Original Research

Impact of Covid-19 containment on community pharmaceutical spending in Andalusia - Spain

Francisco FLORIDO ALBA, Nuria GARCÍA-AGUA, Ángel MARTÍN REYES, Antonio CLAVERO BARRANQUERO, Antonio J. GARCÍA RUIZ.

Received (first version): 2-Mar-2021 Accepted: 30-May-2021 Published online: 18-Jun-2021

Abstract

Background: In the field of health, the year 2020 will be remembered for testing (stressing) all health institutions and their forms of management (centralised and decentralised). The everyday activity of primary and hospital care was significantly altered by the introduction of telephone consultations, which reduce the number of visits to health centres or hospitals and are still relevant today in the face of successive waves of the pandemic.

Objective: To analyse whether population confinement due to the COVID-19 pandemic had an impact on the dispensing of medications in community pharmacies and the associated spending during the period March-July 2020 in Andalusia (Spain).

Methods: A time series analysis applying econometric model analysis techniques to confirm or rule out whether the lockdown caused by the COVID-19 pandemic had an impact on the dispensing of medications by community pharmacies and the associated expenditures. The variables used were the number of medication containers dispensed by community pharmacies (charged to the public funds of the Spanish National Health System) and the expenditure on prescription drugs, both in relation to the population. The analysis was performed within the region of Andalusia, which has 8,464,441 inhabitants.

Results: The data obtained from the time series confirmed that there were no significant differences during the studied period between the number of medication containers actually dispensed and the number that would have been expected to be dispensed according to the trend in this variable for the sample period. The expenditure results followed the same pattern.

Conclusions: The health crisis produced by the COVID-19 lockdown had no impact on medication consumption in Andalusia.

Keywords

COVID-19; Pandemics; Prescription Drugs; Health Expenditures; Financial Management; National Health Programs; Pharmacies; Government Programs; Models, Econometric; Interrupted Time Series Analysis; Spain

INTRODUCTION

Despite the fact that in recent years, its percentage increase has decreased, public spending on prescribed medications is one of the most significant items of Spanish health spending, both in primary care and in hospitals.[1]

Public spending on drugs and health products in the National Health System (Sistema Nacional de Salud - SNS) is composed of hospital pharmaceutical spending, spending on prescription drugs measured as dispensing in community pharmacies and spending on non-prescription health products.[2]

Political measures to improve the efficiency of Spanish health system are common, especially those focused on the containment of pharmaceutical spending, for example, price reduction, the effective establishment of the reference price system, the approval of the Royal Decree Law 16/2012, drug evaluation committees, drug dispensing bidding systems, therapeutic exchange programs, prescription indicators and algorithms, program contracts and reports of therapeutic positioning.[3-7]

In addition, there are many factors that can influence the consumption of medications and the expenditure it causes, including structural factors (demographic, socioeconomic, lifestyles), behavioural factors (medical practice, professional burnout, political ideology in the government and random factors (epidemics, seasonal changes, etc.).[8-10]

In 2019, the consumption of prescription drugs charged to public funds closed with the same trend compared to previous years with an increase in spending on drugs for hospital use, from 27.3% in 2014 to 31.4% in 2019, at the cost of a decrease in the average expenditure per prescription, which represented 52.7% of the total in 2014 and in 2019 fell to 47.8%.[11]

However, as we know, last year something unexpected happened at the health level that put in check all the institutions and forms of health management (central and regional). Especially since March 14, when the state of alarm was declared in Spain, it forced the population to be held for a prolonged period of time and caused changes in behaviour and health management.

This disturbance of the normal functioning of health care caused the ordinary activity of primary and hospital care to be seriously modified by the introduction of telephone consultations, the exhaustive limitation of visits to primary care centres and hospitals in 2020, which is still valid today

Francisco FLORIDO ALBA. Malaga Pharmacists Association. Malaga (Spain). pacofloridoalba@gmail.com
Nuria GARCÍA-AGUA. Health Economics and Rational Use of Medicines. Department of Pharmacology and Clinical Therapeutics. Biomedical Research Institute of Malaga (IBIMA). University of Malaga. Malaga (Spain). nuriags@uma.es
Ángel MARTÍN REYES. Health Economics and Rational Use of Medicines. Department of Pharmacology and Clinical Therapeutics. Biomedical Research Institute of Malaga (IBIMA). University of Malaga. Malaga (Spain). angelmartinreyes@gmail.com
Antonio CLAVERO BARRANQUERO. Department of Statistics and Econometrics. University of Málaga. Malaga (Spain). clavero@uma.es
Antonio J. GARCÍA RUIZ. Health Economics and Rational Use of Medicines. Department of Pharmacology and Clinical Therapeutics. Biomedical Research Institute of Malaga (IBIMA). University of Malaga. Malaga (Spain). ajgr@uma.es

