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The Impact of an Increase in User Costs on the Demand For Emergency Services: The Case of Portuguese Hospitals

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ABSTRACT

Evidence on the impact of user costs on healthcare demand in “universal” public National Health Service (NHS) systems is scarce. The changes in copayments and in the regulation of the provision of free patient transportation, introduced in early 2012 in Portugal, provide a natural experiment to evaluate that impact. However, those changes in user costs were accompanied with changes in the criteria that determine which patients are exempt from copayments, implying that changes to the underlying populations made simple comparisons of user rates meaningless.

The aim of this paper is to evaluate the impact of increases in direct and indirect user costs on the demand for emergency services (ES), in the context of changes to the underlying populations of exempt and non-exempt patients. Our contributions are twofold: we develop a new methodology for analyzing ES demand changes following user cost increases when the underlying population is not constant, and we measure the relative impact of copayments and distance costs on ES demand, in NHS-countries, with “almost free” access to healthcare.

Our results show that the increase in copayments did not have a significant effect in moderating ES demand by paying users. On the other hand, we find a significant effect of the change in transport regulation in the demand for ES, especially in the more general polyvalent ES and for older patients. Thus, our results support the conclusion that indirect costs may be more important than direct costs in determining healthcare demand in NHS-countries where copayments are small and wide exemption schemes are in place, especially for older patients.

Keywords: Copayments; Indirect costs; healthcare demand; National Health Service

JEL Classification: I110, I130, I1180

1. INTRODUCTION

In recent years accessing health care has become more expensive in Portugal, with increases both in direct and indirect costs. On January 1st, 2012, copayments for several health services provided by the Portuguese National Health Service (known in Portugal as "moderating fees" - "*taxas moderadoras*") were significantly increased. For emergency services (ES), copayments were increased between 75% and 108%, depending on the classification (degree of complexity) of the ES: copayments for Basic ES visits were established at €15 (an increase of 75%), copayments for Medical-Surgical ES visits were established at €17.5 (an increase of 103%) and copayments for Polyvalent ES visits were established at €20 (an increase of 108%). At the same time, there was a significant increase in the number of patients that are exempt of copayments, due to changes in the copayments' exemption eligibility criteria, in particular an increase in the income threshold that determines the exemption for economic reasons and a new payment requirement for chronic patients for ES visits unrelated with their chronic disease. (Barros, 2012)

The increase in other access costs is somewhat more difficult to pinpoint, but there is some evidence that transportation costs have increased towards the end of 2011. Public transport ticket prices increased on February 1st, 2012, (5% on average), fuel prices increased during the last months of 2011 and the first months of 2012 (BdP, 2012) and, more importantly, new regulations restricted access to subsidized transport for patients. A new regulation for the transportation of non-emergent patients to and from health services, namely ES, was signed in May 2011, yet a legal transition period of 90 days was required and the Regional Health Administrations had to adapt to the new *modus operandi*. This meant that only towards the end of 2011 were these changes implemented at the hospital level and patients were *de facto* affected by a reduction in the number of subsidized transportation authorizations to ES for non-emergent patients.

There is a large literature on the effects of user costs on the demand for healthcare services (for copayments see, for instance, O'Grady et al. (1985); Selby et al. (1996); Hsu et al. (2006); Lowe et al. (2010); and for other access costs see, for instance, Acton (1975); Dor et al.(1987); Puig-Junoy et al.(1998)), but most of it refers to systems where health insurance is voluntary. There is less evidence of the impact of user costs on ES use in countries where insurance is compulsory and the copayments are usually small, such is the case of Portugal. Although copayments for health services in Portugal, namely ES, have been introduced over two decades ago, ES overcrowding subsists and we are unaware of any study which estimated the impact of this cost-sharing practice in the demand for these health services in the Portuguese National Health Service.

The aim of this paper is to evaluate the effect of these policies that increased user costs – both co-payments and transportation costs - on the demand for ES in Portugal, in the context of a change in the eligibility criteria for copayment exemption.

We exploit the impact of this increase in patients' costs on the demand for ES using a *difference-in-difference* (DD) framework. Consider the increase in co-payments: the idea is that even though we may observe a decrease in demand among patients that were not exempt from co-payments during 2012 (after the increase in co-payments) relative to 2011 (before the increase), this could be due to unobserved time-varying factors unrelated to the policy of increasing co-payment that may have affected demand for ES. However, if that was the case, then we should observe a similar behavior for patients that were exempt from co-payment. The rationale for the transportation policy is the same, but considering patients who live at the minimum distance to the ES and who therefore do not have distance costs. In spirit, our approach is similar to standard DD; the innovative approach of our empirical strategy lies in our design of the *logit* model: we strengthen our estimates by studying only visits that should be price-sensitive and, by comparing with visits that should not, we account for the variations in the underlying population (the changes in the criteria for being exempt from co-payment).

Our paper's contributions are therefore twofold, methodological and policy-oriented: first, we develop a methodology for analyzing ES demand following price increases when the underlying population is not constant; second, we measure the relative impact of copayments and distance costs on ES demand, in special economic circumstances, like those experienced in Portugal in 2012 when the country was under a financial assistance adjustment program.

The rest of the paper is organized as follows. In section 2 we provide some context on the literature on demand for emergency services and user costs, and on the emergency services in Portugal. In section 3 we explain the methodology we used. Section 4 presents the main results from the estimation of our model, while section 5 is dedicated to the discussion of these main findings and of the limitations of our study. Section 6 concludes.

2. CONTEXT

Classic Health Economics papers on cost-sharing have presented demand prices as a *tradeoff between moral hazard and risk avoidance.* (Arrow, 1963; Pauly, 1968) Under perfect information, and in the absence of insurance, the quantity of medical care purchased will be the one that equals the marginal benefit and the marginal cost of healthcare. In the presence of strictly negative price-elasticity of demand for healthcare, full insurance decreases the opportunity cost of purchasing medical care, and generates inefficiency due to overuse of healthcare services. Therefore, the decision of purchasing insurance – and overusing the service - or risking medical expenses will be dependent on the premium asked, according to the consumer's behavior. (Manning and Marquis, 1996, 2001)

With partial data from the milestone RAND Health Insurance Experiment, O'Grady et al.(1985) studied this effect of different insurance cost-sharing, specifically in the demand for ES. The authors found that the expenditure in ES visits for individuals with the highest cost-sharing plan was 30% below the expenditure for individuals in the plan with no cost sharing. Selby et al. (1996) also studying the impact of cost-sharing in ES demand, reported a decrease of 14,6% in demand in the group which was subject to copayments, in comparison with two control groups that did not have such copayment. More recently, Hsu et al. (2006) also reported that ES demand for patients insured by Kaiser Permanente–Northern California fell 23% with the implementation of a 50-100USD copayment and Lowe et al. (2010) found a reduction of 18% on casemix-adjusted utilization rates following the implementation of a 50USD copayment with the Oregon Health Plan.

