

Does €1 Per Prescription Make a Difference? Impact of a Capped Low-Intensity Pharmaceutical Co-Payment

Pilar García-Gómez^{1,2}  · Toni Mora³  · Jaume Puig-Junoy⁴ 

Published online: 16 March 2018

© Springer International Publishing AG, part of Springer Nature 2018

Abstract

Background Increasing patient contributions and reducing the population exempt from pharmaceutical co-payment and co-insurance rates were one of the most common measures in the reforms adopted in Europe during 2010–2015.

Objective We estimated the association between the introduction of a capped co-payment of €1 per prescription and drug consumption of the publicly insured population of Catalonia (Spain).

Methods We used administrative data on monthly pharmaceutical consumption (defined daily doses [DDDs]) from January 2012 to December 2014, for a representative sample of 85,000 people.

Results Our results showed that consumption increased in the 2 months previous to the introduction of the measure, and fell with the introduction of the ‘Euro per prescription’

co-payment. The average net response associated with the reform (including anticipation) was a reduction of 4.1 DDDs per person per month, representing a 6.4% reduction. The decrease in pharmaceutical consumption was larger for those individuals who had free medicines prior to the reform compared with those who already paid a co-insurance rate (9.7 vs. 1.4 DDDs per person per month). The largest reduction in DDDs per person occurred in the following groups: dermatologic drugs, antihypertensives, non-insulin antidiabetic drugs, insulin antidiabetic drugs, and laxatives.

Conclusion A uniform capped low co-payment may give rise to a major reduction in drug consumption to a much greater extent among those who previously had free prescriptions.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s40258-018-0382-x>) contains supplementary material, which is available to authorized users.

✉ Jaume Puig-Junoy
jaume.puig@upf.edu

¹ Erasmus School of Economics, Erasmus University Rotterdam, PO Box 1738, 3000 DR Rotterdam, The Netherlands

² Tinbergen Institute, Burgemeester Oudlaan 50, 3062 PA Rotterdam, The Netherlands

³ School of Economic and Social Sciences, Universitat Internacional de Catalunya (UIC), Immaculada 22, 08017 Barcelona, Spain

⁴ Department of Economics and Business, Research Centre for Health and Economics (CRES-UPF), Universitat Pompeu Fabra (UPF), Ramón Trias Fargas 25-27, 08005 Barcelona, Spain

Key Points for Decision Makers

This study shows that the first out-of-pocket Euro can have a strong impact on drug consumption, especially for patients who previously had free access to medicines. This reduction in consumption was heterogeneous depending on the therapeutic group. It does not only affect potentially less-necessary and less-effective drugs but also groups of medicines prescribed mainly to patients with chronic diseases, such as antihypertensives and non-insulin antidiabetic drugs.

1 Introduction

Modifying the conditions and extent of pharmaceutical co-payment and co-insurance rates was one of the most common measures in the reforms adopted in Europe in 2010–2015 [1]. The aim of this study was to evaluate the effect of one of these reforms, specifically focusing on the association between the introduction of a co-payment of €1 per prescription and the number of defined daily doses (DDDs) prescribed to the Catalan population covered by the single public insurer (CatSalut) during the short period it was in force, from 23 June 2012 to 15 January 2013.

There is extensive empirical literature on the effects of changes to pharmaceutical cost sharing on the use of these products (for a systematic review see Kiil and Houlberg [2]); however, to our knowledge, and using individual microdata, there is no evidence on the impact of the loss of free access to prescription medicines in a public insurance system through the introduction of a small or low-intensity co-payment with an out-of-pocket limit per person. Studying an intervention of this type is especially interesting to assess to what extent the increase in consumption attributable to free access to pharmaceuticals (moral hazard) can be moderated effectively by means of a capped small co-payment, as a policy tool to avoid the so-called ‘zero price effect’ [3], without the need for high co-insurance rates such as those adopted in many European countries after the 2008 financial crisis. This article contributes to the existing literature, providing evidence on the hypothesis that the first Euro of cost shared by the user has a much greater repercussion than the same amount when users are already bearing cost sharing [3].

