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Differences in prescribed medicine availability in Primary Health Care: evidence from the Prover Project

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Abstract *This is a cross-sectional study on the availability of prescribed medicines in Primary Health Care (PHC), with a probabilistic sample of 1,221 users of public pharmacies in a health pole municipality in Minas Gerais, in 2017. Medicine availability indicators were estimated, and a hierarchical logistic regression was performed, according to the behavioral model of health service use. Only 39.3% of patients received all medicines in the prescribed quantities. The most and the least available medicines were, respectively, those for the digestive system/metabolism, and for blood and hematopoietic organs. Full availability of the prescribed treatment was associated with higher schooling (≥ 8 years OR: 1.7; 95% CI: 1.3-2.4); proximity to the pharmacy (≤15 min OR: 1.7; 95% CI: 1.2-2.3); absence of out-of-pocket expenditure on medicines (OR: 2.2; 95% CI: 1.7-2.9), and a smaller number of prescription drugs (≤ 2 OR: 3.2; 95% CI: 2.3-4.4; 3/4 OR: 1.6; 95% CI: 1.2-2.1). These results showed differences in medicine availability within the Brazilian Unified Health System (SUS), and highlighted the need to reorganize the dispensing services network and pharmaceutical procurement planning, as well as to develop public policies to protect the vulnerable population.*

Key words *Primary health care, Pharmaceutical services, Prescriptions, Provision, Medicines*

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Introduction

Brazil has one of the largest public health systems in the world, the Unified Health System (SUS), which is coordinated by three management spheres: federal, state, and municipal. As an integral part of SUS, Pharmaceutical services (PS) has been reoriented after the implementation of the National Medication Policy in 1998[1], in order to ensure greater access to medicines by the population. Over more than 20 years, several measures have been adopted to increase the supply of medicines and to minimize the costs of purchasing pharmaceutical products[2].

One of SUS' organizational pillars is the decentralization of actions, including PS, making municipalities responsible for service provision, especially in the context of Primary Health Care (PHC)[3]. Some municipalities have their lists of essential drugs (REMUME) and, thus, ratify the commitment to supply these products to SUS users. Medicines are dispensed in public pharmacies, and it is usually necessary to present a prescription, which must comply with the items agreed upon by the municipality[3].

Even with the advances resulting from policies aimed at improving access to medicines, some studies have shown managerial and organizational problems in PHC pharmacies, such as those related to infrastructure, service, and lack of medicines[3-5].

The adequate supply of medicines has become a challenge for SUS, since Brazil is the only country with more than 100 million inhabitants with a public, universal, and free health care system[6]. Failures in the availability of medicines in the system can trigger underutilization of such products and lead to therapeutic failure, as well as to increased morbidity and mortality rates, returns to services, and public and out-of-pocket health expenditure[7,8].

Considering that PS actions should be guided to ensure the principle of equity[9], it is important to identify the social groups most likely to obtain medicines through SUS to support the planning and reorientation of policies to improve access to medicines. Given that studies on the availability of medicines in PHC and its associated factors are scarce in Brazil, the need for investigations to identify the population of users that are most likely to obtain all the prescribed pharmacotherapy is reinforced.

Thus, this study aims to analyze the availability of medicines in PHC pharmacies and to determine the factors associated with the full treatment availability.

Methods

Study area, design and population

This study is part of the Prover Project, a cross-sectional survey conducted from August to November, 2017 in a large municipality in Minas Gerais, with more than 200,000 inhabitants. This is a health care pole municipality in the state of Minas Gerais, as it is a reference for other localities in the same region, at any care level of SUS[10]. The municipality has five PHC medicine dispensing services located in regional health areas in order to serve the entire population in such areas.

The Prover Project had a field team consisting of trained interviewers, a field supervisor, and technical-support fellows. Data were collected on paper and entered into final validated, corrected, and formatted databases.

The study population consisted of a probabilistic sample proportional to the number of users served by all PHC medicine dispensing services. Since the investigation was designed to assess multiple events of interest, the sample size was calculated considering 50% prevalence, a 95% confidence level, and a 3% tolerated margin of error, resulting in a maximum sample size of 1,067 individuals. A percentage of 15% was added, totaling a sample size of 1,228 individuals to compensate for possible losses.

Eligible participants were individuals over the age of 18, who had been using the dispensing services for at least six months, and who went to collect medicines for themselves on the day of the interview. Only users who had their medication prescription in hand were selected.

During the data collection period, all users of the dispensing services were approached by the interviewers, who introduced themselves, distributed leaflets about the project, and clarified the objectives of the study. After dispensing, the users were again approached and invited to participate. Those who accepted, answered the full questionnaire, and those who refused, answered a refusal questionnaire. These procedures were adopted to minimize selection bias and ensure a probabilistic sample.

The complete questionnaire consisted of a multi-item instrument pre-tested in a test-retest and pilot reliability study. The research team developed instrument, based on similar questions to those used in large national and international surveys[11-14]. The refusal questionnaire contained the same questions as those in the main questionnaire, concerning sex, age, and self-reported skin color.

Ciência & Saúde Coletiva, 27(3):1191-1203, 2022

Data on all prescriptions and all dispensed medicines were also collected. For each prescription, the names of each of the prescribed medicines, their concentrations, pharmaceutical forms, administration routes, total quantities prescribed, and treatment durations were recorded, when specified. In addition, patients were asked whether they had obtained the medicines, and if so, whether the necessary quantities had been dispensed to fulfill the treatment. In order to confirm the information, the prescriptions and the products obtained during dispensing were compared. The reasons for not obtaining the medicines were questioned when applicable. Answers such as: (1) "I did not need the medicine because I already have it at home"; (2) "I did not seek this medicine because I thought it was not necessary for me"; and (3) "I get this medicine from the popular pharmacy" were excluded from the analysis.