However, in a National Health System funded by taxation, the compulsory existence of a public insurance undermines the trade-off between the decision of purchasing insurance – and overusing the service - or risking medical expenses. Patients whose insurance premium (the taxes they pay) would be higher than the marginal benefits would choose to risk (forgo healthcare insurance), yet cannot do it. Therefore, cost-sharing is needed to reduce the welfare loss due to the overutilization of healthcare services. In France, Chiappori et al. (1998) estimated the effect of an increase of coinsurance on the demand for physician services and concluded that general practitioner (GP) home visits are significantly affected by the copayment level, while GP office visits are not. Cockx and Brasseur (2003) also found that an increase in copayments for GP and specialist visits in Belgium was associated with a decrease in demand for these services, as did Winkelmann (2004) for Germany. Evidence for NHS-based countries is scarcer, since direct out-of-pocket expenditure on the access to health services is usually of marginal importance, especially considering the existence of broad exemption mechanisms.

In this context, other access costs may become important determinants of health care demand in these countries. Studying the impact of other access factors on the demand for medical services, Acton (1975) found that when “free” care is guaranteed, travel time (e.g. distance) becomes a very important behavior modulator on the demand for medical care, approximately as strong as the price itself, i.e., distance-elasticities were very close to – or even higher than – the previously estimated price-elasticities (-0.958 for outpatient care and -0.252 for private doctors’ visits), a phenomenon described as “distance decay”. Interestingly, in a study on the emergency care demand factors in Spain (in the context of a National Health Service “free” at the point of delivery), Puig-Junoy et al. (1998) also found that demand was sensitive both to travel and waiting time, yet more sensitive for low and middle income groups than for high income, a pattern also found in developing countries (Dor et al., 1987).

Drug abuse treatment provides a particularly good context for studying the effect of indirect costs of seeking care, since direct costs are usually fully covered. Borisova and Goodman (2004) found that time is a rationing instrument as powerful as money for methadone maintenance clients.

In Portugal, to our knowledge, only Santana (1996) studied the effect of distance on the demand for hospital (outpatient and emergency) care. The author reported similar “distance decay” findings to the ones found in previous literature, i.e., the increase in distance to the hospital led to lower demand for care.

3. METHODOLOGY

3.1. MODEL

The objective of this paper is to test three hypotheses:

H1: The increase in copayments had a negative impact on the demand for emergency services;

H2: The change in transportation costs had a negative impact on the demand for emergency services;

H3: The impact of user costs on the demand for emergency services differs across ES types.

The main difficulty in testing these hypotheses, in particular H1, arises from the fact that one may not compare ES utilization rates, since the underlying populations are not constant throughout the period of our study. The increase in copayments will not affect the demand for emergency services of patients that are exempt from those copayments, but the exemption criteria changed at the same time that copayments increased, increasing the number of copayment exempt population. Since the copayment exempt and non-exempt populations are not constant throughout the period of our study, and these underlying populations cannot be identified at the hospital level on the basis of available data, comparing utilization rates before and after the copayment increase would be meaningless.

The innovative approach of our methodology relies on the assumption that the ES user cost-elasticity of demand for high-severity visits is significantly lower than the ES user cost-elasticity of demand for low-severity visits. We assume that high-severity visits will not be affected by user cost changes since their level of severity places the reservation price far above the user costs (distance costs are virtually irrelevant since ambulance transportation is available for emergent patients), whilst low-severity visits may be affected by a change on those costs. This assumption is in line with Duarte (2012) who, on a paper on the price-elasticity of expenditure across Chilean health services, found demand elasticities very close to zero on acute services, namely appendectomies, cholecystectomies and arm casts.

Since high-severity visits are not affected by user cost changes, but low-severity visits may be,[1] if the increase in user costs has an impact on the demand for ES it will necessarily be reflected

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[1] Notice that our methodology is still valid even if high-severity visits are affected by user cost changes, as long as the effect of user cost changes on ES demand for high-severity visits is significantly lower than the effect on low-severity visits.

in a reduction of the proportion of low-severity visits relative to high-severity visits. This implies that our hypothesis may be tested by analyzing the evolution of the ratio of low-severity visits to high-severity visits, a methodology that bypasses the difficulties in measuring changes in the copayment exempt and non-exempt populations. Furthermore, this methodology has two additional advantages: first, it directly evaluates one of the stated objectives of the copayment increase policy, which was to steer low-severity demand away from ES; second, it is not affected by any other changes to the health-system that could have affected overall demand for ES in the hospitals in our sample (e.g. changes in the referral network), as long as they do not change the low-severity / high-severity mix.

High-severity visits were defined as those that were classified as “orange” (very urgent) or “red” (emergency) by the Manchester triage color system used in all three ES, while low-severity visits correspond to those classified as “green” (standard) or “blue” (non-urgent).[2] Few economic papers rely on the Manchester Triage (or other clinical priority triages) for studying ES demand, even though that is probably one of the best ways of measuring the patients’ health status at the moment of seeking care. Since increases in ES copayments are often accompanied by a modification on copayment exemption criteria, we argue that this is the best strategy for studying ES demand when the characteristics of the underlying population are not constant. To our knowledge, we are the first to use this approach for studying the impact of a copayment increase in ES.

