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Spending trends on neuropsychiatric drugs in Minas Gerais, Brazil: is the offer of anti-parkinson drugs increasing?

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Abstract *Neuropsychiatric drugs are used for a wide variety of neurological and psychiatric conditions. This article aims to analyze the trend and determinants of public expenditure of these medicines in Minas Gerais, from 2010 to 2017. Data from the Integrated Materials and Services Administration System (SIAD) database were used to estimate volumes of acquisition and expenditure. A breakdown analysis was performed, and the list of purchased drugs was reviewed, and the Drug Utilization technique (DU90%) applied concerning anti-Parkinson drugs. Annual expenditure dropped by 36%, from R$ 111.7 million in 2010 to R$ 40.9 million in 2017, and the determinant factors were the falling prices and volume, associated with changes in the drug mix, which favored the acquisition, on average, of more expensive products. Higher levels of expenditure for anti-Parkinson drugs stand out, however, with a significant change in the list purchased. This study contributed to a better understanding of public spending on neuropsychiatric drugs. A reduced volume can increase the risk of shortages. Regarding anti-Parkinson drugs, there is no evidence to suggest an increased supply to the population.*

Key words *Pharmaceutical Care, Drug Expenditure, Supply, Central Nervous System Agents, Anti-Parkinson Agents*

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Introduction

Neuropsychiatric drugs act on the Central Nervous System (CNS) and are indicated for the treatment of various neurological conditions, psychiatric disorders[1], and other uses, such as anesthetics in surgical procedures. Their use has been increasing exponentially, partly due to factors such as aging populations and lifestyle changes, which are leading to an increased prevalence of NCDs, such as depression, Alzheimer's, and Parkinson[2] disease.

Studies evaluating neuropsychiatric drugs' expenditure in several countries have pointed to growing spending trends. For example, in the U.S., a US$ 5.5 billion increase in the expenditure of these drugs has been recorded in the 2005-2009 period[3]. In Iran, neuropsychiatric drugs were considered one of the primary growth factors of the pharmaceutical market in the 2011-2016 period and were responsible for an increase expenditure of US$ 188 million[4]. In France, in 2016, CNS medications were responsible for 36.6% of the total medication expenditure[5]. Estimates point that neuropsychiatric drugs will correspond to 31.6% and 26.0% of the total drug expenditure in developed and developing countries in 2020, respectively[6].

In Brazil, studies on public spending on neuropsychiatric drugs are still scarce. A nationwide investigation from 2007 to 2014 showed federal spending of US$ 54.6 million on the purchase of these drugs[7].

The information is even more scarce regarding the expenses with the specific pharmacological classes of this therapeutic group. A nationwide study revealed that spending on anesthetic drugs increased 12.9 times between 2006 and 2013, from US$ 7.4 million to US$ 20.2 million[8]. Another study carried out in Minas Gerais between 2010 and 2015 showed that spending on antidepressants, anxiolytics, and hypnotic-sedative drugs increased 2.5 times in the period, from R$ 7.5 million to R$ 18.7 million reais[9].

However, it is important to note that while the levels of spending on neuropsychiatric drugs are, to some extent, known, the composition of these expenditures by therapeutic class, the determining factors, and the spending trend over time are less understood.

Understanding the dynamics of public spending on these drugs contributes to the more efficient allocation and management of available financial resources in a context of growing need for neuropsychiatric drugs and where financial resources to ensure comprehensive therapeutic care are finite.

While a previous study investigated and identified the determinants of public spending on antidepressants, anxiolytics, and hypnotic-sedatives[9], this work updates and expands on the previous analysis, considering eight years of evaluation of public spending on the acquisition of neuropsychiatric drugs in Minas Gerais.

Therefore, this work aims to assess the neuropsychiatric drugs' expenditure and, specifically, concerning anti-Parkinson drugs, to investigate the acquired list and its impact on the expenses incurred.