Data analysis

The analyses were conducted in two stages, and in the first stage, the prescribed medicines were considered. Each medicine was classified according to (1) the anatomical-therapeutic-chemical coding (ATC)[15], and (2) according to its inclusion in the Municipal Medicine List (REMUME). For this study, only drugs classified as "present on REMUME" were included, i.e., when the active ingredient and pharmaceutical form were on the list in force in 2017[16]. The absolute frequencies and proportions of prescribed medicines were presented, according to their main anatomical group (1st ATC level) and therapeutic subgroup (2nd ATC level).

Each medicine was considered "available" in public pharmacies if supplied in sufficiently to fulfill the entire treatment. Absolute frequencies were estimated, and three availability indicators were built: overall availability, availability by the major anatomical group, and availability by the therapeutic subgroup.

Overall medicine availability:

$$\frac{\text{Number of medicines made available by the services}}{\text{Total of number of prescribed medicines}} \times 100$$

Availability by major anatomical groups:

$$\frac{\text{Number of available medicines in each anatomical group}}{\text{Total number of medicines prescribed in each anatomical group}} \times 100$$

Availability by therapeutic subgroups:

$$\frac{\text{Number of available medicines in each therapeutic subgroup}}{\text{Total number of medicines prescribed in each therapeutic subgroup}} \times 100$$

Subsequently, the "full treatment availability" indicator was estimated, classifying it as "full" only if all prescribed medicines were considered available. The prevalence of full treatment availability was calculated by the following formula:

$$\frac{\text{Number of users with fully available treatment}}{\text{Study population}} \times 100$$

In the second stage, the factors associated with the full treatment availability were analyzed (dichotomous variable, "yes" or "no" type). The independent variables were organized based on the behavioral model of health service use proposed by Andersen (1995). This model establishes that the use of health services by individuals is the result of three main factors: (1) predisposing (which predispose the demand for services); (2) enabling (which facilitate or impede access to services); and (3) need factors (representing the perception of health status by individuals or by health professionals, which has an impact on the need for care)[17].

In this study, the predisposing factors consisted of variables sex, age, self-reported skin color (white/non-white), education (number of completed schooling years), and marital status (single/divorced/widowed; married/common-law partner).

As enabling factors, the following were considered: monthly personal income (in minimum wages); health insurance coverage (yes/no); travel time to the pharmacy (in minutes), and out-of-pocket expenditure on medicines in the past three months (yes/no).

As need factors, the following were considered: number of medicines prescribed in the past 15 days (1-2; 3-4; 5 or more); self-assessment of health (very good/good; fair/poor/very poor);

number of health conditions (up to two/three or more - evaluated on basis of the previous medical diagnosis reporting of high blood pressure, cardiovascular diseases, diabetes, pulmonary diseases, peptic ulcer, anxiety/depression, and hypercholesterolemia); physical activity practice (yes/no, with the data being collected through the question: "*In your daily life, do you engage in any kind of physical exercise, such as walking, running, gymnastics, cycling, or sports such as soccer, volleyball, wrestling?*"); recent alcohol use (yes = once or more times a month/every week/every day in the past 30 days; no = less than once a month/I never drink) and current smoking (yes = daily/once or more times a week/more than once a month; no = never smoked/not smoking currently).

Bivariate analyses were performed using logistic regression, with odds ratio (OR) estimates and their respective 95% confidence intervals. The hierarchical logistic regression model was used for the multiple analysis. The independent variables were grouped into three hierarchical levels, in the following order: predisposing, enabling, and need factors. For this step only the variables showing $p<0.20$ in the bivariate analysis were selected. Initially, a model was built with the predisposing factors adjusted to each other (Model 1). Variables showing $p<0.05$ were maintained and entered the next level adjustment. Model 2 was then composed of the enabling factors, adjusted by the significant variables from the previous level. Finally, Model 3 was represented by the need factors, adjusted by the variables showing statistical significance in the two previous models. Interpretations of odds ratios and significance levels were performed according to the respective levels of origin of the variables. Multicollinearity was analyzed through bivariate correlation tests between the explanatory variables. The models were compared using the Likelihood Ratio Test and Akaike's criterion (AIC), and the best predictive power was observed in the model with the lowest AIC value[18]. All data were analyzed using the Stata software (StataCorp LP, College Station, USA) version 15.1.

Ethical aspects

Users participated voluntarily, after reading and signing the Informed Consent Form (ICF). The Prover Project was approved by the Ethics Committee of Oswaldo Cruz Foundation, Brazil, according to report number 1.395.369.

Results

Dispensed Medicines

Of the 4,591 prescribed medicines, 4,039 (88%) were listed on REMUME and were, therefore, included in the analysis. Among these, 2,818 (69.8%) were considered available, that is, they were dispensed to users in the quantities needed for treatment.

Table 1 shows the frequency distributions of prescribed and available medicines according to major anatomical groups and therapeutic subgroups.

The five most prescribed anatomical groups of medicines were those for treatment of the cardiovascular system (48.8%), followed by the digestive system and metabolism (16.6%), central nervous system (14.0%), blood and hematopoietic organs (8.5%), and hormones for systemic use (3.9%). Among these, it was observed that availability ranged from 56.1% to 80.1%, with the lowest prevalence among medicines acting on the blood and hematopoietic organs, and the highest among medicines acting on the digestive system and metabolism.

Considering the drugs that act on the cardiovascular system, it was observed that availability ranged from 49.2% to 91.4%, according to the therapeutic subgroup. Among the subgroups with higher prescription frequency, diuretic agents and those acting on the renin-angiotensin system showed availability of approximately 60%, while among the hypolipemic agents, the supply was over 90%.