The impact of the changes in user-costs on the low-severity visits / high-severity visits ratio is assessed using a *difference-in-differences* (DD) approach, taking advantage of the fact that some specific subpopulations were not affected by the changes in H1 and H2: the increase in copayments did not affect copayment exempt patients (H1), and the increase in transportation

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[2] For a detailed explanation of the Manchester Triage system see Manchester Triage Group (1996). Patients with a “yellow” color code were excluded from our analysis, since these patients’ severity is classified as intermediate. Given that our methodology is based on the differences of user cost-elasticities between different color groups, and that the differences between patients in the “yellow” group and patients classified with other colors are likely to be less pronounced than differences between patients in the extreme groups, the inclusion of “yellow” patients would introduce noise to the estimation and make the results less clear. Nevertheless, in Annex 4 we present a robustness analysis where the effect of introducing “yellow” visits is analyzed. For similar reasons, we also excluded visits classified as “white”. This a group introduced in Portugal for special patients – usually patients who had a formal indication from their discharge doctor to return to the ES in the following days for a re-evaluation – whose user cost-elasticity is difficult to assess.

costs should have an insignificant impact on patients that live close (at the minimum distance) to the hospital (H2).[3]

Our measure of the ES demand is Y, a binary variable such that,

$$Y = \begin{cases} 1, & if\ Low - Severity\ Visit \\ 0, & if\ High - Severity\ Visit \end{cases}$$

A general model to capture the effect of the increase in user costs (H1 and H2), is as follows:

$$Y = \beta_0 + \beta_1 T + \beta_2 CP + \beta_3 D + \beta_4 T * CP + \beta_5 D * CP + \beta_6 T * D + \beta_7 D * T * CP + \beta_x X \quad (1)$$

where T is a dummy variable which equals 1 if the ES visit was made in 2012 and 0 if it was made in 2011 and is expected to capture any aggregate factors that cause changes in ES demand over time; CP is a dummy variable which equals 1 if the ES visit was made by a patient that ought to pay the copayment and 0 if the visit was made by an exempt patient and captures the differences in ES demand between exempt and non-exempt populations before the user costs increased; and D is a continuous variable that represents the natural logarithm of the distance (shortest route in kilometers) between the center of the municipality (home address) registered in each patient's visit and the ES, and shows the effect of the distance for exempt patients prior to the increase in user costs. The interaction term $T*CP$ measures the impact of the increase in copayments, since it measures the incremental difference in ES demand between exempt and non-exempt patients after the policy change. The interaction term $D*CP$ measures the difference in the effect of distance in ES demand for non-exempt patients (relative to exempt patients). The interaction terms $T*D$ and $T*CP*D$ capture the impact of the change in transportation costs both for co-payment exempt and non-exempt patients, respectively. Notice that (low) economic status is a necessary yet not sufficient condition for free home transport eligibility (i.e. even though exemption from co-payment is not a guarantee of eligibility for free home transport, confirmation of economic hardship is a pre-requisite for being eligible). Therefore, we allowed the effects to differ according to exemption status. X is a set of independent variables relevant for the explanation of ES demand differences.

These include the sex of the patient, his/her age at admission (in years), the month of visit (to

[3] Note that patients who are bedridden have free transportation, even after the changes in the transportation regulation.

account for seasonality effects), the date (week vs. weekend) and time (night vs. day) of admission, the type of visit (psychiatric, ophthalmologic or other),[4] patient subsystem (NHS, public subsystems, private subsystems, private insurance or others)[5], patient provenience (no referral, Primary Healthcare Network referral, public hospitals transference or private hospitals transference)[6], and a categorical variable "ES Level" (coded as two dummy variables representing the 3 levels of care in Portuguese ES).

Finally, for testing hypothesis 3, we re-estimated eq. (1) separately for each ES (see below). Remember that the copayments were increased from different baseline levels and to different targets according to the specialization of the ES. Moreover, distance costs are arguably higher for central academic hospitals than for smaller rural hospitals.

Since Y is a binary variable, we used a logistic regression model of the type:

$$\mathcal{L}n\left(\frac{\pi}{1-\pi}\right) = \mathcal{L}n\left(\frac{Prob_{Low-Severity\ Visits}}{Prob_{High-Severity\ Visits}}\right) = \beta\ Z \qquad (2)$$

STATA Ver.12© was used to estimate the multivariate model. ArcGIS (v.10.0, Environmental Systems Research Institute, Redlands, CA) was used to compute distances using patients' geographical information.

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[4] There is substantial evidence that the elasticity of demand differs across specific types of health services, namely eye care and mental health care (Lu et al., 2008; Nahata et al., 2005; Simon et al., 1996), which seem to be more price-sensitive.

[5] In the Portuguese Health System, in addition to the universal NHS, some patients have a supplemental coverage that grants them access to additional services in the private sector. Some have quasi-mandatory supplementary health insurance related to their professional activity – the "subsystems". Others have voluntary private insurance. "Subsystems" are provided for public sector workers, with different schemes for general public sector employees and for the army and the police (public subsystems), and for some specific private sector workers (especially banking employees, and some other big companies). There is some evidence that these patients who have additional coverage have a differential use of health services, compared with patients only covered by the NHS. (Barros et al., 2008; Lourenço, 2003)

[6] The Portuguese Health System has an ES "open door" policy, so the vast majority of patients that reach the ES do not have any referral. Beginning in 2012, patients referred by the primary health care network are exempt from copayment in the ES. Patients transferred by public hospitals are also exempt from copayment in the destination ES.

3.2. DATA

In this paper, we used ES visits electronic data from three Portuguese NHS hospitals, all belonging to the same referral network. The three hospitals are representative of each of the three types of ES found in Portuguese NHS hospitals: basic ES, medical-surgical ES and polyvalent ES. The polyvalent emergency services are those that receive the most complex patients. Basic emergency services receive only patients with simple cases. Medical-surgical emergency services are at an intermediate level, receiving cases with some complexity, but referring the most complex ones to polyvalent emergency services. The differences in the complexity of the cases treated in each type of ES translate into differences in the value of the copayments ("*taxas moderadoras*"): in 2012, the copayment for a basic ES visits was €15, while copayments for medical-surgical ES visits and polyvalent ES visits were €17.5 and €20 (respectively).

The *Hospital de São João* (HSJ) is the largest academic hospital in the North of Portugal. Its polyvalent ES has an average volume of 150,000 annual visits and is at the top of the referral network for 41 of the 86 municipalities in the North of the country, covering a population of about 1.7 million. The other two are smaller proximity hospitals, which together serve a population of about 250,000. *Hospital Conde de São Bento* in Santo Tirso (HSTS) has a basic ES, and *Hospital São João de Deus* in Famalicão (HVNF) has a medical-surgical ES. The three ES included in our sample account for almost 10% of the ES visits in Portugal, especially due to HSJ which is one of the hospitals with the highest ES volume in the country.