Methods

Context

The State of Minas Gerais is located in the Southeast region of Brazil and has a territorial extension of 586,528.293 km² and 853 municipalities, the largest in the number of municipalities and the second in population size in the country (21,119,536)[10]. Its MHDI is 0.731, ranking 9th in Brazil. The state ranks third in the participation in the National GDP, totaling R$ 598.5 billion reais[11] in 2018.

Minas Gerais has a triple burden of diseases, namely, a strong predominance of chronic diseases and conditions linked to human reproduction, coexisting with infectious and parasitic diseases and external causes[12]. In the 2010-2017 period, for example, the leading causes of mortality in the state were, in this order, diseases of the circulatory system, neoplasms, diseases of the respiratory system, and external causes[13]. Results of the *Global Burden of Diseases* project place the state as one of the most affected in the country concerning the burden of Chagas disease and mental disorders resulting from the use of psychoactive substances[14].

Design and data source

This paper is nested in the research *Study of the supply of medicines in Minas Gerais. Supply Project*[15] (free translation from Portuguese). This is a longitudinal Drug Use Study that aims to investigate the supply of medicines in Minas Gerais, through the evaluation of public purchases of these products. This work focuses specifically on the purchase of neuropsychiatric drugs, which are those operating in the CNS.

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The data source is the Integrated Materials and Services Administration System (SIAD), available on demand[16]. SIAD aims to integrate purchasing management with budget management, recording public purchases made and effectively delivered within the scope of Minas Gerais state management.

The following variables were selected for the 2010-2017 period for this study: the name and presentation of each neuropsychiatric medication, the number of drugs purchased, unit prices, and year of purchase. Medicines were classified using the ATC/DDD[17] system up to the fifth level (chemical substance), and products of the ATC class "N" (Central Nervous System) were selected. The medications were added as per the therapeutic subgroup: Anesthetics (N01), Analgesics (N02), Antiepileptics (N03), Anti-Parkinson drugs (N04), Psycholeptics (N05), Psychoanaleptics (N06) and Other Drugs of the Central Nervous System (N07). The number of chemical substances and pharmaceutical presentations was estimated for each subgroup.

Data analysis

The data were analyzed using Microsoft Excel 2016 software (Microsoft Corporation, 2016) in two steps described below.

Step 1. Neuropsychiatric drugs: evaluation of expenditure

The total number of each drug purchased, in the corresponding pharmaceutical presentation, was aggregated according to pharmaceutical units (tablets, injectable solution, oral solution, tubes, transdermal patches, and others) to estimate the purchase volumes. The volume of each drug was multiplied by its purchase price adjusted by the Broad Consumer Price Index (IPCA) for December 31, 2017[10], to estimate the expense. The total annual expenses and volumes of neuropsychiatric drugs were estimated considering the years from 2010 to 2017 and the total annual expenses and volumes, accumulated totals, and variations in the period by therapeutic subgroups.

Then, a breakdown analysis was performed to assess the factors determining the expenditure variation[9,18]. The expenditure variation indicator (G) for a given therapeutic/pharmacological class is obtained by multiplying its three components: price variation (P), volume variation (V), and acquisition list or drug mix variation (D). Therefore, each drug presentation and the corresponding therapeutic subgroup are considered to produce the estimates. Moreover, two comparative periods are adopted, base and final, which in this case were 2010 and 2017, respectively, using the following formula:

$$G = P \times V \times D = \frac{\sum P_1 V_0}{\sum P_0 V_0} \; X \; \frac{\sum V_1}{\sum V_0} \; X \; \frac{(\sum P_1 V_1 / \sum V_1)}{(\sum P_1 V_0 / \sum V_0)}$$

Where P0 = Weighted average price per drug presentation in the base period; P1 = Weighted average price per drug presentation in the final period; V0 = Volume purchased for drug presentation in the base period; V1 = Volume purchased for drug presentation in the final period.