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)

due to successive waves of pandemics. This can have serious repercussions at two levels: alteration of the patient's status quo (loss of contact with the system, longitudinal monitoring of the disease, adaptation to changes in the disease process, etc.) and loss of prevention or early diagnosis of many diseases.

The main objective in this study is to analyse whether population confinement due to the COVID-19 pandemic had an impact on the dispensing of medications in community pharmacies and the associated spending during the period March-July 2020 in Andalusia. The null hypothesis (H_0) is that the containment period did not produce any alteration with respect to the trend of previous periods.

METHODS

Study using time series analysis techniques. That is, a succession of observations of a variable taken at different moments in time. These techniques have not only allowed the study of the behaviour of the variables over time but have also made it possible to make projections outside the sampling period, evaluating, at all times, the error that accompanies these projections.

Study variables and information sources

The variables used were the number of drug containers dispensed from public funds of the SNS and the expenditure made, both in relation to the population. The sources of information used were the Continuous Population Registry of the National Institute of Statistics (INE) and the Total Prescription Billing Data of the National Health System (Regions; National Institute of Health Management - INGESA) and Mutuality General of Civil Servants of the State - MUFACE) from the Statistical Portal of the National Health System of the Ministry of Health, Consumption and Social Welfare.[12,13]

The available information covered the period between January 2009 and July 2020 on a monthly basis, and by territory, the same information is available for all regions and cities and for the country as a whole.

Scope of study

The analysis was performed in the territorial area the region of Andalusia, which has 8,464,441 inhabitants and is the first in terms of the number of inhabitants in the country.

Preliminary analysis

An important issue when making projections of a variable is to take a sample, among all the available information and that has had a certain uniformity in its evolution, especially in the case that a sudden change in the series is observed, such as a structural change, due to a change in the regulations that affect the variables under study, which seems to have occurred in this case.

To confirm this, a multiple graph showed the evolution of the number of containers per inhabitant of medications dispensed during the study period (Figure 1). This graph shows two different behaviours in all regions of Spain, one from January 2009 to the third quarter of 2012 and another from July of that year until the end of the period.

This variation was due to a change in the regulations in force at that time. On April 24, 2012, the Royal Decree Law of "urgent measures to ensure the sustainability of the National Health System" included copayment, which may explain the general decrease in the variable of monthly containers dispensed in the aforementioned period, since many patients, having to “copay” the prescribed medications, decided not to withdraw these medications from the community pharmacy office or reduce the amount consumed.[14,15]

In this way, the sample period that was taken as a reference for our study was between July 2012 and July 2020, where the variable under study was more uniform.