From 1978, the Spanish National Health System (SNS) provided quite generous drug coverage for all Spaniards (except civil servants), with the exception of a 40% co-insurance of the retail price of pharmaceutical prescriptions for the active population. Individuals ceased to pay part of the costs once they acquired pensioner status. This co-insurance exemption gave rise to a 17.3% increase in drug consumption and a 60.4% increase in expenditure per person for the public insurer, after retirement, according to individual data from 2004 to 2006. [4]

A reform of the cost-sharing system took place in two Spanish regions (Catalonia and Madrid) as of June 2012, with the temporary introduction of a co-payment of €1 per prescription (with an annual limit), until its suspension on 15 January 2013. On 1 October 2012, the reform of the central government co-insurance came into force in Catalonia, putting an end to free medicines for most pensioners, and at the same time increasing the co-insurance applicable to some of the active population to 50–60%, depending on their level of income. Table 1 summarises

the changes in the cost-sharing system that took place in 2012 at both the regional and country level, and the populations affected. Individuals cannot privately insure these costs, and transaction costs are small as they are directly charged by the pharmacy when individuals get their prescribed drugs.

Using monthly regional data, Puig-Junoy et al. [5] estimated that the set of measures adopted simultaneously in 2012 in Catalonia and other Spanish regions (changes in central government co-insurance, delisting, and the ‘Euro per prescription’ co-payment) had a considerable effect on the number of prescriptions dispensed, at least in the short term. Their results suggested that these measures caused an abrupt shift in the mean level of the time series, while the existing increasing trend in pharmaceutical consumption remained unaffected. Our study provides two novel key contributions to this evidence. First, the availability of individual data allows us to estimate not only the aggregate effect but also to what extent it was larger among those individuals with free access to pharmaceuticals previous to the reform compared with those who already faced co-insurance. This is crucial in order to learn about the potential of these types of measures to contain moral hazard in pharmaceutical consumption driven by the free availability of drugs (zero price effect). Second, we were able to evaluate the association between the Euro per prescription co-payment and DDDs in isolation from other interventions, while Puig-Junoy et al. [5] only showed the aggregate effect of all these interventions. However, our analysis does not allow us to estimate the potential impact of the intervention on administrative costs or other types of forgone care.

2 Data and Empirical Strategy

The data on consumption and pharmaceutical expenditure from January 2011 to December 2014 came from a representative sample of 85,000 people belonging to the Catalan population consuming a wide range of products¹

¹ Specifically, the therapeutic groups included are: 1: NSAIDs; 2: analgesic and antimigraine drugs; 3: anxiolytics and hypnotics; 4: antiplatelet/anticoagulant drugs; 5: asthma and COPD medications; 6: antibiotics; 7: antidepressants; 8: insulin antidiabetic drugs; 9: non-insulin antidiabetic drugs; 10: antiepileptic drugs; 11: antihypertensives; 12: antihistamines; 13: antineoplastics/immunomodulators; 14: antipsychotics; 15: antiulcer drugs; 16: dermatologic drugs; 17: lipid-lowering drugs; 18: ophthalmic drugs; 19: osteoporosis drugs. This selective sample of medications represents 80% of consumption financed by the public insurer and 83% of total prescriptions. Given that, individually, the remaining therapeutic areas carry very little weight within total consumption, the results of analyzing a representative random sample of the consumers of 100% of medications are expected to be similar to those of the study performed here.

Table 1 Contribution of beneficiaries to outpatient pharmaceutical care in Catalonia during the period of our analysis

Population group	Euro per prescription co-payment from 23 June 2012 to 15 January 2013 with annual upper limit	Central government co-insurance up to September 2012 (%)	Central government co-insurance as of October 2012 (%)	Central government co-insurance with annual limit as of October 2012
Non-contributory and disability pensions	No	0	0	NA
Pensioners $Y \leq \text{€}100,000$	Yes		10	Yes
Pensioners $Y > \text{€}100,000$	Yes		60	Yes
Beneficiaries of social integration allowances ^a	No	40	0	NA
Unemployed without benefits	Yes		0	NA
Active $Y \leq \text{€}18,000$	Yes		40	No
Active $\text{€}18,000 < Y \leq \text{€}100,000$	Yes		50	No
Active $Y > \text{€}100,000$	Yes		60	No

In the case of low co-payment drugs, all users with a positive co-payment rate as of July 2012 pay 10%, with a maximum amount per prescription. Until June 2012, only active workers and their beneficiaries paid this 10%, with a maximum amount per prescription

Y income, *NA* not applicable as these groups did not face co-insurance as of October 2012