We crossed administrative (SONHO database) and clinical (ALERT® database)[7] data from the three hospitals for a period of 6 months (January to June, 2011) before the changes in user costs and an equal period after the change (January to June, 2012). We chose to compare the demand between the 1st semester of both years since ES demand is highly seasonal, and that could lead to biases in our analysis. We limited our analysis to the General Adult ES, thus excluding ES visits by patients aged below 18 years old, since evidence on children's price-elasticity of demand for medical care is mixed (Becker et al., 2013; Colle and Grossman, 1978), and ES visits made by pregnant women since the Manchester Triage is not implemented in the

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[7] SONHO database is an administrative database where the patient's exemption status, patient's health subsystem, and patient's origin within the Health System are recorded. ALERT database is a clinical database where the patient's Manchester Triage classification, among other clinical information related to the ES visit, is recorded. Considering the design of our study, we required the matching of these databases, which was done through the ID visit identifier, common for both databases (primary key).

Obstetrics and Gynecology ES. Furthermore, we did not consider visits with informal exemption criteria (e.g. exemption to hospital workers, exemption decided by the Hospital Administration or exemption due to patient's drop-out), visits with exemptions which are not "intrinsic" to the individual (i.e., the patient is not exempt at the moment of seeking care) such as patients transferred and/or hospitalized, and visits made by victims of domestic violence. Arguably, in neither of these cases do economic incentives apply.

Lastly, for estimating distance costs we measured the distance from the patient's residence, as stated in the address registered in the SONHO database, to the hospital. This meant that we had to exclude all visits from patients with an address outside the Northern Region, because these patients did not travel from their registered addresses to the ES. These were either patients that became sick while travelling in the North of Portugal, or patients that have moved to the North and have not changed their former address. In either case, the distance costs they had to incur on were not the ones related to their registered address, so we have excluded them from this sub-analysis.

Table 1 presents some descriptive statistics of the data, according to ES type and degree of severity. In the three ES there was an important decrease in the number of visits in 2012, relative to 2011, even though this decrease was much higher in the basic ES than in the medical-surgical ES. Moreover, ES visits decreased in 2012 for both groups of visit severity, classified according to the Manchester Triage. Yet, that decrease was substantially higher in the low-severity visits. Considering the copayment exemption status, ES visits decreased for non-copayment exempt patients and decreased for co-payment exempt patients, except in the polyvalent ES.

Table 1: ES visits according with Manchester Triage and Exemption Status

	2011			2012		
	Polyvalent ES	Medical-Surgical ES	Basic ES	Polyvalent ES	Medical-Surgical ES	Basic ES
NUMBER OF VISITS (YoY)	83,589	29,121	13,052	75,451 (-9.7%)	27,424 (-5.8%)	11,082 (-15.1%)
VISITS ACCORDING TO MANCHESTER TRIAGE						
LOW SEVERITY VISITS:	26,998	7,284	5,390	24,854 (-7.9%)	6,312 (-13.2%)	4,015 (-25.5%)
COPAYMENT EXEMPT	15,779	3,640	3,024	13,002 (-17.6%)	3,861 (+6.1%)	2,597 (-14.1%)
NON-COPAYMENT EXEMPT	11,219	3,644	2,366	1,185 (+5.6%)	2,451 (-32.7%)	1,418 (-40.1%)
HIGH SEVERITY VISITS:	10,787	3,688	1,508	9,943 (-7.8%)	3,479 (-5.7%)	1,514 (+0.5%)
COPAYMENT EXEMPT	7,280	2,315	1,117	6,789 (-6.7%)	2,517 (+8.7%)	1,211 (+8.4%)
NON-COPAYMENT EXEMPT	3,507	1,373	391	3,154 (-10.1%)	962 (-29.9%)	303 (-22.5%)

4. RESULTS

4.1. GENERAL MODEL

Table 2 reports the estimated coefficients of interest ($\beta_1 - \beta_7$) from the model in equation 1 (full results are presented in annex 1). The estimated coefficients for the control variables not presented here have the expected sign: low-severity demand is significantly more frequent for females, younger individuals, ophthalmologic patients, patients referred by the primary healthcare network, patients who don't have double coverage (NHS-only users) and patients who visit the ES during the day and during the week. Also, there are significant monthly seasonal effects.

Table 2: Logit estimation of the general model – main coefficients

Variable (coefficient)	Estimated coefficients (standard errors)
Year 2012 (T) (β_1)	0.025 (0.052)
Exemption Status (CP) Non-Exempt (β_2)	0.072 (0.056)
Distance (D) (β_3)	- 0.017 (0.016)
T*CP (β_4)	0.164 (0.083) **
D*CP (β_5)	- 0.013 (0.025)
D*T (β_6)	0.039 (0.024)
D*T*CP (β_7)	-0.033 (0.037)
N	95034
Pseudo R^2	0.1118

** significant at the 5% level.

None of the estimated coefficients in table 2 are significant, with the exception of a significant, but counter intuitive, positive effect of the copayment increase in ES demand. However, this last result is not necessarily an anomaly, since logit coefficients of interaction terms do not have a straightforward interpretation in the odds metric. It is more meaningful to use marginal effects, which we do in Table 3. Note that the odds metric in table 2 give multiplicative effects relative to the baseline odds in each category of the variable, while the marginal effects in table 3 present the effect in an additive scale, so for some estimates the results may yield different magnitudes and statistical significance.

Table 3 presents the average marginal effects of the change from 2011 to 2012, from the logit model with coefficients transformed into semi-elasticities, according to copayment exemption status and distance. The table also presents the difference-in-difference (DD) estimator (equal to the difference in the marginal effects) and the results of the chi-square tests of the null hypothesis that the DD estimator is zero (i.e., both marginal effects are equal).

Table 3 shows that the marginal effects for the different categories are significant at the 1% level, i.e. that there was a significant change in demand for ES between 2011 and 2012.