For each therapeutic subgroup, the component "price variation" in the formula is obtained by the total of the multiplication of the weighted average price of each drug presentation in the final period (2017) by the volume purchased of this drug in the base period (2010), divided by the total of the multiplication of the weighted average price of the presentations in the base period (2010) by the volume in the base period (2010). The "volume variation" component is obtained by dividing the total volumes of drug presentations in the final period (2017) by the base period (2010). Finally, to estimate the drug mix, that is, the variation in the acquired list, the weighted average price values of the final period (2017) are fixed, and mathematical operations are carried out with the variables price and volume as performed for the other components, according to the formula presented.

The Breakdown Analysis' results are obtained by therapeutic/pharmacological class, and the components P, V, and D can have values higher than, less than or equal to 1. For the interpretation of these results, if the value is greater than 1, the component contributes positively to increased expenditure; if less than 1, the component contributes to reduced expenditure; and if it is equal to 1, the component does not contribute to the expenditure variation.

Step 2. Anti-Parkinson drugs: impact of the drug list

From the results obtained in the first stage, considering the significant increase in expenses with anti-Parkinson drugs (N04), and where determining factors for this increase have been sharp price reduction, increased acquisition volumes, and change in the drug mix, we selected this subgroup for further analysis.

Initially, the volume of purchase of each drug was characterized in Defined Daily Do-

ses (DDDs), considering that this information is available for all drugs in this subgroup in the ATC/DDD system. DDD is a standard measure that corresponds to the average daily maintenance dose of a drug when used in its main indication[17]. Moreover, the weighted average acquisition prices for each drug presentation in 2010 and 2017 were calculated.

The DrugUtilization 90% (DU90%) method was used to identify the main anti-Parkinson drugs concerning the acquisition volume. In this analysis, the products purchased in the period are classified in decreasing order of the total volume purchased, measured in DDDs[19]. Then, the individual participation of each one against the total volume is calculated. Two comparison periods were evaluated, namely, 2010 and 2017.

Ethical aspects

This research does not involve human participants, specimens or tissue samples, vertebrate animals, embryos, and the use of data directly obtained from participants or based on identifiable information or that may carry risks. The data used in this work derive from a secondary public procurement database, from the state administration. No risk situation requires the adoption of legal procedures for its implementation[20].

Results

From 2010 to 2017, R$ 850.9 million was invested with the acquisition of more than 4.3 million units of neuropsychiatric drugs in Minas Gerais, and annual expenses decreased by 63.8%, from R$ 111.7 million in 2010 to R$ 40.9 million in 2017. The volume decreased 65.5%, ranging from 472,000 in 2010 to 163,000 in 2017 (Figure 1).

During the period, 168 chemical substances were acquired in 565 presentations of the seven CNS therapeutic classes. Considering all the therapeutic subgroups acquired, only two showed increased expenditure, anti-Parkinson drugs (N04), and anesthetics (N01). In particular, anti-Parkinson drugs were the class in which gross expenditure grew most in the period, from R$ 1.9 million in 2010 to R$ 7.7 million in 2017, an increase of 305.3%. Anesthetics grew more modestly, from R$ 2.0 million in 2010 to R$ 3.5 million in 2017, an increase of 75.0% (Table 1).

The results of the breakdown analysis are shown in Table 2. In general terms, price (P=0.44) and volume (V=0.35) adversely affected expenditure, whereas the drug mix (D=2.27) had a positive effect, showing a general reduction in expenditure in 2017 when compared to 2010 (E=0.35).

Increased expenditure was recorded only for anesthetics (G=1.77) and anti-Parkinson drugs (G=3.98). Anesthetics showed a positive index for both volume (V=1.67) and drug mix (D=1.18). Anti-Parkinson drugs also had positive indexes for volume (V=8.27) and drug mix (D=1.77).

The results of the specific analyses for the class of anti-Parkinson drugs are shown in Table 3 and Figure 2.

The list of anti-Parkinson drugs has considerably changed when comparing 2010 and 2017. In 2010, 5 drugs in 10 pharmaceutical presentations were purchased. In 2017, 9 drugs in 14 different pharmaceutical presentations were added.

