses. As shown in columns (3) and (4) of Table 8, the estimates continue to prove remarkably robust.

In a similar vein, we explore altering the control group by *removing control regions–one at a time*. Figure B in the appendix displays the estimated impacts of the reform on hospitalizations and total costs. The reform lowered the former by roughly 800/trimester and total costs by 4.8 million euros/trimester regardless of the control region being removed. In sum, estimates are not driven by one specific control region.

In columns (5) and (6) of Table 8, we try *changing the treated group*. Unlike our prior analysis, we experiment with including Andalucía in the treated group together with Valencia because, although there was no formal normative change, there is evidence of informal advice to charge foreigners directly for some procedures. As can be seen in the last columns of Table 8, our results prove robust to this robustness check. The reform lowered hospitalizations by 492/trimester and overall costs by 2.9 million euros/trimester. These are reductions hovering around 82 and 91%, respectively.

(a) Number of Hospitalizations

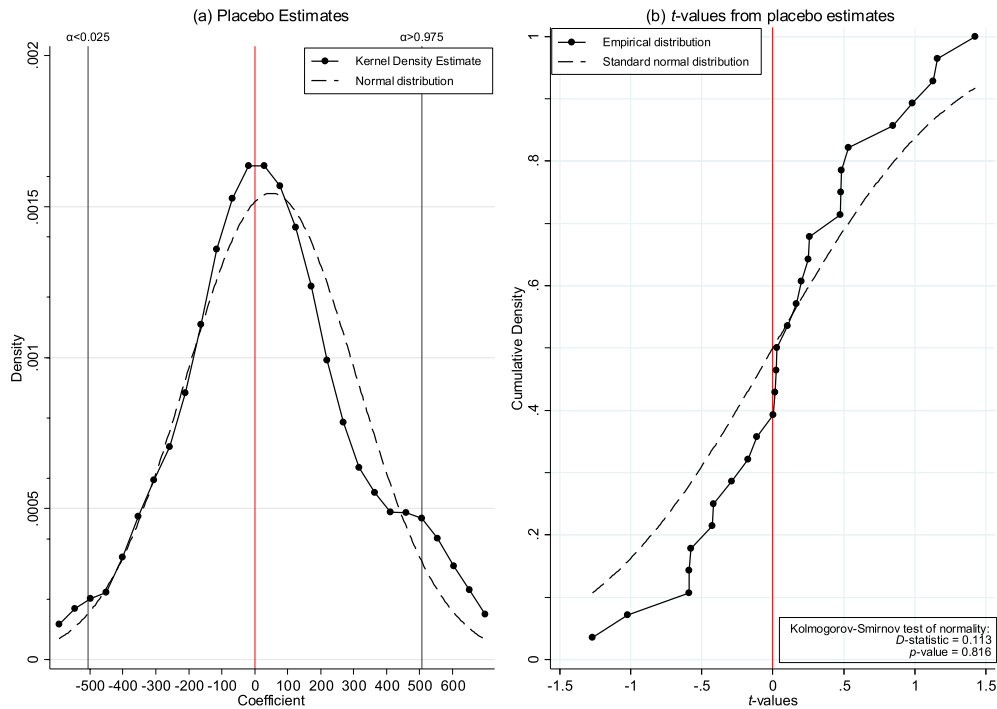
(b) Total Cost (in thousands of euros)

F I G U R E 3 Placebo tests. *Source:* CMBD 2008–2015 and own elaboration [Colour figure can be viewed at wileyonlinelibrary.com]

To conclude, we experiment with conducting the analysis using two *alternative methodologies*. *First*, we use a regression discontinuity (RD) design exploiting the fact that reform was introduced in January 2012 to estimate the following model:

TABLE 8 Robustness checks

Check no.:	Check #1		Check #2		Check #3	
Specification:	Using a 3-year window around treatment		Using regions with similar tourism		Including Andalucía as a treated region	
Outcome:	Hospitalizations	Total cost (in 1000 euros)	Hospitalizations	Total cost (in 1000 euros)	Hospitalizations	Total cost (in 1000 euros)
Column:	(1)	(2)	(3)	(4)	(5)	(6)
Post * treated	−910.190***	−5341.750***	−797.444***	−4741.954***	−492.079***	−2893.719***
	(103.500)	(652.229)	(50.585)	(370.759)	(71.530)	(384.290)
Observations	403	403	256	256	544	544
R-squared	0.876	0.879	0.893	0.897	0.883	0.884
Dep. Var mean	769.77	4344.10	820.44	4499.42	577.19	3174.39
Std. Deviation	(233.97)	(1342.11)	(91.98)	(668.88)	(256.83)	(1441.06)
% change	118	123	97	105	85	91
Region FE	Y	Y	Y	Y	Y	Y
Trimester FE	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y
Linear trend	Y	Y	Y	Y	Y	Y

Note: Bootstrap standard errors in parentheses.