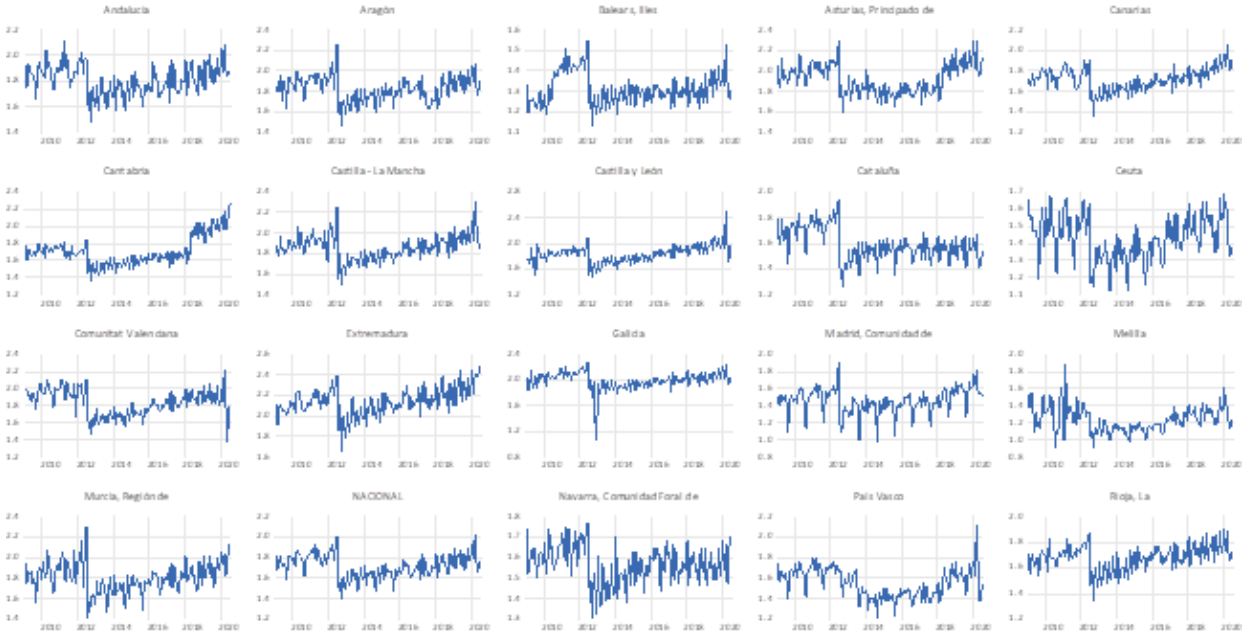

Figure 1. Monthly packaging per inhabitant in the different regions in Spain.

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)

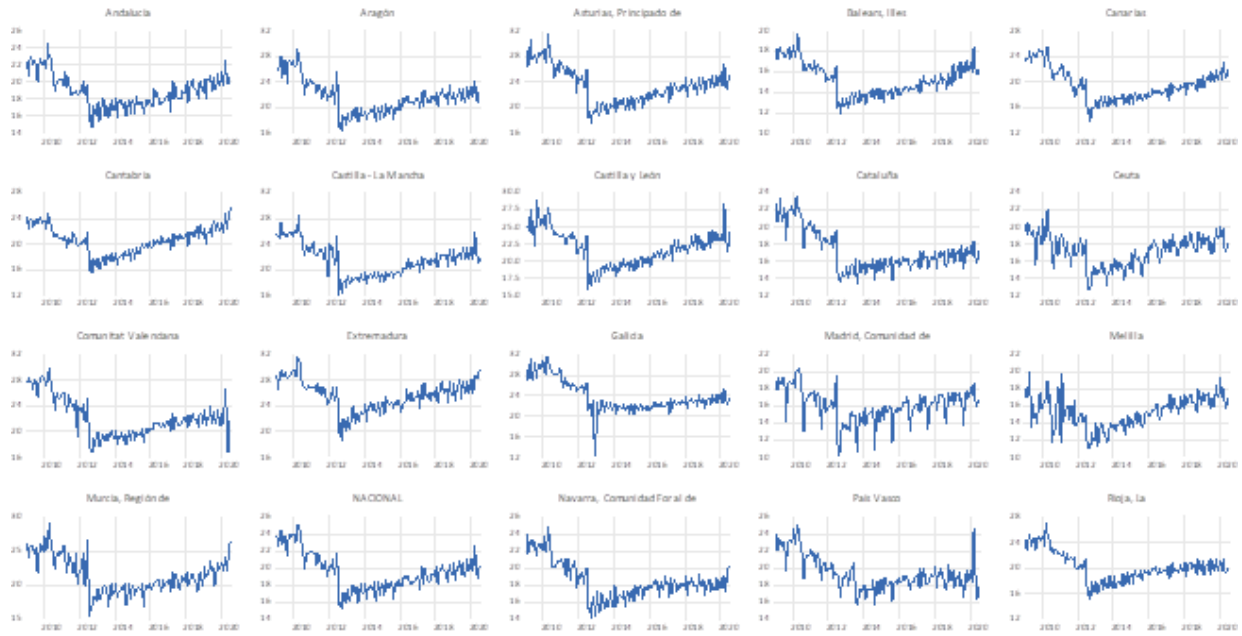

Figure 2. Monthly expenditure per inhabitant in the different regions in Spain

In reference to the per capita spending on prescription drugs, although the degree of magnitude of the variable is different, the pattern of evolution is similar, as shown in Figure 2. Consequently, in this case, the sampling period and the projection period that was used were the same as in the case of the variable container of medicines dispensed per inhabitant.