It can be seen that, in general, the volume of purchased DDDs increased about six-fold, going from 393.3 thousand DDDs in 2010 to 2.7 million DDDs in 2017. The most significant increase in volume was observed for drug biperiden in the 2mg tablet presentation, which hiked from 16.6 thousand DDDs in 2010 to 1.0 million in 2017.

In general, the total weighted average price (WAP) showed little variation in the period (Table 3). In 2010, the WAP ranged from R$ 0.12 to R$ 6.63, and 1mg pramipexole had the highest WAP. In 2017, the WAP ranged from R$ 0.15 to R$ 4.75. In the case of drugs purchased in both 2010 and 2017, only the association of levodopa 100mg with benserazide 25mg showed a significant reduction in WAP, from R$ 1.52 in 2010 to R$ 0.78 in 2017 (49%). A critical variation was observed in the WAP between the combination of levodopa/carbidopa/entacapone and its different presentations, in which their WAP was 2.5 times more expensive than the average of other drugs in the same class.

The results of the analysis of DU90% of anti -Parkinson drugs (N04) are shown in Figure 2. In both 2010 and 2017, three drugs were responsible for approximately 80% of the volume purchased. A variation was observed in this list, where only the association of levodopa with benserazide as second in the ranking, but in different pharmaceutical presentations, coincided in the two periods.

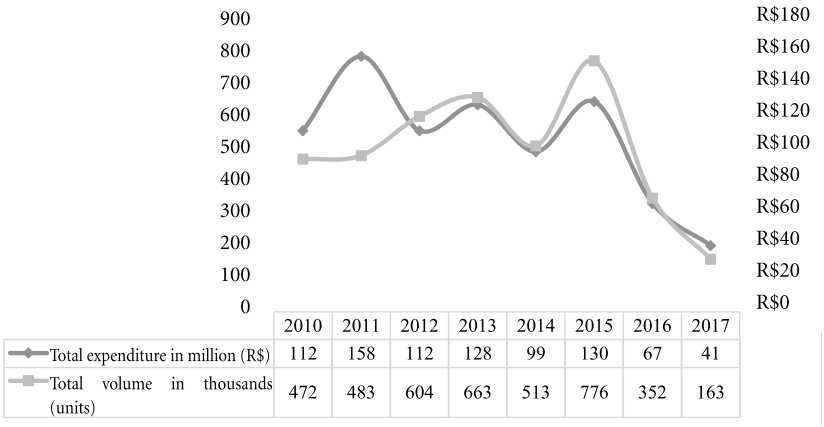

Figure 1. Total annual expenditure and volume of neuropsychiatric drugs. Minas Gerais, Brazil, 2010-2017.

Source: Elaborated by the authors.

Table 1. Therapeutic subgroups, total annual expenditure, and volumes, accumulated totals, and variations in the period. Minas Gerais, Brazil, 2010-2017.

Therapeutic subgroup	Chemical substances (number of pharmaceutical presentations)	Annual Expenditure R$ (million)[a]			Accumulated expenditure R$ (million)[a]	Annual Volume (pharmaceutical units in thousands)			Accumulated Volume
		2010	2017	Variation[b] (%)	2010 to 2017	2010	2017	Variation[b] (%)	2010 to 2017
Anesthetics (N01)	24 (43)	2.0	3.5	75	20.5	0.370	0.618	67	4.764
Analgesics (N02)	21 (69)	8.5	3.8	-55.3	57.6	201.934	38.625	-80.9	1,012.593
Antiepileptics (N03)	20 (92)	14.9	7.0	-53.0	132.2	157.602	37.984	-75.9	1,248.489
Anti-Parkinson drugs (N04)	13 (32)	1.9	7.7	305.3	145.1	1.225	10.139	727.7	228.490
Psycholeptics (N05)	42 (158)	70.8	10.4	-85.3	276.0	64.311	29.014	-54.9	599.370
Psychoanaleptics (N06)	35 (147)	12.1	8.0	-33.9	198.4	46.066	45.943	-0.3	926.994
Other CNS drugs (N07)	14 (24)	1.3	0.2	-3.77	21.1	0.220	0.452	105.5	7.524
Total	168 (565)	111.7	40.9	-63.8	850.9	471.7	162.7	-65.5	4.028

[a]Prices adjusted by the Broad Consumer Price Index (IPCA) of December 2017; [b]Variation = [(∑2017-∑2010)/∑2010] *100.