Abbreviation: FE, fixed effects.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

TABLE 9 Regression discountinuity design estimates of the effect of the reform on cross-border medical care

Outcome:	Hospitalizations		Total cost (in 1000 euros)	
Column:	(1)	(2)	(1)	(2)
Post	−808.213***	−757.365***	−4888.113***	−4540.666***
	(47.023)	(73.259)	(284.893)	(439.437)
Observations	32	32	32	32
R-squared	0.973	0.974	0.968	0.969
Dep. var mean	820.44	820.44	4499.42	4499.42
Std. deviation	(91.81)	(91.81)	(668.88)	(668.88)
% Change	98	92	109	101
Linear trend	Y	N	Y	N
Quadratic trend	N	Y	N	Y

Note: Standard errors in parentheses.

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

$$y_{rqy} = \beta_0 + \beta_1 \text{Trend}_{qy} + \beta_2 \text{Post}_{qy} + \beta_3 (\text{Trend}_{qy} \ x \ \text{Post}_{qy}) + \varepsilon_{rqy} \qquad (4)$$

where Trend_{qy} stands for a linear trend of our running variable by quarter, and Post_{qy} is a binary indicator equal to 1 for the post-reform period. We also allow for a differential trend after the reform ($\text{Trend}_{qy} \ x \ \text{Post}_{qy}$). Therefore, the coefficient on Post_{qy} identifies jumps in the dependent variable at the time of the reform –namely, in January 2012. Finally, to check the robustness of our findings to the use of non-linear trends, we also experiment with adding a quadratic pre-reform trend and a quadratic post-reform trend. Table 9 displays the results from this exercise. As shown therein, the reform lowered hospitalizations in Valencia by 757/trimester in the most complete model specification –a 92 percent reduction. Additionally, it cut total costs by 4.5 million euros/trimester.

Second, we experiment with estimating the impact of the reform using a synthetic control method approach. Results from this exercise are included in Figure C in the appendix. Overall, we observe similar pre-reform trends in hospitalizations and total costs in treated and synthetic control regions. In addition, as with the difference-in-differences and RD

design methodologies, we continue to find evidence of a strong reduction in hospitalizations and costs immediately after the reform –a decline solely driven by the change in the treated region.

In conclusion, the robustness checks confirm the results from our baseline specification, enhancing the credibility and reliability of the estimates and conclusions.

6 | SUMMARY AND CONCLUSIONS

Cross-border care is a relatively unexplored topic in the health literature due, in part, to difficulties in finding adequate data. Yet, cross-border medical care is rather extensive, and can impose a significant financial burden on some nations. We focus on Spain –a country receiving most of its foreign patients from the EU. In the EU context, nationals from any of the 27 EU countries, Iceland, Liechtenstein, Norway, and Switzerland visiting another of these countries, are entitled to receive the same health care treatment in the same conditions than nationals from those countries. While, in principle, the cost associated with treating these patients should be reimbursed by the non-resident's country members, this is often not the case due to the distinct health coverage offered by each country.

We examine the impact of a reform introduced in 2012 in Valencia, Spain, to curtail cross-border medical care costs. The reform consisted in requiring patients upfront payment for cross-border medical care services –an expense that may or may not be reimbursed by their respective countries. As such, in addition to potential liquidity constraints, patients are now uncertain about their medical care cost reimbursement. If they are not fully reimbursed, the policy raises the sticker price of medical care. Although we do not have information on the degree to which foreigners were reimbursed by their respective countries for medical care expenses incurred in Spain after the reform, we know that Spain was reimbursed for only 36% of health care costs incurred by non-residents prior the reform, in 2009. Using administrative data on all interventions to non-residents in the country, along with a quasi-experimental approach, we find that the reform significantly curtailed non-resident hospitalizations by 98% and lowered medical cost by 4.8 million euros/trimester. We also explore the channels through which such reductions took place to gauge any disproportionate impact by type of patient, procedure, or outcomes to learn about selection biases emanating from the policy change. We find that the reform reduced hospitalizations and readmissions for several medical procedures, regardless of whether they were estimated to consume more resources or required surgical interventions. In addition, the reform had no significant impact on the type of patient admitted (as captured by age, gender, or country of origin), nor on scheduled hospitalizations, the duration of the hospital stay or on mortality. Cost savings mostly derived from fewer readmissions, which dropped by 73%, and from patients coming from other European countries.