Among the drugs that act on the digestive system and metabolism, antidiabetic agents are the most frequently prescribed, of which 69.4% were supplied.

Specifically in the group of medicines that act on the central nervous system, the low availability of antiepileptics (37.1%) and psycholytics (55.7%) is highlighted.

Factors associated with full availability of the prescribed treatment

The study included 1,186 individuals who met the inclusion criteria, i.e., who were prescribed only medicines listed on REMUME. The comparison between respondents (n=1,186) and non-respondents (n=387) showed no statistically significant differences at the 5% significance level for sex (p=0.289), race/color (p=0.941), or age (p=0.261).

Ciência & Saúde Coletiva, 27(3):1191-1203, 2022

Table 1. Major anatomical groups (1st ATC level) and therapeutic subgroups (2nd ATC level) prescribed and available in public pharmacies. Prover Project, 2017.

Anatomical group (1st ATC level) and Therapeutic subgroup (2nd ATC level)	Prescribed		Available	
	n[a]	%[b]	n[c]	%[d]
Cardiovascular System (C)	1972	48.8	1432	72.6
Hypolipemiants (C10)	383	9.5	350	91.4
Beta blockers (C07)	240	5.9	183	76.3
Calcium channel blockers (C08)	169	4.2	119	70.4
Diuretics (C03)	495	12.3	344	69.5
Agents that act on the renin-angiotensin system (C09)	585	14.5	384	65.6
Cardiac stimulants/Cardiotonics/Glycosides (C01)	33	0.8	19	57.6
Anti-hypertensives (C02)	67	1.7	33	49.2
Digestive System and Metabolism (A)	669	16.6	536	80.1
Antacids/Antiulcers/Antiflatulents (A02)	263	6.5	252	95.8
Vitamins (A11)	28	0.7	23	82.1
Antidiabetic drugs (A10)	376	9.3	261	69.4
Mineral supplements (A12)	2	0.1	0	0
Central Nervous System (N)	566	14.0	327	57.8
Antiparkinsonian drugs (N04)	17	0.4	15	88.2
Analgesics (N02)	34	0.8	27	79.4
Psychoanaleptics (N06)	163	4.0	125	76.7
Psycholeptics (N05)	158	3.9	88	55.7
Antiepileptics (N03)	194	4.8	72	37.1
Blood and hematopoietic organs (B)	344	8.5	193	56.1
Antithrombotics (B01)	323	8.0	182	56.3
Antianemics (B03)	21	0.5	11	52.4
Hormones for systemic use (H)	158	3.9	113	71.5
Thyroid treatment (H03)	139	3.4	102	73.4
Corticosteroids for systemic use (H02)	19	0.5	11	57.9
Others (D-G-J-M-P-R-S)	330	8.2	217	65.7
Total	4039	100.0	2818	69.8

a: Absolute number of prescribed medicines; b: According to the total number of prescribed medicines (n=4,039); c: Absolute number of available medicines; d: According to the number of prescribed medicines per anatomical group/therapeutic subgroup.

Source: Authors.

Among the participants, only 39.3% fully obtained all the prescribed medicines. The participants characteristics are described in Tables 2, 3 and 4. Most were female (65.1%), with a mean age of 59.5 (SD: 13.2) years, four to seven years of schooling (39.8%); they were married or had a common-law partner (57.3%). Regarding health conditions, it was observed that more than half of the individuals had a negative self-perception of their health (57.7%), reported having up to two medical conditions diagnosed by the physician (58.1%), and did not practice physical activity (56.5%).

The results of the unadjusted logistic regression, with the crude Odds Ratio estimates for the predisposing, enabling, and need factors and the full availability of the prescribed treatment, are shown in Tables 2, 3, and 4, respectively. The variables selected for the multiple model, at a 20% significance level, were: age, schooling, and marital status (predisposing factors); monthly personal income, travel time to the pharmacy, and out-of-pocket expenditure on medicines in the past three months (enabling factors); number of medicines prescribed in the past 15 days, self-perception of health, and number of health conditions diagnosed by the physician (need factors).

The results of the hierarchical logistic regression analysis of the full treatment availability predictors are shown in Table 5. It is observed that individuals who attended school for eight years or more had an almost twofold greater chance of having full treatment availability compared to individuals with less time of schooling (OR: 1.7; 95% CI: 1.3-2.4) (Model 1).

The chance of obtaining all prescribed medicines was also higher among those who took up to 15 minutes to get to the pharmacy (OR: 1.7; 95% CI: 1.2-2.3), and who had no out-of-pocket expenditure on medicines in the past three months (OR: 2.2; 95% CI: 1.7-2.9) (Model 2).

Among the need factors, the number of medications prescribed in the past 15 days showed a dose-response relationship with the full treatment availability (Model 3). The smaller the number of medications prescribed in the past 15 days, the greater the chance that individuals would obtain all the prescribed pharmacotherapy. The AIC estimate decreased with the addition of blocks of variables, reflecting a better fit of the models.

Discussion

Patients' ability to obtain prescribed medicines is a fundamental requirement of the care process, and it is also considered a quality indicator of the health system[19]. The literature lacks research that analyzes the availability of medicines in PHC and its associated factors, especially in public health systems, such as the Brazilian system. Authors have observed, for example, that in Bangladesh 33% of the medicines analyzed were available in public facilities[20], while, in Sri Lanka, that prevalence was 56%[21]. In Kuwait, higher availability was observed, with 97.9% of the prescribed medicines being dispensed[22]. In our study, the overall availability of prescription drugs in public pharmacies was 69.8%.