Source: Elaborated by the authors

Discussion

In general, the results of this study showed a significant decrease in expenditure incurred with the acquisition of neuropsychiatric drugs in the State of Minas Gerais between 2010 and 2017, whose determining factors were price and volume decline, associated with drug changes mix, opting for the acquisition of products that were, on average, more expensive. Together, these observations point to (1) a declining use of financial resources in the acquisition of this class of drugs and (2) a reduced efficiency of the public procurement process for neuropsychiatric drugs.

Table 2. Results of the expenditure breakdown analysis of neuropsychiatric drugs. Minas Gerais, Brazil, 2010-2017.

Therapeutic subgroup	Price Variation (P)[a]	Volume Variation (V)[b]	Drug Mix Variation (D)[c]	Expenditure Variation (G)[d]
Anesthetics (N01)	0.90	1.67	1.18	1.77
Analgesics (N02)	0.45	0.18	1.86	0.45
Antiepileptics (N03)	1.06	0.24	0.10	0.46
Anti-Parkinson drugs (N04)	0.27	8.27	1.77	3.98
Psycholeptics (N05)	0.25	0.45	1.26	0.14
Psychoanaleptics (N06)	0.50	0.99	1.33	0.66
Other CNS drugs (N07)	0.09	2.05	1.01	0.20
Total	0.44	0.35	2.27	0.35

[a]Price Variation = $\sum(P_{2017}xV_{2010})/\sum(P_{2010}xV_{2010})$; [b]Volume Variation = $\sum V_{2017}/\sum V_{2010}$; cDrug Mix Variation = $[\sum(P_{2017}xV_{2017})/\sum V_{2017})]/[\sum(P_{2017}xV_{2010})/\sum V_{2010})]$; [d]Expenditure Variation = Price Variation x Volume Variation x Drug Mix Variation.

Source: Elaborated by the authors.

Table 3. Anti-Parkinson drugs purchased, volume, and average purchase price. Minas Gerais, Brazil, 2010-2017.

Chemical substance	2010		2017	
	Volume (DDD)[a]	WAP[b] (R$)	Volume (DDD)[a]	WAP[b](R$)
Amantadine (N04BB01)				
100mg tablets[c]	-	-	94,800	0.42
Biperiden (N04AA02)				
2mg tablets[c]	16,623	0.12	1,001,510	0.15
5mg/ml injectable[d]	50	1.95	850	1.66
Bromocriptine (N04BC01)				
2.5mg tablets[c]	-	-	5,133.6	1.85
Entacapone (N04BX02)				
200mg tablets[c]	-	-	106,650	1.63
200mg coated tablets[e]	-	-	322,686	2.36
Levodopa/Benserazida (N04BA02)				
100mg+25mg caps[f]	1,520	1.28	-	-
100mg+25mg tablets[c]	130,666.7	1.52	169,693.3	0.78
100mg+25mg cdispersible tablets[g]	120	1.31	-	-
200mg+50mg tablets[c]	-	-	678,573.3	0.7
Levodopa/Benserazide (N04BA02)				
250mg+25mg tablets[c]	3,944.4	0.48	55,354.4	0.50
Levodopa/Carbidopa/Entacapona (N04BA03)				
50mg+12,5mg+200mg coated tablets[e]	-	-	240	4.31
100mg+25mg+200mg coated tablets [e]	-	-	800	4.53
1500mg+37,5mg+200mg coated tablets[e]	-	-	640	4.75
Pramipexole (N04BC05)				
0,125mg tablets[c]	691.5	0.54	-	-
0,25mg tablets[c]	38,214	1.28	-	-
1mg tablets[c]	21,216	6.63	-	-
Selegiline (N04BD01)				
5mg tablets[c]	-	-	272,960	0.65
10mg tablets[c]	180,240	2.01	-	-
Trihexyphenidyl (N04AA01)				
5mg tablets[c]	-		3,570	0.20
Total	393,285.6	1.71	2,713,460.6	1.75