The fact that Valencia's reform effectively curtailed non-resident hospitalizations and lowered medical costs is not surprising, although the degree to which it achieved its goal certainly is, especially considering no spillover effects on neighboring regions or, for that matter, on more distant Spanish regions. That said, one might wonder about the welfare implications of the reform. While we cannot gauge the well-being effects on foreigners seemingly choosing to be treated elsewhere, we can get a sense of what the yearly savings of 20 million euros –amounting to 0.3% of the health care budget of Valencia in 2011– represent for the region. Given the current salary scales for doctors and nurses in the public health care sector in Spain, the yearly cost savings would allow for the hiring of an additional 600 nurses (a 4% increase in the share of nurses in the workforce in 2019) or 325 doctors (a 3.4% increase in the share of doctors in the workforce in 2019) in a system that, as made evident by the COVID-19 pandemic, is deficient in medical personnel.[24]

Overall, the findings extend our understanding of medical travel by providing causal evidence on the impact of the policy introduced in Valencia, Spain, in containing the financial burden imposed by cross-border medical care. In the absence of more equitable and enforceable reimbursement agreements, directly billing patients, who may later seek reimbursement in their home countries for the incurred medical expenses, can prove effective in reducing the cost burden borne by some regions. This is important considering the increase in cross-border medical care and the lack of a uniform health care coverage menu in the EU context, which creates incentives to seek care in other EU countries covering the treatment in question.

CONFLICT OF INTEREST

No.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the Spanish Ministry of Health, Consumption and Social Welfare. The dataset used from this third party is called "Spanish Minimum set of Basic Data". Restrictions apply to the availability of these data, which were used under license for this study. Data are available directly from the Spanish Ministry (Ministerio de Sanidad - Portal Estadístico del SNS - Registro de Altas de los Hospitales del Sistema Nacional de Salud. CMBD) with the permission of the Ministry and after signing some confidentiality agreements between the researchers and the Ministry.

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ENDNOTES

[1] The top world destinations in this category are Costa Rica, India, Israel, Malaysia, Mexico, or Singapore (see: https://www.patientsbeyond-borders.com/media).

[2] Each Spanish region is an autonomous community with full competency over the provision of health care. Because Valencia was not denying health care services but, rather, requesting upfront payment for received care, it did not interfere with the provision of care to EU citizens, which could still seek care by paying, seeking reimbursement for any incurred expenses later from their respective governments.

[3] More information can be found in Mathijsen and Mathijsen (2020).

[4] In 2019, approximately 76 percent of all hospitalizations occurred in public hospitals, underscoring the relevance of our data when examining the impact of reforms on the Spanish health care system (i.e., https://www.mscbs.gob.es/estadEstudios/estadisticas/estHospiInternado/inforAnual/homeESCRI.htm). Moreover, unlike medical tourism, cross-medical care reimbursed by other EU governments can only take place in public hospitals.

[5] See the Organic Law 4/2000 and the Royal Decree 16/2012, for reference. Yet, it should be noted that, even though abortion services are covered by the public health care system, more than 91% of Spanish women still went to private clinics for this type of service in 2019.

[6] In addition to these two factors, the proximity of countries in Europe and the availability of affordable flights between EU countries have contributed to the proliferation of online providers of planned health tourism. These online companies offer packages that include accommodation, flights, and medical interventions in the destination country. For example, "Medical Tourism Corporation", a U.S. based company, ranks Spain among the top destination countries for health tourism because of the quality of the health care system and other country amenities, such as culture, food, beaches, etc.

[7] Spain currently has bilateral agreements with Andorra, Argentina, Australia, Brazil, Cape Verde, Canada, Chile, Colombia, Korea, Ecuador, United States, Philippines, Japan, Morocco, Mexico, Paraguay, Peru, Dominican Republic, Russia, Tunisia, Ukraine, Uruguay and Venezuela. More information can be found at: http://www.seg-social.es/wps/portal/wss/internet/InformacionUtil/32078/32253?changeLanguage=en.

[8] Over the period under examination, Spanish regions have autonomy and legislative powers over several topics, including health.

[9] A few days later (5th January 2012), another Decreto-Ley 1/2012 laid down some additional details on the implementation of the Ley 9/2011 of 26th December.

[10] Some of the coverage in the media can be found here: https://www.levante-emv.com/comunitat-valenciana/2012/01/07/consell-sujeta-caballo-batalla-turismo-sanitario-c-valenciana/870487.html

[11] More information can be found at: https://europa.eu/youreurope/citizens/health/unplanned-healthcare/going-to-doctor-hospital-abroad/index_en.htm

[12] For instance, in the U.K., the information is available at: https://www.nhs.uk/using-the-nhs/healthcare-abroad/going-abroad-for-treatment/going-abroad-for-medical-treatment/

[13] One example is "treatmentabroad" at https://www.treatmentabroad.com/

[14] See Table A in the appendix for further detail.

[15] Under Organic Law 4/2000 and Royal Decree 16//2012.

[16] Only 8 hospitalizations in Valencia had an unknown or wrong diagnostic coding (7 before the reform, 1 after the reform).