However, the DD estimators are not significantly different from zero, meaning that the change in demand is not significantly different for the different categories of patients considered. If the increase in copayments had a significant effect in ES demand, one should observe significantly different demand changes between copayment exempt and non-exempt patients, since the former are not affected by the copayment increase. Similar results should emerge for distance: if the increase in transportation costs had a significant effect on ES demand, that effect would be reflected in significant differences in the marginal effects for patients that live at the minimum distance and patients that live at the mean distance, which are not present in our data. Thus, one could conclude from the general model that neither the increase in copayments nor the change in transportations costs had a significant effect in ES demand.

Table 3: Tests of differences in marginal effects (2012-2011)

	Marginal effects [ey/dx] (standard errors)	
2012-2011: Copayment exemption status		
Exempt	0.045 (0.006) ***	
Non-exempt	0.034 (0.006) ***	
DD estimator	0.011 (0.009)	
χ^2	1.74	
N	95068	
2012-2011: Distance	**Non Exempt**	**Exempt**
Minimum distance	0.040 (0.015)***	0.005 (0.018)
Mean distance	0.045 (0.006)***	0.034 (0.006)***
DD estimator	0.004 (0.014)	0.029 (0.017)
χ^2	0.03	2.73
Joint χ^2 for distance effects change	2.76	
LR test (for the 4 interaction terms) *(*χ^2)	14.05**	
N	41526	53542

** significant at the 5% level; *** significant at the 1% level.

4.2. MODEL BY EMERGENCY SERVICE LEVEL

The results in Annex 1 indicate that there are significant differences in ES demand according to ES level. In this section, we extend those results by estimating different models for each ES level. The results for the main coefficients are presented in table 4, where one can identify three or four significant coefficients in each regression, while in the general model only one coefficient was significant.

The average marginal effects of the change from 2011 to 2012, from the logit model with coefficients transformed into semi-elasticities, according to copayment exemption status and distance, for each ES level are presented in Table 5. The marginal effect of the increase in the copayment is not significant in all three ES levels, confirming that this policy change did not cause a significant decrease of access to ES. However, one is able to find significant effects of the patient transportation policy change for the polyvalent ES. The increase in the probability of low-severity patients that is found in our data was significantly lower, at the 10% level, for patients that lived at the mean distance than for patients that lived at the minimum distance, i.e. low severity visits are less common for patients that live far from the hospital and to whom transportation costs may be relevant.

Table 4: Logit estimation of the models by ES level – main coefficients

Variable (coefficient)	Estimated coefficients (standard errors)		
	POLYVALENT ES	MEDICAL-SURGICAL ES	BASIC ES
Year 2012 (T) (β_1)	0.141 (0.073) *	0.207 (0.107)*	-0.250 (0.105) **
Exemption Status (CP) Non-Exempt (β_2)	-0.061 (0.076)	-0.055 (0.111)	0.457 (0.134) ***
Distance (D) (β_3)	-0.054 (0.021) **	0.005 (0.036)	0.116 (0.037) **
T*CP (β_4)	0.341 (0.110) ***	-0.328 (0.167)*	-0.140 (0.194)
D*CP (β_5)	0.032 (0.033)	0.031 (0.053)	- 0.129 (0.065)**
D*T (β_6)	0.020 (0.032)	-0.081 (0.051)	0.057 (0.052)
D*T*CP (β_7)	-0.094 (0.045) **	0.155 (0.079)*	0.096 (0.097)
N	63300	19950	11814
Pseudo R^2	0.1131	0.1071	0.1322

* p<10%. ** p< 5%.*** p< 1%. The table presents only the coefficients of interest. Full results are presented in Annex 2.

For the basic ES, there is also a significantly different effect of the distance between 2011 and 2012. However, in this case there was decrease in the probability of low severity visits, which was significantly lower (at the 10% level) for patients living farther away from the hospital.

Table 5a: Tests of differences in marginal effects (2012-2011): polyvalent ES

	Marginal effects [ey/dx] (standard errors)	
2012-2011: Copayment exemption status		
Exempt	0.071 (0.007) ***	
Non-exempt	0.057 (0.008) ***	
DD estimator	0.014 (0.010)	
χ^2	1.98	
2012-2011: Distance	**Exempt**	**Non Exempt**
Minimum distance	0.046 (0.016)**	0.090 (0.013)***
Mean distance	0.057 (0.008)***	0.071 (0.007)***
DD estimator	0.011 (0.014)	-0.019 (0.011) *
χ^2	0.41	4.27**
Joint χ^2 for distance effects change	4.68*	
LR test (for the 4 interaction terms) (χ^2)	17.13**	
N	34615	28685

** significant at the 5% level; *** significant at the 1% level.

Table 5b: Tests of differences in marginal effects (2012-2011): medical-surgical ES

	Marginal effects [ey/dx] (standard errors)	
2012-2011: Copayment exemption status		
Exempt	0.004 (0.015)	
Non-exempt	0.018 (0.016)	
DD estimator	-0.013 (0.022)	
χ^2	0.38	
2012-2011: Distance	**Exempt**	**Non Exempt**
Minimum distance	0.071 (0.036)	-0.031 (0.035)
Mean distance	0.018 (0.016)	0.005 (0.015)
DD estimator	-0.052 (0.033)	0.037 (0.031)
χ^2	2.61	1.44
Joint χ^2 for distance effects change	4.04	
LR test (for the 4 interaction terms) *(*χ^2)	11.04**	
N	11572	8378