[a]DDD = Defined Daily Dose; [b]WAP = Weighted Average Price =∑ of purchase values/total acquisitions; [c]Tablet; [d]Injectable Solution; [e]Coated Tablet; [f]Capsules; [g]Dispersible Tablet.

Source: Elaborated by the authors.

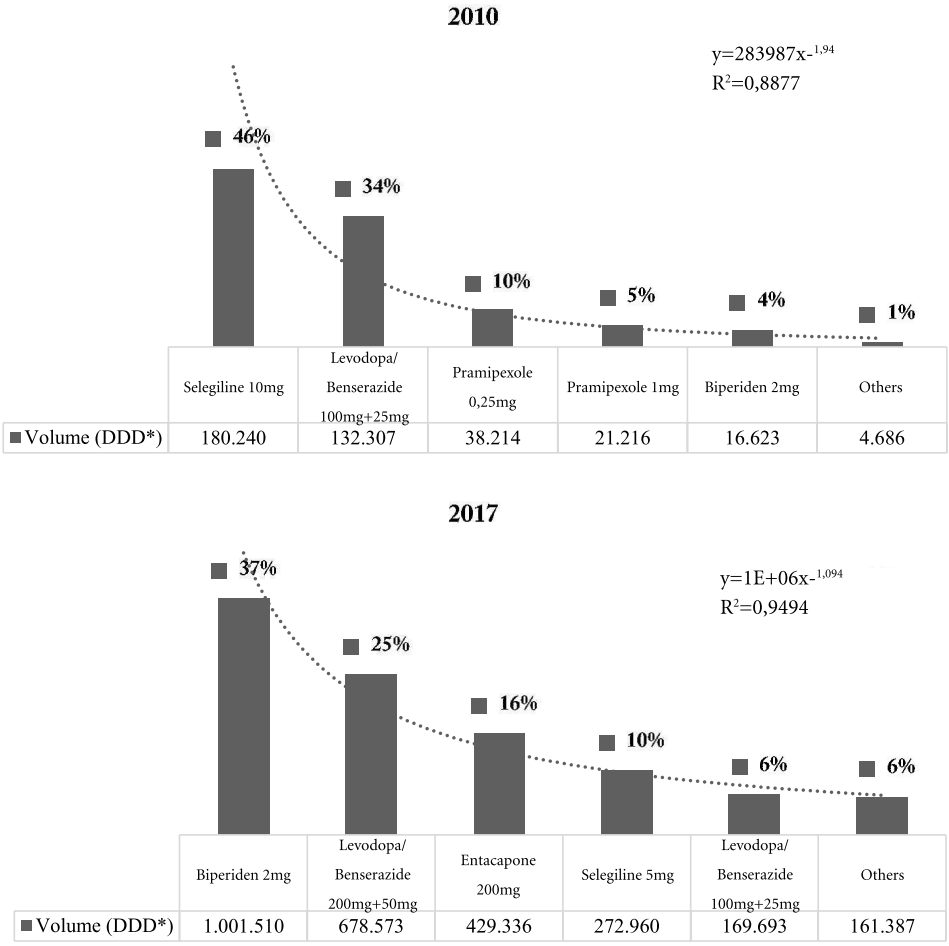

Figure 2. Result of Drug Utilization analysis 90% (DU90%) for antiparkinsonians. Minas Gerais, Brazil, 2010-2017.

*DDD: Defined Daily Dose.