[17] In some instances, the region of residence is unknown. This is the case for those residing in Spain and lacking access to public healthcare when the law is enacted. Similarly, as noted by Chapaprieta and Pérez (2015), that would also be the case for individuals residing abroad, and for those seeking health care in a region other than the one in which they reside. Hence, hospitalizations among non-residents are underestimated.

[18] Some hospitals in Andalucía required direct payment for the procedures performed from non-residents, for example https://www.lavan-guardia.com/local/sevilla/20121107/54354259730/condenan-al-pago-de-2-265-euros-a-un-extranjero-por-la-asistencia-dada-en-el-hospital-costa-del-sol.html.

[19] Non-treated regions include Balearic Islands, Castilla-La Mancha, Madrid, Murcia, Ceuta, Melilla, and Castilla–León, Aragón, Asturias, Canary Islands, Cantabria, Cataluña, Extremadura, Galicia, and Basque Country.

[20] In robustness checks, we experiment with adding Andalucía, where informal reports are suggestive of a similar practice to the one followed by Valencia, to the treated group.

[21] The Mayor Diagnostic Category is a group of diagnostics which is divided in 25 groups plus an additional category that cannot be included in the previous one. Note that we do not report pregnant diagnostic category since we remove pregnant women from the analysis.

[22] The pre-MDC diagnosis includes transplants, tracheostomies, as well as wrong diagnoses, contributing to its higher-than-average costs.

[23] Unfortunately, we cannot distinguish elective from non-elective surgeries in our data.

[24] In 2019, the number of nurses and doctors in Valencia was 14,474 and 9462, respectively (see: https://www.mscbs.gob.es/estadEstudios/estadisticas/estHospiInternado/inforAnual/homeESCRI.htm

REFERENCES

Cameron, A. C., Gelbach, J. B., & Miller, D. L. (2008). Bootstrap-based improvements for inference with clustered errors. *The Review of Economics and Statistics*, *90*(3), 414–427.

Chapaprieta, A. G., & Pérez, E. M. (2015). El turismo sanitario en España: mitos y realidades. *Comunitania. Revista Internacional de Trabajo Social y Ciencias Sociales*, (9), 91–118.

de Cuentas, T. (2012). *Informe de fiscalización de la gestión de las prestaciones de asistencia sanitaria derivadas de la aplicación de los reglamentos comunitarios y convenios internacionales de la seguridad social* (Vol. 937).

Escuela de Organización Industrial, Spanish Ministry of Industry, Energy and tourism. (2013). *Turismo de salud en España*. Available at: https://turismo.gob.es/es-ES/Servicios/Documents/turismo_salud_espana.pdf

Flash Eurobarometer. (2007). Cross-border health services in the EU. *European Commission*.

Forgione, D., & Smith, P. (2007). Medical tourism and its impact on the US health care system. *Journal of Health Care Finance*, *34*(1), 27–35.

Guy, B. S., Nevins Henson, J. L., & Dotson, M. J. (2015). Characteristics of consumers likely and unlikely to participate in medical tourism. *International Journal of Healthcare Management*, *8*(2), 68–76.

Hanefeld, J., Smith, R., Horsfall, D., & Lunt, N. (2014). What do we know about medical tourism? A review of the literature with discussion of its implications for the UK national health service as an example of a public health care system. *Journal of Travel Medicine*, pp. 1195–1982.

Johnston, R., Crooks, V. A., Snyder, J., & Kingsbury, P. (2010). What is known about the effects of medical tourism in destination and departure countries? *A Scoping Review. International Journal for Equity in Health*, *9*(1), 24.

Lunt, N., & Carrera, P. (2010). Medical tourism: Assessing the evidence on treatment abroad. *Maturitas*, *66*, 27–32.

Lunt, N., & Carrera, P. (2011). Systematic review of web sites for prospective medical tourists. *Tourism Review*, *66*(1), 57–67.

Mathijsen, A. (2019). Home, sweet home? Understanding diasporic medical tourism behaviour. Exploratory research of polish immigrants in Belgium. *Tourism Management*, *72*, 373–385.

Mathijsen, A., & Mathijsen, F. P. (2020). Diasporic medical tourism: A scoping review of quantitative and qualitative evidence. *Globalization and Health*, *16*, 1–15.

Padilla-Melédez, A., & Del Águila Obra, A. R. (2016). Health tourism: Conceptual framework and insights from the case of a Spanish mature destination. *Tourism & Management Studies*, *12*(1), 86–96.

Ramírez de Arellano, A. B. (2007). Patients without borders: The emergence of medical tourism. *International Journal of Health Services*, *37*(1), 193–198.

Runnels, V., & Carrera, P. M. (2012). Why do patients engage in medical tourism? *Maturitas*, *73*, 300–304.

Woodman, J. (2020). *Patients without borders: Everybody's guide to affordable, world-class healthcare*. Publisher: Healthy Travel Media.

SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.