Statistical and econometric analysis

Three types of analyses of time series econometric models were used: classical approaches, smoothing models and ARIMA models (Online appendix 1).

Subsequently, the one that provided the best predictions was chosen to perform the difference test of means (between predicted model and real model) that allowed us to conclude on our assumptions (null hypothesis).

- The classical approach is characterized by considering that the time series consists of four components: the long-term component (trend), the medium-term component (cycle), the short-term component (seasonal) and an irregular component that is the residual that remains after having extracted the previous components of the series (it is possible to study what type of random behaviour these residuals present, using some type of probabilistic model that describes them). The components used to predict are the trend and seasonality. The Theil index was also calculated as a measure of inequality between groups. The value of the Theil index is given by the formula Theil= -exp(-R). The resulting value is between 0 and 1; the closer the value is to 1, the worse the distribution of the variable (in our case of consumption and expenditure associated with the dispensing of medications).
- The approach of the smoothing models is characterized by having a series of structures that adapt to the characteristics of the series. Among these models, the most commonly used are the Brown and Holt-Winters models.
- The approach of the ARIMA models is characterized by considering the time series under study as the materialization or sample of size one of a stochastic process. They are nonstationary models, which have a tendency, and it is convenient to explain this tendency through a differentiation process.

RESULTS

Analysis of the econometric model

Classical approach

The existence of seasonality is confirmed with respect to the number of monthly containers per inhabitant dispensed from the public funds of the SNS and the monthly expenditure per inhabitant (Table 1).

Table 1. Seasonal component of packaging and expenditure (monthly per capita) according to the classical approach (ratio to moving average method)

Ggeneral index of seasonal variation (GISV)						
Month	**Containers dispensed**	**Expenditure**		**Month**	**Containers dispensed**	**Expenditure**
January	1.058781	1.040179		July	0.985820	1.004742
February	0.938492	0.928062		August	0.939391	0.953216
March	1.055986	1.047444		September	0.955258	0.964954
April	1.032610	1.024379		October	1.025218	1.027313
May	1.060882	1.048855		November	0.981692	0.983434
June	0.982090	0.988089		December	0.994935	0.997726

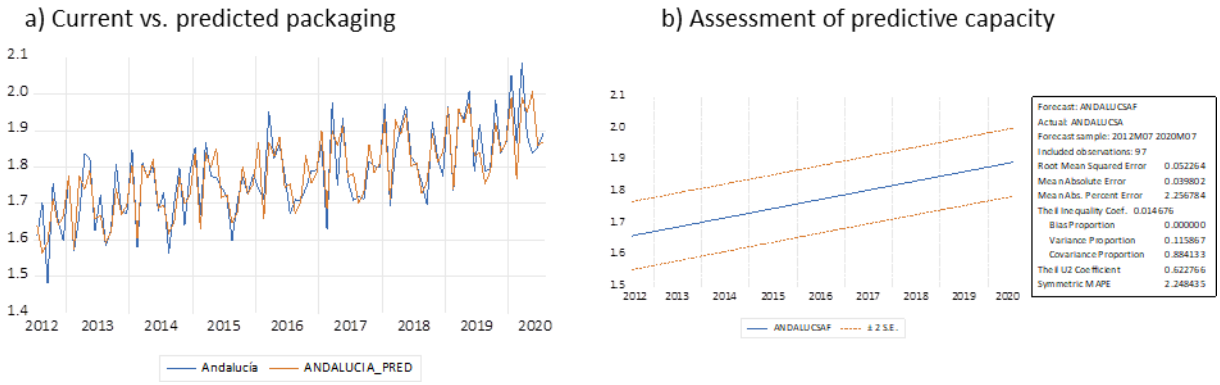

Figure 3. Actual vs. predicted packaging and assessment of predictive ability (classical approach)

In both cases, the values of the general index of seasonal variation (IGVE) obtained show deviations with respect to one, which would be the value that the IGVE should take if the containers and the expenditure, respectively, were uniformly distributed throughout the year, is, if the series did not have a seasonal behaviour. Thus, in January, there was a dispensing of containers 5.88% higher than what would occur if the same uniform distribution were given. For spending, in January, spending was 4.02% higher than what would occur if the aforementioned uniform distribution were applied.