Comparisons of availability prevalence data from different studies should be cautiously made; however, methodological differences make it difficult to directly compare the results, such as the way availability is measured, the types of medicines included for evaluation, and the study populations.

Table 2. Bivariate analysis of the association between full treatment availability and predisposing factors. Prover Project, 2017.

Variables	n (%)[a]	Full treatment availability		
		Prevalence (%)	OR[b] (IC 95%)	p-value[b]
Sex				
Male	414 (34.9)	38.6	Ref.	-
Female	772 (65.1)	39.6	1.0 (0.8-1.3)	0.739
Age				
60 years or older	650 (54.8)	36.9	Ref.	-
18-59 years	536 (45.2)	42.2	1.2 (1.0-1.6)	0.066*
Skin color				
Non-White	608 (53.3)	38.7	Ref.	-
White	533 (46.7)	39.6	1.0 (0.8-1.3)	0.747
Schooling				
0-3 years	262 (22.2)	33.6	Ref.	-
4-7 years	469 (39.8)	35.4	1.1 (0.8-1.5)	0.623
8 years or more	448 (38.0)	46.7	1.7 (1.3-2.4)	0.001*
Marital Status				
Single/Divorced/Widowed/	505 (42.7)	37.0	Ref.	-
Married/Common-Law Partner	678 (57.3)	41.0	1.2 (0.9-1.5)	0.167*

OR: Odds Ratio; 95% CI: 95% confidence interval; Ref.: reference category. a: Study Population; b: Unadjusted Logistic Regression. * p<0.20

Source: Authors.

Ciência & Saúde Coletiva, 27(3):1191-1203, 2022

Table 3. Bivariate analysis of the association between full treatment availability and enabling factors. Prover Project, 2017.

Variables	n (%)[a]	Full treatment availability		
		Prevalence (%)	OR[b] (IC 95%)	p-value[b]
Personal monthly income[c]				
< 1 MW	321 (27.5)	41.4	Ref.	-
1 MW	446 (38.1)	36.6	0.8 (0.6-1.1)	0.171*
>1MW	402 (34.4)	40.3	0.9 (0.7-1.3)	0.758
Health insurance coverage				
Yes	856 (72.2)	38.3	Ref.	-
No	330 (27.8)	41.8	1.2 (0.9-1.5)	0.269
Travel time to the pharmacy				
>30 min	303 (25.6)	32.0	Ref.	-
15-30 min	435 (36.8)	37.5	1.3 (0.9-1.7)	0.127*
< 15 min	444 (37.6)	46.0	1.8 (1.3-2.4)	0.000*
Out-of-pocket expenditure on medicines in the past three months				
Yes	906 (76.5)	34.6	Ref.	-
No	278 (23.5)	54.7	2.3 (1.7-3.0)	0.000*

MW: Minimum Wage; OR: Odds Ratio; 95% CI: 95% confidence interval; Ref.: reference category. a: Study Population; b: Unadjusted Logistic Regression; c: MW at the time when the study was conducted - R$ 937. * p<0.20

Source: Authors.

Table 4. Bivariate analysis of the association between full treatment availability and need factors. Prover Project, 2017.

Variables	n (%)[a]	Full treatment availability		
		Prevalence (%)	OR[b] (IC 95%)	p-value[b]
Number of medicines prescribed in the past 15 days				
5 or more	583 (49.2)	29.2	Ref.	-
3-4	356 (30.0)	40.7	1.7 (1.3-2.2)	0.000*
1-2	247 (20.8)	61.1	3.8 (2.8-5.2)	0.000*
Self-Perception of Health				
Fair/Bad/Very Bad	675 (57.7)	35.7	Ref.	-
Very Good/Good	495 (42.3)	45.1	1.5 (1.2-1.9)	0.001*
Health conditions as diagnosed by the physician				
Three or more	497 (41.9)	29.0	Ref.	-
Up to two	689 (58.1)	46.7	2.2 (1.7-2.7)	0.000*
Physical activity practice				
No	669 (56.5)	38.0	Ref.	-
Yes	516 (43.5)	41.1	1.1 (0.9-1.4)	0.276
Recent alcohol use				
Yes	248 (20.9)	41.9	Ref.	-
No	936 (79.1)	38.5	0.9 (0.7-1.2)	0.319
Currently smoking				
Yes	143 (12.1)	35.7	Ref.	-
No	1042 (87.9)		1.2 (0.8-1.7)	0.340

OR: Odds Ratio; 95% CI: 95% confidence interval; Ref: reference category. a: Study Population; b: Unadjusted Logistic Regression. * p<0.20

Source: Authors.

Table 5. Hierarchical analysis, using multiple logistic regression, of factors associated with full treatment availability. Prover Project, 2017.

Variables	Model 1		Model 2		Model 3	
	OR (95% CI)	p-value	OR (95% CI)	p-value	OR (95% CI)	p-value
Predisposing Factors						
Schooling						
0-3 years	Ref.		Ref.		Ref.	
4-7 years	1.1 (0.8-1.5)	0.623	1.1 (0.8-1.6)	0.472	1.1 (0.8-1.5)	0.615
8 years or more	1.7 (1.3-2.4)	0.001*	1.7 (1.2-2.3)	0.002*	1.6 (1.1-2.2)	0.008*
Enabling Factors						
Travel time to the pharmacy						
>30 min	-	-	Ref.		Ref.	
15-30 min	-	-	1.3 (0.9-1.7)	0.148	1.2 (0.9-1.7)	0.283
< 15 min	-	-	1.7 (1.2-2.3)	0.001*	1.6 (1.2-2.2)	0.004*
Out-of-pocket expenditure on medicines in the past three months						
Yes	-	-	Ref.		Ref.	
No	-	-	2.2 (1.7-2.9)	0.000*	1.8 (1.4-2.4)	0.000*
Need Factors						
Number of medicines pre-scribed in the past 15 days						
5 or more	-	-	-	-	Ref.	
3-4	-	-	-	-	1.6 (1.2-2.1)	0.002*
1-2	-	-	-	-	3.2 (2.3-4.4)	0.000*
Akaike's Criterion	1569.063		1522.264		1476.294	

95% CI: 95% confidence interval; OR: Odds Ratio; Ref.: reference category.
Model 1: Adjusted among the predisposing factors; Model 2: Adjusted among the enabling factors and schooling; Model 3: Adjusted among the need factors and schooling, travel time to the pharmacy and out-of-pocket expenditure on medicines.