^aThe category 'Beneficiaries of social integration allowances' includes beneficiaries of the Integration Minimum Income Programme, beneficiaries of aid for the maintenance of basic needs, and beneficiaries of the Social Welfare Fund (FAS)

financed by the public insurer. The sample was selected and anonymized by the Agency for Health Quality and Assessment of Catalonia (AQuAS).²

All individuals in the sample consumed at least one medicine during the study period. The data included demographic information on the insured individuals (age, sex, health region of residence, and immigrant status) and prescriptions dispensed (maximum co-insurance rate faced each month, number of prescriptions, total expenditure, and DDDs) in the period stretching from 1 January 2011 to 31 December 2014, grouped by active ingredient. The sample comprised 5.6 million monthly observations. We collapsed the information to one observation per month per individual, and deleted those individuals who died during our observation period, as well as those with missing information in any of the variables used in the analysis.³ The final sample consisted of 3,537,769 observations for 74,100 individuals, and the outcome variable of interest was the number of DDDs. The period previous to the assessed intervention consisted of 18 months, the period of application of the intervention was 7 months, and the post-intervention period was 23 months.

Table A-I in the electronic supplementary appendix shows the mean of the variables. On average, individuals are prescribed 2.07 prescriptions, with 62 DDDs, on a

monthly basis, which amounts to €22.8/month. On average, they face a maximum co-insurance rate of 26% of the total price. Table A-I also contains information on the distribution of the sample of insured individuals by age, sex (55% women), and immigrant status (14% of the sample), and by type of therapeutic area of the medicine consumed.

Given that the reform is applied differently to different groups of beneficiaries of pharmaceutical care, it would be possible to assess its causal effects as long as the population group unaffected by the reform (beneficiaries of social integration allowances; see Table 1) did not also modify its behaviour due to the reform [6]. In this case, we find that the control group formed by the population unaffected by the introduction of the Euro per prescription co-payment is not a suitable comparison group as it also modified its behaviour after the intervention, as shown in Fig. A1 in the electronic supplementary appendix. This drop in pharmaceutical consumption of the a priori unaffected population is not surprising given the lack of information and uncertainty among patients and prescribers about which population groups were excluded from the Euro per prescription co-payment, especially during the first months of application of this intervention. Therefore, in order to identify the effect of interest, we were restricted to a before-and-after analysis. Our identification strategy will provide a biased estimate of the impact of the measure unless we are able to control for other co-existing measures that might have an effect on pharmaceutical consumption. In particular, we must bear in mind the coincidence, in 2012, of other policies such as drug delisting and the reform of central

² We have used data anonymized and made available by AQuAS within the PADRIS Programme.

³ Our results are robust to the exclusion of those individuals who died during our observation period. Results are available upon request from the authors.

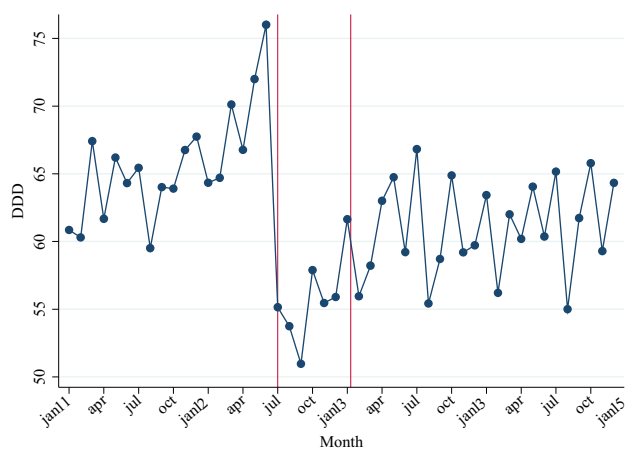


Fig. 1 Evolution of the average number of DDDs during the period 2011–2014. Vertical red lines refer to the period in which a capped co-payment of €1 per prescription was introduced in Catalonia. The first line indicates the month in which the co-payment was introduced and the second line indicates the month in which it was suspended. DDDs defined daily doses

government co-payment rates. In order to isolate the effect of the Euro per prescription co-payment from that of the other two measures, all delisted drugs have been excluded from the study and we control for a dummy variable that takes value one in all the periods affected by the central government co-insurance reform in our empirical model.