Source: Elaborated by the authors.

The reduced financial contribution for the procurement of neuropsychiatric drugs coincides with the period of public finance crisis in Brazil, in general, and specifically in the State of Minas Gerais, characterized by the mismatch between the paths of mandatory revenues and expenses, with a significant reduction of fiscal space[21], which may have played an essential role in state health budgets. Between 2015 and 2017, real spending on medicines in the SUS in Brazil fell by 7%[22].

Another possible factor is the decentralization of public procurement of medicines to municipalities, following the publication of the Pharmaceutical Care Regionalization Strategy (ERAF) policy by the State Health Secretariat in 2016[23]. However, it is essential to note that the ERAF policy's impact was small, as it only influences the Primary Care Medication List and acts only at the end of the observation period. Additionally, the Ministry of Health's centralized acquisition of high-cost drugs was previously acquired by the State Health Secretariat, such as olanzapine, clozapine, quetiapine, and rivastigmine, as of 2012[24], may have also contributed to these results. Considering only expenditures with these medications, a ten-fold reduced expenditure is observed, from R$ 54.9 million in 2010 to R$ 5.5 million in 2017.

Also noteworthy are the demands involving judicialization and the incorporation of technologies, as both have a significant impact on health budgets. In Minas Gerais, state spending on health judicialization totaled R$ 691.6 million[25] between 2013 to 2015. A cohort study of patients with rheumatoid arthritis conducted between 2008 and 2013 showed that each vial of a single biological drug, etanercept, cost, on average, R$ 1,300-R$ 1,500 to state public coffers[26]. Given this scenario, it is plausible to assume that the state reallocates financial resources that could be used for neuropsychiatric drugs for other demands.

Although Brazilian government purchases are governed by the Bidding Law and other subsidiary laws[27,28] that seek the lowest price and the best quality of the products purchased, the evidence in this study points to lower efficiency of the public procurement process for neuropsychiatric drugs. It is noteworthy that this efficiency of purchases, in the case of medicines, concerns the selection of products, based on epidemiological and technical criteria[29], associated with the falling prices and the maintenance or increase of purchase volumes[30], since it is necessary to ensure people's access to pharmacotherapy. Minas Gerais shows that falling prices were accompanied by declining volumes associated with the change in the drug mix, with the purchase of products with higher average prices, a trend that threatens the very sustainability of the system.

The results by therapeutic subgroups show that only two had increased spending in the period studied, anesthetics (N01), and anti-Parkinson drugs (N04). Anti-Parkinson drugs, in particular, showed the highest growth in expenditure, with a variation of 305.3%. Moreover, this group showed a significant price drop, volume elevation, and variation in the drug mix.

The upward trend in pharmaceutical spending on anti-Parkinson drugs is being observed in several countries worldwide[31,32]. One of the possible reasons would be the increased incidence and prevalence of Parkinson's disease (PD), treated mainly with anti-Parkinson drugs[33,34]. In the United Kingdom alone, the annual incidence of PD is 8,000 new cases[35]. The prevalence of PD is expected to double by 2030 in European countries[36], and, considering that this prevalence increases with age, one may expect significant growth in the number of cases in Brazil as well, compatible with the country's age pyramid. Furthermore, an increase in the mean duration of PD treatment[37] is foreseen due to increased life expectancy.

The volume of anti-Parkinson drugs in DDDs purchased by the State of Minas Gerais increased significantly, from 393.3 thousand DDDs in 2010 to 2.7 million DDDs in 2017. Similar results were found in a study carried out in Croatia, which showed an elevation in the use of anti-Parkinson drugs, up from 78.0 thousand DDDs in 2000 to 2.5 million DDDs in 2010, an increase of 218%[38].

Among the factors that explain the increased spending on anti-Parkinson drugs is the change in the list of medications found in 2017 when compared to 2010, both in the number of drugs and pharmaceutical presentations. Moreover, the ranking of products concerning volume and average purchase price also varied in the two study periods.