Source: Authors.

Our study also assessed the full treatment availability, identifying that only 39.4% of users received all the prescribed medicines. These results confirm what was previously observed by Luz *et al.*[23] , who pointed out, as a recurring issue, the unavailability of medicines in public pharmacies, in the perception of pharmacists and patients. On the other hand, considering that, in this study, only the medicines included on the municipal list of essential medicines were analyzed, greater availability of medicines in the units would be expected[24].

It is noteworthy that the prevalence of full treatment availability was lower than that in other studies conducted in Brazil[7,25,26]. It is possible to explain these differences using a more robust indicator in our investigation, which considered, for evaluation, all medicines included in REMUME, as well as the quantities dispensed, compared to the prescriptions.

No major anatomical group or therapeutic subgroup prescribed was totally dispensed as demanded by the users. Among the three anatomical groups with the highest prescription proportion, suboptimal availability is highlighted among those that act on the cardiovascular and the central nervous systems. These medicines are generally used to treat several chronic conditions[27,28], and unavailability can lead to underutilization of such products, thus worsening patients' quality of life and increasing morbidity and mortality[29]. Since the PHC user population consists mostly of individuals with chronic diseases[30] and these health conditions are responsible for 70% of deaths in the country[31], the importance of an adequate supply of those products for the SUS user population is reinforced.

In general, these results suggest problems involving the stages of planning and procurement of medicines in PHC. In addition, failures in communication management could be assumed since if prescribers were aware of the products in shortage in public pharmacies, they could make substitutions for available therapeutic equivalents. However, our findings do not support this hypothesis, since failures in availability were observed in all the subgroups analyzed. It is also assumed that managers are relying on the Popular Pharmacy Program, thus not offering medicines made available by that program[32].

In this study, it was observed that predisposing, enabling, and need factors contributed to explain the full treatment availability.

Among the predisposing factors, having a higher schooling level almost doubled the chance of obtaining all the prescribed medications. These results contradict the findings in studies conducted in Brazil analyzing the acquisition of medicines exclusively through the public health system, which showed higher acquisition among the population with lower schooling levels[33-36]. This difference can partly be explained by the methodologies used by those authors, who considered the general population, accessed through household surveys. On the other hand, what our study shows is that there are also differences in obtaining medicines within the health system itself, possibly explained by the fact that individuals with higher schooling have a better perception of their health needs, which would lead them to use the services more often[37], thus making it easier for them to obtain their medicines.

Regarding the enabling factors, two factors remained associated with the full treatment availability: shorter travel time to public pharmacies and absence of expenditure on medications in the past three months. In the case of travel time to pharmacies, this result was, to some extent, expected, since authors have shown that individuals who live close to health units are more likely to seek assistance and care[38-40]. This finding also suggests the need for an adaptation of the health care network in order to optimize geographical accessibility and meet the health needs of the population using PHC in an equal manner.

With regard to expenditure on medications in the past three months, individuals who did not have such expenses showed a higher chance of obtaining all the prescribed medicines. This association is not easy to explain since, in general, according to the time logic, the lack of medicines in public pharmacies leads users to acquire them from the private sector, thus incurring out-of-pocket expenditure on medicines[24,33,36,41-44]. Studies in India[41], Cambodia[43] and Mexico[42] showed that, respectively, 76%, 52% and 35.4% of the interviewed users depended on private pharmacies for medicine acquisition due to shortages in the public sector. Thus, it is not possible to rule out the reverse causality hypothesis to explain the results found in our study, i.e., the availability of all pharmacotherapy in public pharmacies would lead to the absence of out-of-pocket expenditure on these products. In fact, this is the most plausible hypothesis since the question about out-of-pocket expenditure recalls three months before the interview date, thus reflecting previous experiences with the service - individuals sought their medicines during that period and having found them, had no expenditure on medicines. The interview occasion, on the other hand, must be considered a new experience with the service in this case - the individual is there seeking service for a new prescription - which elucidates the relationship observed between the absence of expenses and the full treatment availability.

The number of prescribed medicines was the only need factor that remained associated with full treatment availability, and an inversely proportional relationship was shown, i.e., individuals with fewer prescribed medicines had significantly higher chances of obtaining the full pharmacotherapy. This finding is consistent with that observed by other authors[42,45] and evidence that the system is failing to serve the people with greater health needs since a larger number of medicines may be related to a heavier disease burden[35,46-48].

This study provides relevant information on the availability of medicines in PHC in a municipality that is a health service pole in the state of Minas Gerais. Among the advantages of the study, we highlight the operationalization of availability measurement, which considered only the medicines listed on REMUME, analyzing each item prescribed and dispensed in sufficient quantities for treatment, with verification of all these data *in loco*, following dispensing. In the literature researched, several studies were found that characterize the "physical availability" of medicines according to the presence of at least one unit of the pharmaceutical product under evaluation in the pharmacy stocks[5,24,48,49], a measure that tends to overestimate supply[5,24,51]. Another method for measuring medicine availability is through users' self-reporting, which can be influenced by memory bias[25,33-35,52,53] and information bias, since individuals may not have a concept of medicine and may not know the contents of municipal medicine lists.