Figure 1 shows the evolution of the average monthly consumption of DDDs over the period January 2011 to January 2015. First, we observed a positive trend prior to the introduction of the payment of €1 per prescription in July 2012, with seasonal variation, i.e. lower consumption during the summer. Second, we found that the value of the mean DDD falls substantially when individuals have to pay €1 per prescription, and that consumption increased in the 2 months prior to the introduction of the measure (stockpiling).⁴ After 3 months, the positive trend gradually recovered, although consumption in January 2015 continued to be lower than consumption at the beginning of our observation period. Although other measures affected our population in 2012, none coincided with the introduction of the €1 per prescription co-payment so as to be able to explain the drop observed in the graph in July 2012.

Fixed-effects estimation of coefficient β_1 in Eq. 1 enables us to identify the effect of the intervention during the months it was in force.

⁴ The period of validity for prescriptions depends on the type of treatment. While prescriptions for acute episodes tend to be valid for a short period (approximately 1 week), the duration for chronic illnesses tends to be longer, although less than 1 month in most cases. Stockpiling has also been found by others [2] and is driven by patients either collecting their prescriptions earlier from the pharmacy or visiting their doctors to obtain their prescriptions sooner.

$$Y_{it} = \alpha + \beta_1 ER_t + \beta_2 SP_t + \beta_3 Cop_{it} + \beta_4 RC_t + \beta_5 X_{it} + \gamma_1 t + \gamma_2 t^2 + \gamma_3 t^3 + \lambda_{mt} + u_i + \varepsilon_{it} \quad (1)$$

where Y_{it} is the value of the outcome variable for individual i in period t , and where $t = 1, \dots, 48$ months. ER_t is a dummy variable that takes value 1 for all individuals during the period in which the €1 per prescription co-payment was in force, and 0 otherwise. As data are only available on a monthly level for this study, the first month of application of this measure is considered to be July 2012 and the last month January 2013. SP_t is a variable that identifies the anticipation effect (stockpiling) in the 2 months prior to the reform, and therefore takes value 1 in May and June 2012, and 0 otherwise. With the aim of identifying the effect of interest, in our estimations we also controlled for the following variables: Cop_{it} is the maximum percentage of the retail price that the individual has paid as central government co-insurance in month t ; RC_t is a dummy variable that takes value 1 after the changes in central government co-insurance on 1 October 2012; and X_{it} refers to the set of explanatory variables that include age and health region.⁵ We control for time effects, including a cubic time trend and a set of dummies (λ_{mt} , where $m = 1, \dots, 12$ months), to pick up seasonal effects. Lastly, u_i is the unobserved individual heterogeneity, and ε_{ict} is the random error term. The individual fixed effect allows us to control for the effect of time-invariant characteristics such as sex, country of birth, and initial health or occupation that may affect the pharmaceutical consumption.

3 Results

The results in Table 2 show that individuals consumed 7.54 DDDs per month less during the months the measure was in force, and that they stockpiled 7.79 DDDs per month in the 2 months before it was introduced. If we estimate the model separately for those individuals who did not have to face any pharmaceutical co-insurance before 23 June 2012 (pensioners) and those who had co-insurance of 40% of their total consumption (active population),⁶ we find that

⁵ The Catalan territory is divided into seven health regions; health region is the basic territorial unit through which primary healthcare services are organized.

⁶ We did not directly observe the type of pharmaceutical coverage (active individuals under the co-insurance scheme or retired individuals/pensioners exempt from it) of each individual, but followed Puig-Junoy et al. [4] and infer their status from the amount of the retail price borne by the patient. Unfortunately, we could not identify the coverage of individuals with zero consumption, and therefore excluded individuals without consumption prior to the introduction of the Euro per prescription co-payment from the subgroup analysis. We re-estimated the pooled model excluding this population, and the estimated coefficients, are similar to those reported in the first column of Table 2 (results are available from the authors upon request).

Table 2 Estimated effect of the Euro per prescription co-payment and the anticipation effect on monthly defined daily dose

	Whole population (SE)	Pensioners ^a (SE)	Active population ^b (SE)
Euro per prescription	- 7.54 (0.30)***	- 17.57 (0.77)***	- 2.69 (0.25)***
Anticipation effect	7.79 (0.55)***	17.88 (1.41)***	3.00 (0.46)***
<i>N</i>	3,537,769	1,136,354	2,401,415

All regressions include cubic time trend, month dummies, maximum monthly co-payment, dummy to control for introduction of changes by the central government, age dummies, health region dummies, and individual fixed effects