The trend model that seems to best fit the seasonally adjusted series suggests the specification of a linear model YD=a+bt.

Once the results were evaluated and considered quite satisfactory (number of containers per inhabitant of dispensed drugs: coefficient a=1.660090; coefficient b=0.002424; R^2=0.62); (per capita spending on prescription drugs: coefficient a=16.05634; coefficient b=0.043735; R^2=0.852068), projections were made for the sample period to calculate the indicators to evaluate the predictive capacity of the model. Online appendix 2 section A shows the results obtained after estimating the model parameters by ordinary least squares.

Given the results obtained for the variable containers dispensed per inhabitant, with a Theil index of 0.0147 (low inequality), an RECM of 0.0522 and a relative error of 2.95% can be considered a good prediction. The results for the monthly expenditure per inhabitant on prescribed medications are in the same line, with a Theil index of 0.0139, an RECM of 0.507 and a relative error of 2.78%, which is also considered a good prediction.

It only remains to prepare these predictions with the seasonal component to obtain predicted values comparable with the values of the original series of packages of medications dispensed per inhabitant (Figure 3a) and monthly expenditure per inhabitant (Figure 4a).

Once the results have been evaluated, which can be considered quite satisfactory, projections are made for the sample period for the series of drug packages (Figure 3b) and monthly pharmacy spending (Figure 4b) to calculate indicators to evaluate the predictive capacity of the model.

Approach to the smoothing models

Given the characteristics of the series, the most appropriate model is the Holt-Winters model with multiplicative seasonality. The results are very similar to those obtained by applying the classical approach, with an almost identical root mean square (RMSE) and, consequently, a relative error of 2.95% for the variable of number of containers per inhabitant of dispensed drugs and the 2.78% for the monthly expenditure per inhabitant due to the prescription (Online appendix 2 section B).

ARIMA models

In the case of containers per inhabitant of dispensed drugs, the most appropriate model after the tests performed has been an ARIMA model (0,0,1) (0,1,0) (12), i.e., moving average of order one in the regular part after taking a difference in the seasonal part. Regarding the monthly expenditure per inhabitant due to prescription, the most

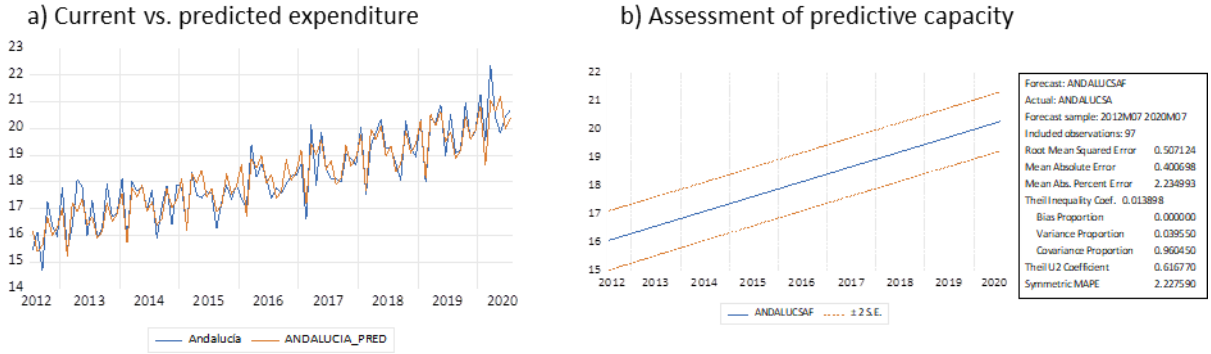

Figure 4. Actual vs. predicted expenditure and assessment of predictive ability (classical approach)

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)

appropriate model after several tests has turned out to be an ARIMA model (3,1,1) (0,1,1,1) 12, that is, an autoregressive model of order three and a moving average of order one in the regular part and a moving average of order one in the seasonal part, after having taken a difference in the regular part and another in the seasonal part.

In both cases, after having proceeded to the estimation, evaluation and prediction with the proposed model, the results are not at all satisfactory, so they are not taken into account for the verification of the hypothesis maintained in this research.