To ensure the internal validity of the study, a representative sample of the adult population, distributed proportionally to the number of visits to public pharmacies, was included, and the profile of respondents and non-respondents did not show statistically significant differences. It is believed that the results found can also apply to other Brazilian municipalities, especially the large ones, with a population between 100,000 and 900,000 inhabitants[54], because (1) the profile of users is similar to that of the adult population served in the Brazilian PHC[30], and (2) the rules for regulating the implementation and financing of PS in PHC are the same throughout the country[2].

Some limitations in this study, however, must be taken into consideration. As it has a cross-sectional design, it is not possible to assume that the lack of medicines observed is a constant reality in the investigated pharmacies. Nevertheless, considering that data collection lasted four months and that our results align with the specialized literature on the subject[7,26,50,55], it is reasonable to assume that drug shortages are a frequent problem. Furthermore, the data were collected through interviews, and were subject to information and memory biases. A multi-item, pre-tested questionnaire was used to minimize these effects, obtaining data from prescriptions and dispensed medications. The interviews took place shortly after the service was provided at the pharmacies and were conducted by trained interviewers, who used standardized procedures throughout the data collection. To avoid overestimation of unavailability, only the drugs listed on REMUME were included in the data analysis.

Conclusions

The results in this study elucidate essential issues related to the availability of medicines and their determinants in the Brazilian public system, from the PHC perspective, revealing significant differences in medicine acquisition by the population served by SUS.

The findings point to the need for improvement in the organization of the care provision network to optimize the geographical access to dispensing services, and the planning of medicine acquisition. Equally important is the design of public policies and strategies that can reduce heterogeneities in obtaining medicines, especially among the most vulnerable population (individuals with less education, with out-of-pocket expenditure on medicines, and who use more prescription drugs). Furthermore, the results show the importance of analyzing the availability of medicines in the public health systems, considering specifically the user population, since it is thereby possible to evaluate the effectiveness of the pharmaceutical care actions adopted. In Brazil, considering that SUS serves approximately 70% of the population[56] and and there is a budget and fiscal reduction scenario, the relevance of studies of this nature as sources of information to support public management is also emphasized.

Collaborations

MAM Bueno and TCB Luz contributed equally to the study design, data analysis, interpretation and manuscript drafting. TCB Luz was responsible for funding acquisition and Prover Project coordination. TC Simões contributed with the data analysis.

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References

1. Brasil. Portaria nº 3.916, de 30 de outubro de 1998. Aprova a Política Nacional de Medicamentos. *Diário Oficial da União* 1998; 1 out.
2. Brasil. Ministério da Saúde (MS). *Assistência Farmacêutica no SUS:* 20 anos de políticas e propostas para desenvolvimento e qualificação: Relatório com análise e recomendações de gestores, especialistas e representantes da sociedade civil organizada. Brasília: MS; 2018.
3. Silva RM, Pereira NC, Mendes LVP, Luiza VL. Pharmaceutical Services in Rio De Janeiro Municipality, Brazil: Development Regarding Selected Aspects From 2008 to 2014. *Cien Saude Colet* 2016; 21(5):1421-1432.
4. Leite SN, Bernardo NLMC, Álvares J, Guerra Junior AA, Costa EA, Acurcio FA, Guibu IA, Costa KS, Karnikowski MGO, Soeiro OM, Soares L. Medicine dispensing service in primary health care of SUS. *Rev Saude Publica* 2017; 51 (supl.2):11s.
5. Mendes LV, Campos MR, Chaves GC, Silva RM, Freitas PS, Costa KS, Luiza VL. Availability of medicines in primary health care facilities and related factors: a cross sectional approach. *Saude Debate* 2014; 38(n. spe).
6. David G, Andrelino A, Beghin N. *Direito a medicamentos. Avaliação das despesas com medicamentos no âmbito federal do Sistema Único de Saúde entre 2009 e 2015*. Brasília: INESC; 2016.
7. Santa Helena ET, Andersen SE, Menoncin SM. Users Insights on About Access to Medicines in Primary Care. *Cad Saude Colet* 2015; 23(3):280-288.
8. Wirtz VJ, Hogerzeil HV, Gray AL, Bigdeli M, Joncheere CP, Ewen MA, Gyansa-Lutterodt M, Jing S, Luiza VL, Mbindyo RM, Möller H, Moucheraud C, Pécoul B, Rägo L, Rashidian A, Ross-Degnan D, Stephens PN, Teerawattananon Y, ‘t Hoen EF, Wagner AK, Yadav P, Reich MR. Essential medicines for universal health coverage. *Lancet* 2017; 389(10067):403-476.
9. Brasil. Resolução nº 338, de 06 de maio de 2004. Aprova a Política Nacional de Assistência Farmacêutica. *Diário Oficial da União* 2004; 6 maio.
10. Brasil. Portaria nº 373, de 27 de fevereiro de 2002. Aprova a Norma Operacional da Assistência à Saúde do Sistema Único de Saúde – NOAS-SUS 01/02. *Diário Oficial da União* 2002; 27 fev.
11. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa Nacional de Saúde. Proposição do Questionário da PNS.* Rio de Janeiro: IBGE; c2010 [acessado 2019 nov 12]. Disponível em: https://www.pns.icict.fiocruz.br/index.php?pag=proposicao
12. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa Nacional por Amostra de Domicílios - 2008. Manual do Suplemento: Saúde e Acesso à Internet.* Rio de Janeiro: IBGE; 2008.
13. Grootaert C, Narayan D, Jones VN, Woolcock M. Measuring Social Capital: An Integrated Questionnaire. *World Bank Working Paper* 2004; 18.
14. Fröhlich SE, Dal Pizzol TS, Mengue SS. Instrument to evaluate the level of knowledge about prescription in primary care. *Rev Saude Publica* 2010; 44(6):1046-1054.
15. World Health Organization (WHO). Collaborating Centre for Drug Statistics Methodology. *Guidelines for ATC classification and DDD assignment 2018.* Oslo: WHO; 2017.

