

Cost analysis of a medication dispensing service in community pharmacy in Brazil

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This study was aimed to calculate in detail the costs of a medication dispensing service in community pharmacy in Brazil. Descriptive and retrospective analysis with a cost analysis based on mixed costing; absorption costing and time-driven activity based-costing, considering year 2018 and both public and private health system perspectives within a one-year time horizon to estimates costs related to implement and to deploy the service, costs per patient and costs per activity of process (US\$ 1 = R\$ 3.8310 in October, 2018). Total costs of dispensing service ranged from US\$ 24,451.61 to US\$ 37,914.48. Costs per patient ranged from US\$ 2.43 to US\$ 3.77. Costs per activity of the process ranged from US\$ 0.39 in pharmacotherapy assessment to US\$ 2.46 in pharmaceutical interview. This provides evidence to deploy and implement a structured medication dispensing service in community pharmacy in Brazil with a view to optimize the usage of medicines.

Keywords: Community pharmacy services. Costs and cost analysis. Health care costs. Pharmaceutical services.

INTRODUCTION

The misuse of medicines is not only a health problem but represents a social and economic burden as well. It reduces therapeutic success and increases preventable morbidity and mortality. It also creates a need for health interventions and increases the costs related with health care (Freitas *et al.*, 2017; Busfield, 2015; Souza *et al.*, 2014; Ernst, Grizzle, 2001; Johnson, Bootman, 1995). It is estimated that 50% of all medicines are improperly prescribed, dispensed or misused (Organización

Mundial de la Salud, 2010). There is an incidence of 14.6% of damage and emergency department visits associated to drug-related problems (DRPs). Current studies also show annual total treatment costs of US\$ 7.5 million due DRPs, mainly related to adverse drug reactions (39.3%), nonadherence (36.9%) and incorrect dosages (16.9%). These costs correspond to up to 20% of hospital budgets to deal with health complications due misuse of medicines. It is important to note that almost 60% of these DRPs can be prevented (Freitas *et al.*, 2017; Organización Mundial de la Salud, 2010).

In this context, light technologies in health, i.e., technologies that produce relations between health professionals and patients, which has as strategy the health education and patient empowerment on their therapies, are important to optimize the usage of

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the medicines (Petramale, 2016; Nascimento Júnior, 2016; Merhy, 2002; Merhy, Onocko, 1997). Within the community pharmacies context, the medicine dispensing service consists of a light technology in health which have demonstrated efficiency in interfere and change this scenario by involve cognitive aspects when interpreting the information concerning prescription and patient while converting these aspects into personalized information to patients. Thus, dispensing service is an opportunity for patient counseling and to increase chances of therapeutic success by being an opportunity to approach to DRPs. Furthermore, dispensing services have greater service capacity and amplitude compared to other pharmaceutical clinical services, which makes it a health system solution as a screening service to financial resources saving (Kleemann, Freitas, Heineck, 2017; Ferreira *et al.*, 2016; Nascimento Júnior, 2016; Nicolas *et al.*, 2013; Klepser, Bisanz, Klepser, 2012; Oliveira, 2011; Chatsisvili *et al.*, 2010; Hernández, Castro, Dáder, 2009; Westerlund, Marklund, 2009; Galato *et al.*, 2008; Comité de Consenso, 2007; Cipolle, Strand, Morley, 2006; Cranor, Bunting, Christensen, 2003; Buurma *et al.*, 2001; Brasil, 2001).

However, dispensing service in Brazil does not occur as the concept assigned by health department (Brasil, 2001). Most often, there is only the delivery of medicines without involving the clinical aspects in order to promote rational use of medicines (Nascimento Júnior, 2016; Galato *et al.*, 2008). This reflects a paucity of studies and structured models to perform the service. Structured service models suitable to Brazilian reality are still incipient and that is an obstacle to address this service in public health policies (Mossialos, Naci, Courtin, 2013). Therefore, this study aims to calculate in detail the costs of a medication dispensing service in community pharmacy in Brazil. The dispensing service consisted of a pharmaceutical interview, pharmacotherapy assessment and medicine delivery. This cost analysis complements a previous study, which describes the medication dispensing service and assesses its structure, process and outcomes (Ferreira *et al.*, 2016; Cardoso *et al.*, 2015).

MATERIAL AND METHODS

Study design

A retrospective analysis quantified costs associated with a medication dispensing service provided by pharmacists to patients in a single community pharmacy in Brazil from the public and private health systems

perspectives with a time horizon of one year and at the base year of 2018.

Intervention

The medication dispensing service involves the following three activities (Ferreira *et al.*, 2016; Cardoso *et al.*, 2015):

- Pharmaceutical interview: pharmacist asks for information about the patient and his pharmacotherapy, including his knowledge regarding medicine usage process. This activity also includes assessing legal issues of prescription.
- Pharmacotherapy assessment: pharmacist assesses the pharmacotherapy using the information of previous step to verify the existence of DRPs. This assessment is carried out in necessity, effectiveness and safety perspectives.
- Medicine delivery: pharmacist delivers the medicine to patient with provision of information about the proper and safe usage according to the individual needs.