** significant at the 5% level; *** significant at the 1% level.

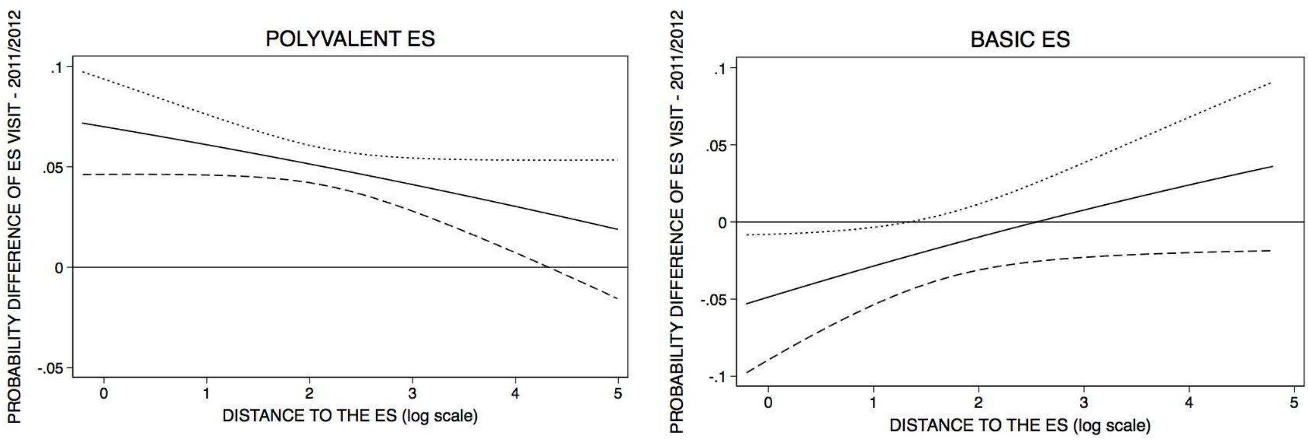
Table 5c: Tests of differences in marginal effects (2012-2011): basic ES

	Marginal effects [ey/dx] (standard errors)	
2012-2011: Copayment exemption status		
Exempt	-0.021 (0.014)	
Non-exempt	-0.045 (0.016)**	
DD estimator	0.023 (0.021)	
χ^2	1.21	
2012-2011: Distance	**Exempt**	**Non Exempt**
Minimum distance	-0.089 (0.039)**	-0.072 (0.031) **
Mean distance	-0.043 (0.016)**	-0.018 (0.014)
DD estimator	0.046 (0.035)	0.054 (0.029)*
χ^2	1.20	3.52*
Joint χ^2 for distance effects change	4.71*	
LR test (for the 4 interaction terms) *(*χ^2)	8.55**	
N	7354	4460

* significant at the 10% level; ** significant at the 5% level; *** significant at the 1% level.

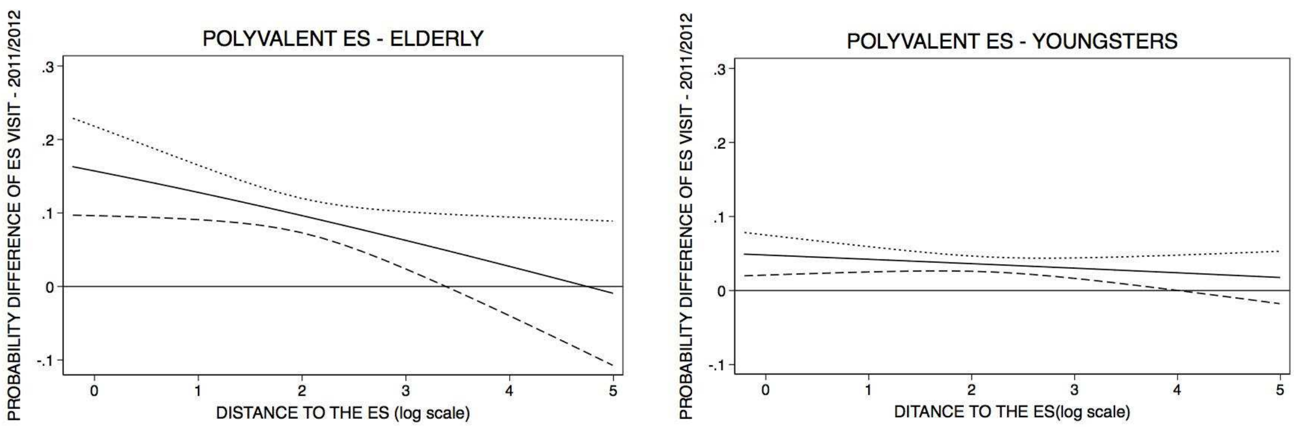
The effects of the distance on ES demand are easier to observe in Figure 1, which presents the increase in the probability of low-severity patients from 2011 to 2012, for the polyvalent ES and the basic ES, and highlights the different effect of the distance (measured in Km, log scale). Dotted lines show two standard deviations intervals.

Figure 1: Difference in ES demand between 2011 and 2012 (variation with distance)



Finally, we re-estimate these findings of an effect of the transportation policy in the Polyvalent ES considering only elder patients - older than 60 (marginal effects in annex). Arguably, elder patients are the ones who are the most affected by transport regulations: they use ES intensively and have less mobility. We found that for the elderly the DD coefficient for the effect of the transportation policy is larger (-0.066), i.e., compared with patients that lived at the minimum distance, low-severity visits were 6.6% less frequent among patients that lived at the mean distance from the ES, between 2011 and 2012. Figure 2 clearly shows this intensification of the distance effect for the elderly.

Figure 2: Difference in ES demand between 2011 and 2012 (variation with distance) – elderly and youngsters



5. DISCUSSION

The results in the previous section present no evidence that the increase in copayments had any significant moderation effect on ES demand. This may seem to be in contradiction with the results of the milestone RAND Health Insurance Experiment (RHIE), where it was found that higher cost-sharing led to lower ES use, with a more pronounced effect on reducing "less urgent" ES visits (O'Grady et al., 1985). However, one should take into consideration that copayments in Portugal are fixed amounts (whereas in the RHIE copayments were a percentage of total expenditure), that all low income patients are exempt of the copayment, and that even after the increase, copayments are not very high (for example, the higher €20 copayment for polyvalent ES represents only 3.2% of the lowest monthly wage a patient may have and not be eligible for copayment exemption).

As such, we conciliate the RHIE findings with ours by hypothesizing that copayment amounts were still established lower than the patients' reservation price, not allowing for an effective ES demand moderation. Especially in highly specialized ESs, such a small increase in copayments induces an insignificant relative change in the ES total cost for these patients, too small to encourage any observable change in demand, i.e., at these copayment levels, emergency care is virtually inelastic. Actually, Selby et al. (1996) had already found no differences in demand among patients who were required different cost-sharing fees (25 USD vs. 35 USD) for ES visits. Our findings are also in line with some previous work that indicated that copayments had no effect in moderating ES demand in Portugal (Pereira et al. 1997), nor did their recent increase (Barros et al., 2013; Canedo, 2012).