Significance level: *** $p < 0.01$

SE standard error

^aPopulation exempt from central government co-payment before the introduction of the Euro per prescription co-payment

^bPopulation not exempt from central government co-payment before the introduction of the Euro per prescription co-payment

both the estimated anticipation effect and the impact of the Euro per prescription co-payment on the number of DDDs during the 7 months it was applied are approximately sixfold greater in pensioners than in the active population. Combining the anticipation effect with the drop in consumption once the measure was introduced, we find that, on average, this measure is associated with a reduction in monthly per capita consumption of 4.1 DDDs. This is a sizeable relative estimate of 6.4% compared with the average consumption of 64.2 DDDs per month prior to the reform. Despite the estimated stockpiling and the drop associated with the Euro per prescription co-payment both being larger for pensioners, our results show that large differences remain when we look at the combined effect: the average monthly reduction was 9.7 DDDs for each pensioner and 1.4 DDDs for each member of the active population. Thus, the average net monthly reduction in the number of DDDs over the 7 months of application of the Euro per prescription co-payment for the population who until then had free access to pharmaceutical care was 6.9-fold greater than the reduction for those who were already subject to central government co-insurance. This supports the hypothesis that the first Euro of cost shared by the user has much greater repercussions.

The change in consumption patterns associated with the introduction of the payment of €1 per prescription can vary over time. In particular, one would expect a larger response in the first months due to stockpiling prior to the introduction and the uncertainty about policy implementation. In the latter periods, patients and doctors were expected to be more acquainted with the new payment structure, although one could not rule out that other lagged effects could play a role. In order to analyse the existence of a dynamic response of the Euro per prescription co-payment during the approximately 7 months it was in force, we estimate the association between the payment of €1 per prescription and the aggregate number of DDDs for each of

the 7 months concerned. In the first 3 months, the population exempt from central government co-insurance (pensioners) had not yet faced the new co-insurance from the central government. In the following 3 months, the Euro per prescription co-payment was applied concurrently with the effective application of the central government co-insurance reform. In the seventh month (January 2013), the Euro per prescription co-payment was only applied up to 15 January due to its non-anticipated suspension by the Spanish Constitutional Court.

Table 3 presents the results of the estimation of the fixed-effects model (1) for the average monthly consumption of DDDs, allowing for dynamic effects. It was during the first 3 months that the Euro per prescription co-payment showed the greatest negative association with consumption, being much greater still (between six- and tenfold greater) for pensioners who still enjoyed effective exemption from central government co-insurance. In the following 3 months, coinciding with the introduction of effective payment of the new central government co-insurance by pensioners in October 2012, the association continued to be negative but was notably reduced, both for the active population and for pensioners. Finally, in January 2013, when the Euro per prescription co-payment was in force for only the first half of the month, there was a rise in the average monthly consumption per person of 2.28 DDDs, with this increase being much larger for pensioners (4.14 DDDs) than for the active population (1.52 DDDs).

Figures 2 and 3⁷ present the impact of the Euro per prescription co-payment and its anticipation effect on the population as a whole, as well as on the two subpopulation groups (active population and pensioners), for each of the therapeutic groups. One would expect larger estimates for the anticipation effect for medicines related to medical conditions that require longer treatments. In this respect,

⁷ Tables A2 and A3 in the electronic supplementary appendix include information on the estimated coefficients and standard errors.

Table 3 Estimated monthly dynamic effect of the Euro per prescription co-payment and the anticipation effect on monthly defined daily dose

	Whole population (SE)	Pensioners ^a (SE)	Active population ^b (SE)
July 2012	- 16.04 (0.71)***	- 39.25 (1.80)***	- 4.90 (0.60)***
August 2012	- 8.51 (0.73)***	- 21.43 (1.83)***	- 2.23 (0.62)***
September 2012	- 14.71 (0.72)***	- 33.39 (1.83)***	- 5.72 (0.61)***
October 2012	- 3.87 (0.69)***	- 6.69 (1.66)***	- 2.45 (0.66)***
November 2012	- 3.17 (0.68)***	- 6.69 (1.65)**	- 1.42 (0.63)**
December 2012	- 4.82 (0.64)***	- 9.62 (1.59)***	- 2.47 (0.57)***
January 2013	2.28 (0.65)***	4.14 (1.55)***	1.52 (0.62)***
Anticipation effect	5.15 (0.60)***	11.23 (1.53)***	2.26 (0.50)***
<i>N</i>	3,537,769	1,136,354	2,401,415