16. Prefeitura de Divinópolis. *REMUME*. 2017.
17. Andersen RM. Revisiting the Behavioral Model and Access to Medical Care: Does it Matter? *J Health Soc Behav* 1995; 36(1):1-10.
18. Mccullagh P, Nelder JA. *Generalized Linear Models.* London: Chapman and Hall; 1989.
19. Organización Mundial de la Salud (OMS). *Acceso equitativo a los medicamentos esenciales: un marco para la acción colectiva*. Ginebra: OMS; 2004.
20. Kasonde L, Tordrup D, Naheed A, Zeng W, Ahmed S, Babar Z-U-D. Evaluating medicine prices, availability and affordability in Bangladesh using World Health Organisation and Health Action International methodology. *BMC Health Serv Res* 2019; 19(1):383.
21. Rathish D, Premarathna I, Jayathilake T, Kandegedara C, Punchihewa K, Ananda L, Bandara T, Jayasumana C, Siribaddana S. Availability of essential medicines in selected public, primary and secondary health care institutions of a rural Sri Lankan district: a spot survey. *BMC Health Serv Res* 2017; 17(1):11.
22. Awad A, Al-Saffar N. Evaluation of drug use practices at primary healthcare centers of Kuwait. *Eur J Clin Pharmacol* 2010; 66(12):1247-1255.
23. Luz TCB, Costa MESS, Portes DS, Santos LBC, Sousa SRA, Luiza VL. Pharmaceutical Services in Primary Health Care: are pharmacists and users on the same page? *Cien Saude Colet* 2017; 22(8):2463-2474.
24. Helfer AP, Camargo AL, Tavares NUL, Kanavos P, Bertoldi AD. Affordability and Availability of Drugs for Treatment of Chronic Diseases in the Public Health Care System. *Rev Panam Salud Publica* 2012; 31(3):225-232.
25. Álvares J, Guerra Junior AA, Araújo VE, Almeida AM, Dias CZ, Ascef BO, Costa EA, Guibu IA, Soeiro OM, Leite SN, Karnikowski MGO, Costa KS, Acurcio FA. Access to medicines by patients of the primary health care in the Brazilian Unified Health System. *Rev Saude Publica* 2017; 51(Supl. 2):20s.
26. Melo DO, Silva SRA, Castro LLC. Evaluation of Drug Prescription Quality Indicators in a Primary Health Care Facility With Different Models of Health Care. *Epidemiol Serv Saude* 2016; 25(2):259-270.
27. Cameron A, Roubos I, Ewen M, Mantel-Teeuwisse AK, Leufkens HG, Laing RO. Differences in the Availability of Medicines for Chronic and Acute Conditions in the Public and Private Sectors of Developing countries. *Bull World Health Organ* 2011; 89(6):412-421.
28. Pereira VOM, Acurcio FA, Guerra Júnior AA, Silva GD, Cherchiglia ML. Use of Medicines by Individuals With Hypertension and Diabetes in Municipalities Covered by the Pharmacy Network in Minas Gerais State, Brazil. *Cad Saude Publica* 2012; 28(8):1546-1558.
29. Tavares NUL, Costa KS, Mengue SS, Vieira MLFP, Malta DC, Silva Júnior JB. Use of medication for treatment of noncommunicable chronic diseases in Brazil: results from the National Health Survey, 2013. *Epidemiol Serv Saude* 2015; 24(2):315-323.
30. Guibu IA, Moraes JC, Guerra Junior AA, Costa EA, Acurcio FA, Costa KS, Karnikowski MGO, Soeiro OM, Leite SN, Álvares J. Main characteristics of patients of primary health care services in Brazil. *Rev Saude Publica* 2017; 51(Supl. 2):17s.
31. Instituto Brasileiro de Geografia e Estatística (IBGE). *Pesquisa Nacional de Saúde, 2013: Percepção do Estado de Saúde, Estilos de Vida e Doenças Crônicas: Brasil, Grandes Regiões e Unidades da Federação.* Rio de Janeiro: IBGE; 2014.
32. Mattos L, Silva R, Chaves G, Luiza V. Pharmaceutical services in primary healthcare and the Farmácia Popular Program: the perspective of public administrators from subnational spheres of the Brazilian National Health System. *Saude Soc* 2019; 28(1):287-298.
33. Boing AC, Bertoldi AD, Boing AF, Bastos JL, Peres KG. Acceso a medicamentos en el sector público: análisis de usuarios del Sistema Único de Salud en Brasil. *Cad Saude Publica* 2013; 29(4):691-701.
34. Aziz MM, Calvo MC, Schneider IJC, Xavier AJ, d'Orsi E. Prevalence and factors associated with access to medication among the elderly in a city in southern Brazil: a population-based study. *Cad Saude Publica* 2011; 27(10):1939-1950.
35. Costa KS, Francisco PMSB, Barros MBA. Use and Sources of Medicines: A Population-Based Study in Campinas, São Paulo State, Brazil. *Cad Saude Publica* 2016; 32(1).
36. Costa KS, Francisco PMSB, Malta DC, Barros MBA. Sources of Medicines for Hypertension and Diabetes in Brazil: Telephone Survey Results From Brazilian State Capitals and the Federal District, 2011. *Cad Saude Publica* 2016; 32(2).
37. Paniz VMV, Fassa AG, Facchini LA, Bertoldi AD, Piccini RX, Tomasi E, Thumé E, Silveira DS, Siqueira FV, Rodrigues MA. Access to Continuous-Use Medication Among Adults and the Elderly in South and Northeast Brazil. *Cad Saude Publica* 2008; 24(2):267-280.
38. Kelly C, Hulme C, Farragher T, Clarke G. Are Differences In Travel Time Or Distance To Healthcare For Adults In Global North Countries Associated With an Impact on Health Outcomes? A Systematic Review. *BMJ Open* 2016; 6(11):e013059.
39. Emmerick ICM, Luiza VL, Camacho LAB, Vialle-Valentin C, Ross-Degnan D. Barriers in Household Access to Medicines for Chronic Conditions in Three Latin American Countries. *Int J Equity Health* 2015; 14:115.
40. Vialle-Valentin CE, Serumaga B, Wagner AK, Ross-Degnan D. Evidence on Access to Medicines for Chronic Diseases from Household Surveys in Five Low- and Middle-Income Countries. *Health Policy Plan* 2015; 30(8):1044-1052.
41. Elias MA, Pati MK, Aivalli P, Srinath B, Munegowda C, Shroff ZC, Bigdeli M, Srinivas PN. Preparedness For Delivering Non-Communicable Disease Services In Primary Care: Access To Medicines for Diabetes and Hypertension in a District in South India. *BMJ Glob Health* 2018; 2(Supl. 3):e000519.