Differences with respect to the trend

Finally, the hypothesis of the study has been tested for the results obtained according to the classical approaches and the smoothing model. According to both approaches, applying the mean difference test for the containers per inhabitant of medications dispensed in the period between March and July 2020, H_0 is accepted, which implies that there are no significant differences in the period considered between the containers actually dispensed and those that would be expected to be dispensed according to the trend shown by this variable in the sample period considered according to the classical approaches (p=0.67) and the smoothing models (p=0.57). The results for the monthly expenditure per inhabitant due to prescription are in the same line, and H_0 is accepted, which implies that there is no significant difference in the period considered between the actual expenditure made and that which would be expected to occur according to the trend shown by this variable in the sample period considered according to the classical approaches (p=0.61) and the smoothing models (p=0.76).

DISCUSSION

The first data showing the possible impact of the coronavirus epidemic in Spain are those for the month of March, which indicate that the pharmaceutical expenditure of the set of regions through the official prescription grew by 14.18% compared to the same month of the previous year and that, in terms of total volume of spending on medicines, Andalusia accumulated the most spending, with 179.29 million euros. Likewise, the data published by the Ministry of Health reflect an increase of 12.73% in the number of containers invoiced by SNS in March of that year. However, at the general level, although at first it seemed that there was an increase in March, this turned out to be a peak, since it returned to its usual course in April, which only recorded an increase of 1.96%, lower than that recorded in April 2019 (2.35%). In the rest of the year, there were ups and downs with periods of increases and others of decreases.[11]

One of the keys for this to continue has been the adaptation of health services (health centres) and community services (pharmacies). Electronic prescription systems have helped doctors and patients to continue with their usual prescriptions, and community pharmacies have not ceased to offer assistance to patients by facilitating therapeutic compliance. It is worth highlighting here different strategies promoted in Andalusia, such as the withdrawal of medicines for hospital use in community pharmacies, telephone follow-up by pharmacists for vulnerable patients (over 70 years of age) or those with significant risk factors (COPD, diabetes, immunosuppressive treatments, etc.).

As has been shown in this study, the incidence of confinement has not led to an imbalance in medical prescriptions in terms of either the per capita packaging of dispensed drugs or per capita spending on prescription drugs.

One of the main limitations of this study is that we have considered only one region of Spain; however, we believe that as this is the main region in the number of inhabitants in Spain, these data can guide pharmaceutical policies in the sense that the consumption of drugs does not seem to have been harmed by the terrible pandemic and the state of alarm produced (population confinement). However, it should be noted that Andalusia is the first region of Spain in number of inhabitants (8,464,441 inhabitants), well above other European countries such as Denmark, Norway, Finland, Ireland, Croatia or Slovakia.

Another possible limitation may be that the consumption of medications in the private sector has not been taken into account; however, the greatest consumption of medications in Andalusia is the responsibility of the public funds (>75%). Nor has it been possible to analyse the medications used and prescribed in hospitals, since we only have access to general data from the region, and not in detail, as would be desirable. Nor has it been possible to compare with other countries, since to present it, data on drug consumption are needed month by month and region by region, which was not our main objective either.

In short, as proof of our hypothesis, pharmaceutical spending with prescriptions closed 2020 with a total of 11,000 million euros and a total of 979 million prescriptions billed, these data are similar to those of 2011 after a cumulative period of decline. The figures for 2020 represent an increase of 0.8% in the number of prescriptions billed and 2.6% in the amount compared to the previous year, with an average expenditure per prescription of 11.3, growing by 1.79%. In the rest of the months, there have been ups and downs, with periods of increased spending and others of reduced spending.[16]

Finally, we believe that one of the main keys for the period of population confinement to have no effect on drug consumption has been the adaptation of health services (health centres) and community services (pharmacies). Electronic prescription systems have helped physicians and patients continue with their usual prescriptions, and community pharmacies have continued to offer assistance to patients facilitating compliance. Different strategies promoted in Andalusia have also helped, such as the withdrawal of drugs for hospital use in community pharmacies, telephone follow-up by pharmacists to vulnerable patients (over 70 years) or with significant risk factors (COPD, diabetes, immunosuppressive treatments, etc.).

CONCLUSIONS

Our study has shown that, despite the confinement order, community pharmacies have not been affected in terms of

dispensing by official prescription in Andalusia, patients receiving their medication with total normality, as it should be in a period critical for community health.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

FUNDING

None.