All regressions include cubic time trend, month dummies, maximum monthly co-payment, dummy to control for introduction of changes by the central government, age dummies, health region dummies and individual fixed effects

Significance levels: *** $p < 0.01$, ** $p < 0.05$

SE standard error

^aPopulation exempt from central government co-payment before the introduction of the Euro per prescription co-payment

^bPopulation not exempt from central government co-payment before the introduction of the Euro per prescription co-payment

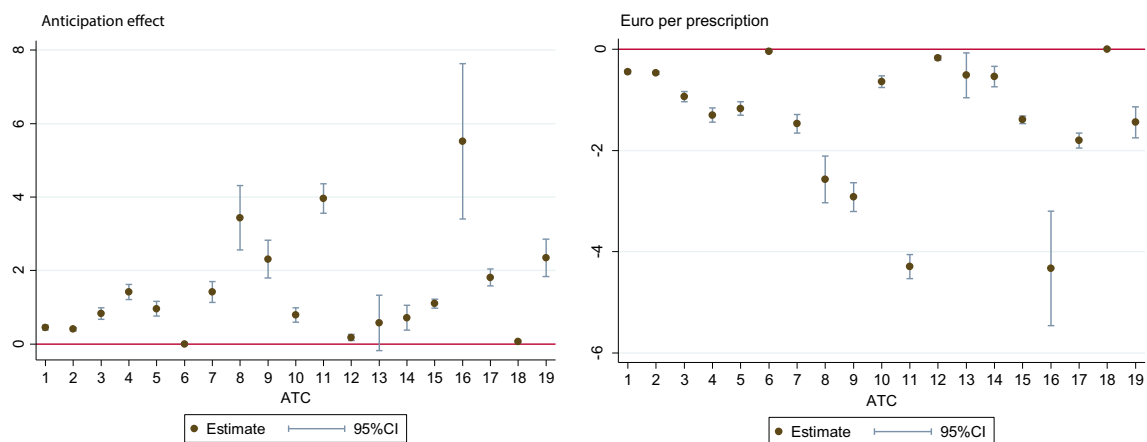


Fig. 2 Estimate of the anticipation effect and Euro per prescription co-payment on the number of defined daily doses by therapeutic groups. 1: NSAIDs; 2: analgesic and antimigraine drugs; 3: anxiolytics and hypnotics; 4: antiplatelet/anticoagulant drugs; 5: asthma and COPD medications; 6: antibiotics; 7: antidepressants; 8: insulin antidiabetic drugs; 9: non-insulin antidiabetic drugs; 10: antiepileptic drugs; 11: antihypertensives; 12: antihistamines; 13:

antineoplastics/immunomodulators; 14: antipsychotics; 15: antiulcer drugs; 16: dermatologic drugs; 17: lipid-lowering drugs; 18: ophthalmic drugs; 19: osteoporosis drugs. Each point estimate comes from a separate regression. ATC anatomical therapeutic chemical classification system, CI confidence interval, NSAIDs non-steroidal anti-inflammatory drugs, COPD chronic obstructive pulmonary disease

we found that the estimated stockpiling was larger for some medicines related to chronic conditions, such as antidiabetic, antihypertensive, or osteoporosis drugs. In addition, these results show that the magnitude of effect of the Euro per prescription co-payment is greater for pensioners for all therapeutic groups for which the effect is statistically significant. For example, the average monthly reduction for dermatologic drugs was 8.58 DDDs for pensioners and only 1.87 DDDs for the active population. Similarly, the reduction in the consumption of antihypertensives was 5.25 DDDs for pensioners and 2.32 DDDs for active

individuals. In the case of pensioners, the largest monthly reduction in the number of DDDs occurred in the groups corresponding to dermatologic drugs, antihypertensives, and antidiabetic drugs.