Thus, in 2010, for example, drug selegiline was responsible for almost half of the volume acquired of anti-Parkinson drugs, with the second-highest average price compared to the list acquired that year. It is important to note that selegiline does not appear on the list of the first anti-Parkinson drugs concerning purchased volume in international studies since it is a therapeutic alternative reserved for specific situations of use[39,40]. According to official national and international PD treatment protocols, this drug is indicated in the initial phase of the disease, as monotherapy and when symptoms are mild, that is, when there are no functional impairments and complications of daily living[41-43]. These restrictions were already included in the official protocols of the Ministry of Health, which was in force between 2010 and 2017[41,44] and which were maintained in the current document[41]. Another aspect worth considering is that there was no factory price regulation for this selegiline presentation by the Brazilian Medicines Market Regulation Chamber (CMED) in 2010[45].

In 2017, biperiden started to lead the ranking of the highest volume acquired. This drug is indicated for the initial treatment phase of PD, but it is not the first choice according to official protocols[41-43] and, as per international surveys[46,47], is also not among the most used anti-Parkinson drugs. Studies indicate that, except for the early onset of tremor, biperiden is not extensively prescribed for PD due to a high frequency of adverse effects, such as xerostomia, urinary retention, mental confusion, hallucinations, and cognitive impairment[38,47].

Another relevant drug in this study is levodopa combined with benserazide, responsible for the second-largest volume acquired, both in 2010 and 2017. This result is, to some extent,

expected, since levodopa, in combinations, has been the most consumed anti-Parkinson drug, according to some international studies[46-49]. Official national and international protocols set this medication as the gold standard of treatment for the control of symptoms that cause functional impairment in PD, especially stiffness and bradykinesia. The association is also indicated in cases of patients with advanced PD[41-44,50,51]. Furthermore, this medication also has a good cost-benefit ratio and a lower number of side effects in the short term[52].

In general, the prices of acquired anti-Parkinson drugs did not change significantly between 2010 and 2017. However, noteworthy is the inclusion of higher-priced products, such as the different presentations of levodopa associated with carbidopa and entacapone. Some studies show that the combination of the three drugs is more effective in the treatment of PD[53,54]. Moreover, the combined dose in a single medication can facilitate adherence to treatment, especially in patients who have difficulty swallowing[55]. While evidence in the literature shows the relevance of this drug association, this product is not included in official Brazilian protocols[41,44]. There is a lack of cost-effectiveness studies to support decisions to include these drugs in the free distribution list[56,57].

Some limitations of this study should be considered. The database only contains records of the products purchased and lacks data on the use of medicines in clinical practice. Thus, it is not possible to state that all anti-Parkinson drugs were acquired for PD treatment. For example, drug biperiden, one with the highest acquisition volume, is widely used for other conditions, such as in the treatment of side effects in patients using antipsychotics[58], in sleepwalking refractory cases[59] and in the treatment of cocaine/crack addiction[60]. Another important aspect is that the drug purchase records in the SIAD do not allow systematically identifying which purchases are made as a result of court orders, which may have interfered with the implementation of the drug purchase policy by the State of Minas Gerais. On the other hand, it should be noted that SIAD is a database with several advantages for studies of this nature, with good representativeness and coverage of records, reliability, and standardization of the collected data, and continuity in the registration of these data over time, allowing longitudinal comparisons. It is suggested to standardize purchase records by court orders to further improve this database, in order to allow more specific investigations.

In summary, this study allowed a greater understanding of the determinants of public spending on neuropsychiatric drugs, revealing a significant reduction in the volumes purchased, which points to the need to review the public procurement practices to avoid the risk of shortages. Regarding anti-Parkinson drugs, despite the increase observed in acquisition volumes, the results found cannot be interpreted as an increase in the supply of these drugs to the population.

Collaborations

All authors participated in the conception, planning, analysis, interpretation and writing of the work. All authors read and approved the final version and made significant contributions in the writing of this manuscript.

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