42. Servan-Mori E, Heredia-Pi I, Montañez-Hernandez J, Avila-Burgos L, Wirtz VJ. Access to Medicines by Seguro Popular Beneficiaries: Pending Tasks towards Universal Health Coverage. *PLoS One* 2015; 10(9):e0136823.
43. Bigdeli M, Jacobs B, Men CR, Nilsen K, Van Damme W, Dujardin B. Access to Treatment for Diabetes and Hypertension in Rural Cambodia: Performance of Existing Social Health Protection Schemes. *PLoS One* 2016; 11(1):e0146147.
44. Wagner AK, Graves AJ, Reiss SK, Lecates R, Zhang F, Ross-Degnan D. Access to Care and Medicines, Burden of Health Care Expenditures, and Risk Protection: Results from the World Health Survey. *Health Policy* 2011; 100(2-3):151-158.
45. Matta SR, Bertoldi AD, Emmerick ICM, Fontanella AT, Costa KS, Luiza VL. Sources of Medicines for Chronic Patients Using the Brazilian Unified National Health System. *Cad Saude Publica* 2018; 34(3):e00073817.
46. Teljeur C, Smith SM, Paul G, Kelly A, O'Dowd T. Multimorbidity in a Cohort of Patients with Type 2 diabetes. *Eur J Gen Pract* 2013; 19(1):17-22.
47. Nobili A, Garattini S, Mannucci PM. Multiple Diseases and Polypharmacy in the Elderly: Challenges for the Internist of the Third Millennium. *J Comorb* 2011; 1:28-44.
48. Caughey GE, Tait K, Vitry AI, Shakib S. Influence of Medication Risks and Benefits on Treatment Preferences in Older Patients with Multimorbidity. *Patient Prefer Adherence* 2017; 11:131-140.
49. Ewen M, Zweekhorst M, Regeer B, Laing R. Baseline Assessment of WHO's Target for Both Availability and Affordability of Essential Medicines to Treat Non-Communicable Diseases. *PLoS One* 2017; 12(2):e0171284.
50. Nascimento RCRM, Álvares J, Guerra Junior AA, Gomes IC, Costa EA, Leite SN, Costa KS, Soeiro OM, Guibu IA, Karnikowski MGO, Acurcio FA. Availability of Essential Medicines in Primary Health Care of the Brazilian Unified Health System. *Rev Saude Publica* 2017; 51(Supl. 2):10s.
51. Paniz VMV, Fassa AG, Facchini LA, Piccini RX, Tomasi E, Thumé E, Silveira DS, Rodrigues MA, Domingues MR, Bertoldi AD. Free Access to Hypertension and Diabetes Medicines Among the Elderly: a Reality yet to be Constructed. *Cad Saude Publica* 2010; 26(6):1163-1174.
52. Oliveira MA, Luiza VL, Tavares NUL, Mengue SS, Arrais PSD, Farias MR, Dal Pizzol TS, Ramos LR, Bertoldi AD. Access to Medicines for Chronic Diseases in Brazil: a Multidimensional Approach. *Rev Saude Publica* 2016; 50(Supl. 2):6s.
53. Monteiro CN, Gianini RJ, Barros MBA, Cesar CLG, Goldbaum M. Access to Medication in the Public Health System and Equity: Populational Health Surveys in São Paulo, Brazil. *Rev Bras Epidemiol* 2016; 19(1):26-37.
54. Calvo MCM, Lacerda JT, Colussi CF, Schneider IJC, Rocha TAH. Municipalities Stratification for Health Performance Evaluation. *Epidemiol Serv Saude* 2016; 25(4):767-776.
55. Bittencourt RA, Silveira MPT, Guttier MC, Miranda FF, Bertoldi AD. Assessment of Pharmaceutical Services in a Southern Brazilian City. *Rev Bras Epidemiol* 2017; 20(2):310-323.
56. Instituto de Pesquisa Econômica Aplicada (IPEA). *Objetivos de Desenvolvimento Sustentável.* Brasília: IPEA; c2019 [acessado 2020 maio 25]. Disponível em: https://www.ipea.gov.br/ods/ods3.html#coll_3_8

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