In addition to the copayment change, we studied the effect on the demand for ES of a transportation regulation change that increased transportation costs, at least for some patients. Our study found that in the polyvalent ES, there was a significant difference in the *"distance decay effect"* in the ES demand by non-exempt patients, between the two years. In other words, after the regulation change, compared to the period before, low severity demand reduced more with the increase in distance. Moreover, when we studied a population that is more vulnerable to distances – the elderly – we found a higher distance effect in the Polyvalent ES.

When copayments are small, as it is the case in Portugal (as we argued above), indirect costs may become a dominant demand modulator (Acton, 1975; Puig-Junoy et al., 1998). For

Portugal, Lourenco and Ferreira (2005), under the same assumption that direct costs are not relevant in the Portuguese NHS, had already shown the importance of other costs – in their case the opportunity-cost of time – in determining demand for GP doctors in Portugal.

The change in the Emergency Service Non-Urgent Transport Regulation - RGATNU (2011) -, which hardened the criteria for being eligible for free home ambulance transportation, increased distance costs associated with an ES visit for some patients. In the *Centro Hospitalar São João*, for instance, administrative services reported a decrease of 12% in the number of transport documents (authorizing free transportation) issued in their polyvalent ES. Unlike the other ES levels, in the Basic ES we found a positive effect of the distance on the demand for ES between the two years, i.e., the decrease on the demand occurred for patients who lived closer to the ES. We hypothesize that the increase in distance costs made some of the patients who live at intermediate distances shift their demand away from central polyvalent ESs towards proximity basic ESs, where distance costs and copayment fees are lowest.

One final finding that is drawn from our study is related with the Basic ES, where we found a large decrease in demand irrespective of the payment status and/or the distance to the ES. Given that Basic ESs have less staff (usually there is only one doctor and two nurses) and have little access to lab and imaging tests (they have only x-ray and elementary lab tests), patients may perceive that there is not much difference between care in a Basic ES and care in the primary care health centre. Any improvement to the primary care network in the region could also be reflected in a sharp decrease in low-severity demand in this Basic ES. Moreover, this particular Basic ES had already been proposed for closing in a widely publicized Report that studied the Emergency Services' Network (CRRNEU, 2012) and is relatively close to more differentiated ES.

6. CONCLUSION

In this study, we have examined the effect of an increase in user costs on the demand for Emergency Services (ES) in Portugal, determined by two different yet simultaneous changes in user costs: an increase in copayments charged for access to ES and changes in the rules of access to subsidized transportation that increased transportation costs for some patients.

We introduce a new design for studying user cost increases when the characteristics of the population are not constant, namely because of changes to the copayments' exemption criteria. We use a difference-in-difference estimator, using as control groups two groups that are arguably not affected by these policies: first, the copayment exempt population, which is not affected by the copayment increase, and which has increased due to changes in the exemption criteria; second, the patients who live very close to the ES (at the minimum distance), which are unaffected by changes in transportation costs.

Our results show that the increase in copayments did not have a significant effect in moderating ES demand by paying users, implying that small copayments such as the ones introduced in Portugal are hardly effective in their explicit goal of reducing ES overcrowding and redirecting low-severity demand towards primary health care. Conversely, we found a significant effect of the change in transport regulation in the demand for ES, especially in the more central polyvalent ES and for older patients. Thus, our study adds on the existing evidence that indirect costs may be more important than direct costs in determining healthcare demand in NHS-countries where copayments are small and wide exemption schemes are in place, especially for older patients. Health policies that attempt to guarantee universal access should be mindful of these findings.

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ANNEXES

Annex 1: Estimated coefficients for the full logit model – general model

Model Increase in User Costs	Coefficient (SE)
2012 (T)	0.025 (0.052)
$NonExempt$ (CP)	0.072 (0.056)
$Distance$ (D)	-0.017 (0.016)
2012 $* NonExempt$ $(T*CP)$	0.164 (0.083)**
2012 $* Distance$ $(T*D)$	0.039 (0.024)
$NonExempt * Distance$ $(CP*D)$	-0.013 (0.025)
2012 $* NonExempt * Distance$ $(T*C*D)$	-0.033 (0.037)
$Level\_MedSur$	-0.299 (0.019)***
$Level\_Basic$	0.340 (0.025)***
$Month\_February$	0.022 (0.026)
$Month\_March$	0.106 (0.026)***
$Month\_April$	0.247 (0.027)***
$Month\_May$	0.219 (0.026)***
$Month\_June$	0.0328 (0.027)***
$Visit\_Weekend$	-0.050 (0.017)***
$Visit\_Night$	-0.652 (0.018)***
$Type\_Psychiatric$	-0.860 (0.057)***
$Type\_Ophthalmologic$	1.442 (0.035)***
$Subsystem\_Public$	-0.248 (0.036)***
$Subsystem\_Private$	-0.044(0.213)
$Subsystem\_VHI$	-0.580 (0.050)***
$Subsystem\_Others$	-0.009(0.090)
$Provenience\_PHC$	0.086 (0.049)*
$Provenience\_PrivateTransferred$	-0.863 (0.050)***
$Provenience\_Others$	-0.267 (0.355)
Age	0.007 (0.002)***
$Age2$	-0.001 (0.000)***
Sex_Female	0.289 (0.016)***
N	95034
Pseudo R2	0.1118

Notes: Estimates of the *logit* regression. Robust standard errors are shown in parentheses.
* p<10%. ** p< 5%.*** p< 1%.