AUTHOR ROLES (CRediT)

Conceptualization: FFA, AJGR, NGA, AMR, ACB.
Data curation: FFA, AJGR, NGA, AMR.
Formal analysis: AJGR, ACB.
Methodology: FFA, AJGR, ACB.
Supervision: FFA, AJGR, NGA, AMR, ACB.
Validation: FFA, AJGR, NGA, AMR, ACB.
Writing – original draft: FFA, AJGR, NGA, AMR, ACB.
Writing – review & editing: FFA, AJGR, NGA, AMR, ACB.

References

1. Lillo JM, Rodriguez MC. Public health expenditure statistics 2016: Main results, March 2018 edition. https://www.mscbs.gob.es/estadEstudios/estadisticas/docs/EGSP2008/egspPrincipalesResultados.pdf (accessed Jan 8, 2021).
2. Ministry of Health. Pharmaceutical Provision in the National Health System Annual Report of the National Health System 2018. https://www.mscbs.gob.es/estadEstudios/estadisticas/sisInfSanSNS/tablasEstadisticas/InfAnualSNS2018/Cap.7_Farmacia.pdf (accessed Feb 2, 2021).
3. Paz-Ares T, Cocina B. The reference price system: fifteen years of experience. https://www.uria.com/documentos/publicaciones/3585/documento/A2.pdf?id=4387 (accessed Feb 5, 2021).
4. [Decree-Law 3/2011, of 13 December, approving urgent measures on pharmaceutical provision in the Andalusian Public Health System]. https://www.juntadeandalucia.es/boja/2011/245/1 (accessed Feb 5, 2021).
5. [Royal Decree-Law 16/2012, of 20 April, on urgent measures to guarantee the sustainability of the National Health System and improve the quality and safety of its services]. https://www.boe.es/eli/es/rdl/2012/04/20/16/con (accessed Feb 15, 2021).
6. Spanish Society of Hospital Pharmacy. Therapeutic exchange programmes. https://gruposdetrabajo.sefh.es/genesis/genesis/Enlaces/PITsHospitales.htm (accessed Feb 15, 2021).
7. Ministry of Health, Consumer Affairs and Social Welfare Therapeutic Positioning Reports. https://www.aemps.gob.es/medicamentosUsoHumano/informesPublicos/home.htm (accessed Feb 15, 2021).
8. Blanco Montagut LE. [Factors explaining drug expenditure in primary care]. Aten Primaria. 2000;25(7):518. https://doi.org/10.1016/s0212-6567(00)78558-1
9. Cebrià J, Sobrequés J, Rodríguez C, Segura J. [Influence of burnout on pharmaceutical expediture among primary care physicians]. Gac Sanit. 2003;17(6):483-489. https://doi.org/10.1016/s0213-9111(03)71795-6
10. Florido Alba F, García-Agua Soler N, Martín Reyes Á, García Ruiz AJ. [Crisis, Public Spending on Health and Policy]. Rev Esp Salud Publica. 2019;93:e201902007.
11. Ministry of Finance, Indicators on pharmaceutical and health spending. https://www.hacienda.gob.es/es-es/CDI/Paginas/EstabilidadPresupuestaria/InformacionAAPPs/Indicadores-sobre-Gasto-Farmac%C3%A9utico-y-Sanitario.aspx (accessed Feb 10, 2021).
12. National Statistics Institute. Continuous census of inhabitants. https://www.ine.es/dyngs/INEbase/es/operacion.htm?c=Estadistica_C&cid=1254736177012&menu=ultiDatos&idp=1254734710990 (accessed Jan 15, 2021).
13. Ministry of Health, Social Services and Equality. Provisional prescription billing data. https://www.mscbs.gob.es/profesionales/farmacia/ (accessed Jan 10, 2021).
14. [Royal Decree-Law 16/2012, of 20 April, on urgent measures to guarantee the sustainability of the National Health System and improve the quality and safety of its services]. https://www.boe.es/eli/es/rdl/2012/04/20/16/con (accessed Jan 10, 2021).
15. Granda E. [Copayment: open debate]. Farmacia Profesional 2017;31(2):1-4
16. National Statistical Plan. Invoicing of Medical Prescriptions. https://www.mscbs.gob.es/profesionales/farmacia/datos/home.htm (accessed Jan 10, 2021).

www.pharmacypractice.org (eISSN: 1886-3655 ISSN: 1885-642X)