4 Discussion

Our results indicate that a capped co-payment of €1 per prescription, with very selective exemptions, may be effective in the short term for reducing consumption of

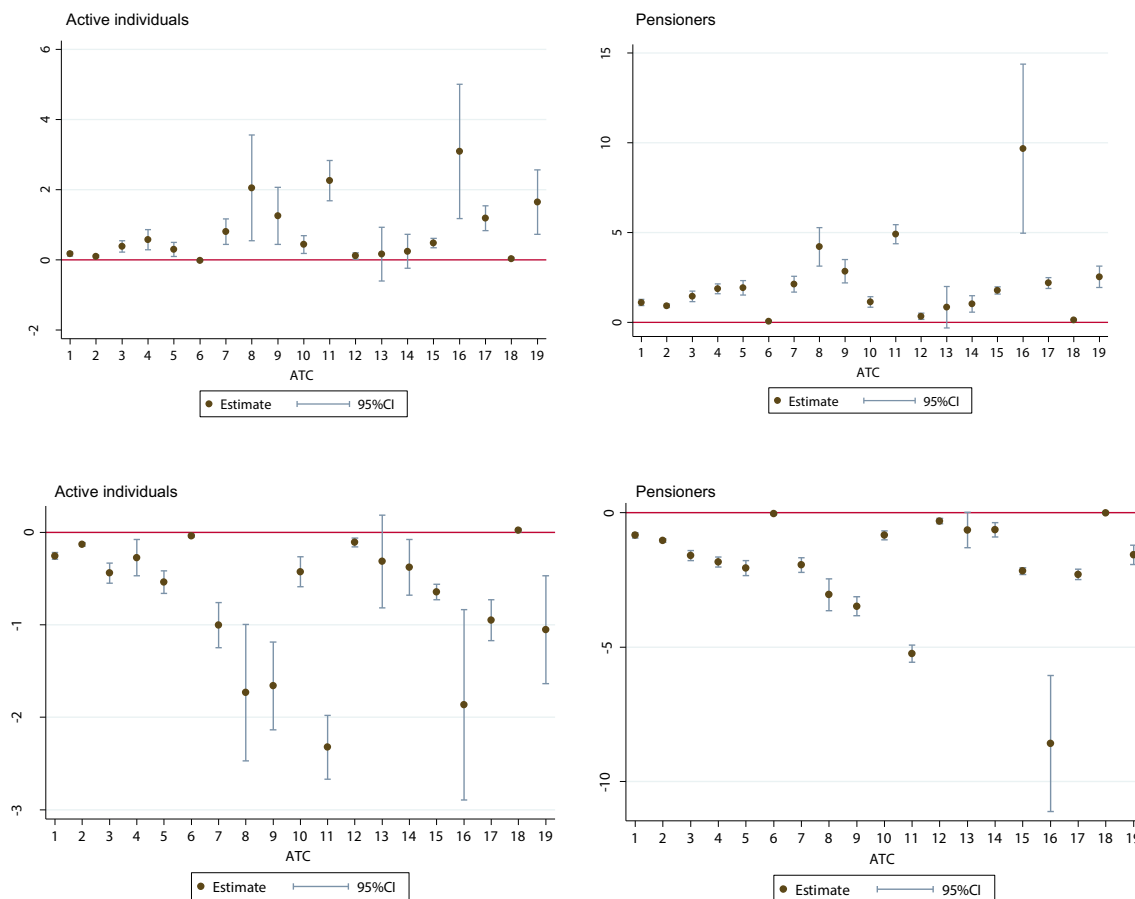


Fig. 3 Estimate of the anticipation effect and Euro per prescription co-payment on the number of defined daily doses by therapeutic groups, for active individuals and pensioners. 1: NSAIDs; 2: analgesic and antimigraine drugs; 3: anxiolytics and hypnotics; 4: antiplatelet/anticoagulant drugs; 5: asthma and COPD medications; 6: antibiotics; 7: antidepressants; 8: insulin antidiabetic drugs; 9: non-insulin antidiabetic drugs; 10: antiepileptic drugs; 11: antihypertensives;

12: antihistamines; 13: antineoplastics/immunomodulators; 14: antipsychotics; 15: antiulcer drugs; 16: dermatologic drugs; 17: lipid-lowering drugs; 18: ophthalmic drugs; 19: osteoporosis drugs. Each point estimate comes from a separate regression. *ATC* anatomical therapeutic chemical classification system, *CI* confidence interval, *NSAIDs* non-steroidal anti-inflammatory drugs, *COPD* chronic obstructive pulmonary disease

medicinal products, especially for patients who previously had free access to medicines. However, although the reduction in consumption is heterogeneous depending on the therapeutic group, it does not only affect potentially less-necessary and less-effective drugs but also groups of medicines prescribed mainly to patients with chronic diseases, such as antihypertensives and non-insulin antidiabetic drugs. We found that monthly consumption of these medicines is reduced by more than two DDDs per person. This drop in the consumption of potentially effective and necessary drugs can be associated with potential negative health effects, as well as offsetting effects in the form of greater use of other health services [1, 2]. Unfortunately, these effects could not be studied with our data but merit attention in future research.