Annex 2: Estimated coefficients for the full logit model – model by ES level

Model	**Coefficient (SE)**		
	Polyvalent ES	**Medical Surgical ES**	**Basic ES**
2012 (*T*)	0.141 (0.073) *	0.207 (0.107)*	-0.250 (0.105) **
NonExempt (CP)	-0.061 (0.076)	-0.055 (0.111)	0.457 (0.134) ***
Distance (D)	-0.054 (0.021) **	0.005 (0.036)	0.116 (0.037) **
2012 * *NonExempt (T*CP)*	0.341 (0.110) ***	-0.328 (0.167)*	-0.140 (0.194)
2012 * *Distance (T*D)*	0.032 (0.033)	0.031 (0.053)	- 0.129 (0.065)**
NonExempt * Distance (CP*D)	0.020 (0.032)	-0.081 (0.051)	0.057 (0.052)
2012 * *NonExempt * Distance (T*C*D)*	-0.094 (0.045) **	0.155 (0.079)*	0.096 (0.097)
Month_February	0.042 (0.033)	-0.10 (0.054)	-0.032 (0.077)
Month_March	0.128 (0.032) ***	0.064 (0.054)	0.073 (0.078)
Month_April	0.262 (0.033) ***	0.265 (0.054) ***	0.0137 (0.080) *
Month_May	0.304 (0.033) ***	-0.009 (0.055)	0.200 (0.078) **
Month_June	0.332 (0.033) ***	0.288 (0.055) ***	0.414 (0.080) ***
Visit_Weekend	-0.082 (0.021) ***	-0.083 (0.036) **	0.177 (0.053) ***
Visit_Night	-0.749 (0.023) ***	-0.533 (0.038) ***	-0.410 (0.054) ***
Type_Psychiatric	-0.888 (0.060) ***	-1.994 (0.385) ***	0.336 (0.303)
Type_Ophthalmologic	1.427 (0.038) ***	1.606 (0.115) ***	1.957 (0.213) ***
Subsystem_Public	-0.143 (0.041) ***	-0.190 (0.110) *	-0.949 (0.110) ***
Subsystem_Private	-0.074 (0.219)	0.595 (1.191)	n.a.
Subsystem_VHI	-0.866 (0.064) ***	-0.211 (0.087) **	0.113 (0.236)
Subsystem_Others	-0.513 (0.111) ***	0.554 (0.169) ***	1.737 (0.514) ***
Provenience_PHC	0.124 (0.061) **	0.175 (0.113)	-0.103 (0.124)
Provenience_PrivateTransferred	-1.006 (0.056)***	-0.736 (0.236) ***	-1.280 (0.308) ***
Provenience_Others	-0.069 (0.390)	-0.257 (0.193)	-0.537 (0.953)
Age	0.008 (0.003) ***	0.018 (0.005) ***	-0.025 (0.007) ***
Age2	-0.001 (0.000) ***	-0.001 (0.000) ***	-0.001 (0.000) *
Sex_Female	0.280 (0.019) ***	0.303 (0.033) ***	0.277 (0.047) ***
N	63300	19950	11814
Pseudo R2	0.1131	0.1071	0.1321

Notes: Estimates of the *logit* regression. Robust standard errors are shown in parentheses.
* p<10%. ** p< 5%.*** p< 1%.

Annex 3: Marginal Effects - logit model only for patients older than 60 years old

Polyvalent ES	Marginal effects [ey/dx] (standard errors)	
2012-2011: Distance	**Exempt**	**Non Exempt**
Minimum distance	0.064 (0.027)**	0.175 (0.022)***
Mean distance	0.084 (0.014)***	0.071 (0.007)***
DD estimator	0.020 (0.024)	-0.066 (0.036) *
χ^2	0.47	5.20**
Joint χ^2 *for distance effects change*	5.67*	
LR test (for the 4 interaction terms) (χ^2)	24.33***	
N	17558	5376

** significant at the 5% level; *** significant at the 1% level.

Annex 4: Robustness analysis

In this section, we present an informal robustness analysis. Our first possible bias arises from our selection of the sample: as we have mentioned in the methodology section, we have chosen to exclude the “yellow” group since our study crucially depends on a differential price-elasticity of demand and these visits are in an intermediary group and, in the margins, may be very price (in)elastic.

Nevertheless, we have tested our results including the yellow group alongside the other emergent conditions. Table A4.1 shows that our DD coefficients for the co-payment policy have the same sign and significance as in our preferred method, with slightly higher magnitudes, except for the Medical-surgical ES which was significant at 10%. This is in line with our argument that, in margins, (some) yellow group visits may be sensitive to price and consider them alongside more severe visits (since they are classic ES visits) may yield biased results. You may notice that our estimates for the distance costs’ model for the Basic ES have lost their “positive” distance effect, while the medical-surgical ES is now significant. We argue that these results should be read cautiously: for some (but not all) “yellow” visits, the existence of an ambulance transportation distorts the (distance) price-sensitiveness.

One other possible bias is related with the copayment policy, namely the with the patients’ payment status. We try to study whether the increase in copayments decrease ES demand. However, one may argue that if some patients have already the intention of not paying the charge, the policy would have never had an effect. In table A4.2 we present the results of our estimates considering only patients that have paid the fee (according to the hospitals’ billing information), and show that our conclusions of no impact of the policy do not change.

Table A4.1: Tests of differences in marginal effects (2012-2011): model including “yellow” visits

	Marginal effects [ey/dx] (Std. error)					
ES LEVEL	Polyvalent ES		Medical-Surgical ES		Basic ES	
Increase in Co-payments						
DD estimator	0.019 (0.016)		-0.052 (0.031)*		-0.028 (0.034)	
χ^2	1.48		2.81		0.67	
Increase in Distance costs	Exempt	Non-Exempt	Exempt	Non-Exempt	Exempt	Non-Exempt
DD estimator	0.012 (0.019)	-0.061 (0.019) ***	-0.067 (0.044)	0.138 (0.047)***	0.040 (0.044)	0.073 (0.050)
χ^2	0.42	9.76 ***	2.30	8.62**	0.60	1.67
Joint **(χ^2)**	10.18 ***		10.92**		2.27	
LR test	60.34***		18.19***		3.12	
N	91264	60404	31850	22208	15301	8369

Notes: Table A4.1 presents the average marginal effects from the logit model with coefficients transformed into semi-elasticities. Standard errors are shown in parentheses. LR test compares models with and without distance interactions * p<10%. ** p< 5%.*** p< 1%.

Table A4.2: Tests of differences in marginal effects (2012-2011): model without patients with copayments in debt

	Marginal effects [ey/dx] (Std. error)		
ES LEVEL	Polyvalent ES	Medical-Surgical ES	Basic ES
Increase in Copayments			
DD estimator	-0.002 (0.011)	-0.027 (0.022)	0.022 (0.022)
χ^2	0.04	1.46	0.96
N	51457	18747	10931

Notes: Table A4.2 presents the average marginal effects from the logit model with coefficients transformed into semi-elasticities. Standard errors are shown in parentheses. LR test compares models with and without distance interactions * p<10%. ** p< 5%.*** p< 1%.

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