This paper looks at the effect of a fixed capped co-payment on drug consumption (measured by DDD) for two population groups: a group that was already subject to a co-

insurance system, and pensioners who used to receive free medications. Although we show that this measure was associated with a sizeable drop in pharmaceutical consumption, our results only provide a partial evaluation of the effect of patient charges applied to prescriptions. First, it does not include effects over a long time period as the co-payment was withdrawn after a few months. In addition, we were not able to estimate the impact on other relevant outcomes such as health changes driven by the lower use of (some types of) pharmaceuticals and spillover effects on other types of healthcare expenditures (GP visits, specialist visits or hospitalizations). Finally, our evaluation does not include the administrative costs incurred by either the public insurer or pharmacies. Moreover, while we provide heterogeneous effects by subgroups based on previous co-payment status, we cannot evaluate to what extent our results are driven by users at the bottom of the income distribution. One could expect these individuals to have a

stronger response, especially among older groups. Unfortunately, the nature of administrative data prevents us from estimating these heterogeneous responses, however this merits attention in future research in order to provide policy recommendations for a targeted design to certain subgroups that differ by need.

5 Conclusions

Notwithstanding these limitations, our results have important policy implications. In particular, our results provide evidence that the first Euro can indeed be sufficient to have a strong repercussion on drug consumption [3]. In addition, they coincide with existing literature [7, 8] showing that even low-intensity uniform co-payments can reduce both necessary and less-necessary consumption.

Acknowledgements The authors would like to thank participants at the VI EvaluAES Workshop and the 2017 Conference of the International Health Economics Association for their valuable comments and suggestions, and the AQuAS for access to the data, particularly Anna García-Altés and Cristina Colls. Pilar García-Gómez would also like to thank the Netherlands Organization for Scientific Research for financial support under the Innovational Research Incentives Scheme—VENI.

Author Contributions Jaume Puig-Junoy evaluated the literature; all three authors were equally involved in the design of the empirical strategy; and Pilar García-Gómez and Toni Mora conducted all the empirical analyses. All three authors reviewed and approved the final submitted version of the manuscript and are the guarantors for the overall content.

Compliance with Ethical Standards

Conflict of interest This research was supported by an unrestricted grant from the AQuAS. Pilar García-Gómez, Toni Mora, and Jaume

Puig-Junoy have no financial or other conflicts of interest that are directly relevant to the content of this article.

Data availability statement Unfortunately data were supplied by the Catalan Health Service, the public insurer, under a contract that does not allow researchers to share the database with any other third-party.

References

1. Vogler S, Zimmerman N, de Joncheere K. Policy interventions related to medicines: Survey of measures taken in European countries during 2010–2015. *Health Policy*. 2016;120(12):1363–77.
2. Kiil A, Houlberg K. How does copayment for health care services affect demand, health and redistribution? A systematic review of the empirical evidence from 1990 to 2011. *Eur J Health Econ*. 2014;15:813–28.
3. Ellis RP. Five questions for health economists. *Int J Health Care Finance Econ*. 2012;12:217–33.
4. Puig-Junoy J, Rodríguez-Feijóo S, López-Valcárcel BG. Paying for formerly free medicines in Spain after 1 year of co-payment: changes in the number of dispensed prescriptions. *Appl Health Econ Health Policy*. 2014;12(3):279–87.
5. Puig-Junoy J, García-Gómez P, Casado-Marín D. Free medicines thanks to retirement: impact of coinsurance exemption on pharmaceutical expenditures and hospitalization offsets in a national health service. *Health Econ*. 2016;25(6):750–67.
6. Angrist J, Pischke J-S. *Mastering metrics: the path from cause to effect*. Princeton: Princeton University Press; 2014.
7. Chernew ME, Newhouse J. What does the RAND health insurance experiment tell us about the impact of patient cost sharing on health outcomes? *Am J Manag Care*. 2008;14:412–4.
8. Pauly MV. Insurance and drug spending. In: Danzon P, Nicholson S, editors. *The Oxford handbook of the economics of the biopharmaceutical industry*. Oxford: Oxford University Press; 2012. p. 336–64.