Setting

This study was conducted in a university pharmacy of a Federal University in state of Goiás (Universidade Federal de Goiás - UFG). In Brazil, university pharmacies are community pharmacies run by schools of pharmacy and designed for academic education. Two pharmacists were responsible for medication dispensing service at the time of a previous study that assessed structure, process and outcomes. This previous study was done by a quasi-experimental design in a three month period with 104 patients using 769 medicines (Ferreira *et al.*, 2016).

Identification of costs

The cost components of the medication dispensing service include the items described in Table I. These cost components were categorized into capital outlays and recurrent costs. To estimate total cost, we consider two cost centers applying attributable fractions to allocate capital outlays and recurrent costs: management cost center and dispensing cost center. We considered that all cost components identified contribute to estimated costs since community pharmacies can only work in the presence of a pharmacist.

TABLE I – Cost components and cost items of medicine dispensing service in a community pharmacy, Goiânia, Goiás, Brazil

Cost component	Cost item	Capital outlay	Recurrent cost
Infrastructure	Physical structure*	X	
	Maintenance expenses		X
Office equipment and supplies	Office equipments	X	
	Office supplies		X
Human resources	Salary		X
Professional training	Post-graduate at the interest area		X
Individual protection equipment	Coats		X
Patient handout	Advertising and informative leaflets		X
Information sources to pharmacist	Scientific journals and databases		X

* In private system perspective it was considered a recurrent cost (rent value per m²).

- Infrastructure: area where is conduct medicine dispensing service. Capital outlay was obtained by annual depreciation. Recurrent costs correspond to maintenance resources (which was applied an attributable fraction).
- Office equipment and supplies: capital outlays of office equipment were obtained by annual depreciation. Recurrent costs of office supplies were obtained by observing and consumption estimates.
- Human resources: it considers one pharmacist in medicine dispensing service and another one in management (which was applied an attributable fraction).
- Professional training: graduate or updating courses.
- Individual protection equipment: coat/ uniform.
- Advertising and informative material to patient.
- Information sources to pharmacist: scientific journals and databases.

Measurement and valuation of costs

The measurement of costs was based on average time of three activities of medication dispensing service according table II.

TABLE II - Average time of activities of medication dispensing service

Activity of process	Average time (seconds)
Pharmaceutical interview	448.30
Pharmacotherapy assessment	109.87
Medicine delivery	130.02

Data from Ferreira et al. (2016)

TABLE III - Measurement and valuation form from identified cost items and its data source

Cost items	Measurement of costs	Valuation of costs	Data source
Physical structure	Ratio between the total area of university and the area used to medication dispensing service and administration.	Medication dispensing service area: 46.75 m ² (0,01335%). Administrative area: 9.46 m ² (0,0025%) with depreciation and inflation adjustment in capital outlays.	Construction industry trade union of state and Center of management of physical space (Sinduscon, 2016; Universidade Federal de Goiás) and prices quotations per m ²
Maintenance expenses	Relation between total maintenance costs and areas from dispensing service.	Attributable fractions from physical structure.	Department of administration and finances (Universidade Federal de Goiás)*
Office equipments	Number and type of office equipment was obtained at the place where the service is performed.	Depreciation and inflation adjustment in capital outlays.	Department of materials and property and Department of Planning, Budget and Management (Universidade Federal de Goiás) and price quotations
Office supplies	The amount of office supplies was obtained by estimates of consumption according a previous study to one year.	Inflation adjustment was performed to year 2018.	Department of Planning, Budget and Management (Universidade Federal de Goiás) and Ferreira <i>et al.</i> (2016) and price quotations
Salary	One pharmacist performing medication dispensing service in full-time and another one in administrative activities.	It included the gross salary in public health system perspective and also charges on remuneration in private health system perspective.	Department of administration and finances (Universidade Federal de Goiás) and association responsible for salary regulation
Post-graduate at the interest area	Specialization course of 400 hours in clinical pharmacy.	Inflation adjustment was performed.	Obtained by price quotations**
Coats	One coat per pharmacist.	Inflation adjustment was performed.	Obtained by price quotations**
Advertising and informative leaflets	Delivery of three flyers per patient.	Inflation adjustment was performed.	Obtained by price quotations**
Scientific journals and databases	The access to scientific journals and databases, such as Micromedex® is provided by UFG. This cost item could not be valued.	-----	-----

* The valued costs from public system perspective were used in private system perspective. ** The valued costs from private system perspective were used in public system perspective.

We also considered data from the previous study of Ferreira *et al.* (2016). Cost items and its measurement and valuation form as well data source are described in table III. Cost items described in table III were the same for both perspectives and secondary data was obtained through government acquisition process data (public system perspective) and quotations (private system perspective) (Brasil, 2014).

A mixed costing approach was used to value resource use associated with medicine dispensing service. The valuation of total cost through attributable fractions in an absorption costing with departmentalization was made by top-down approach. Bottom-up approach was used for the valuation of activities identified in the process of medicine dispensing service through time-driven activity-based costing (TDABC) (Drummond *et al.*, 2015; Kaplan, Anderson, 2004; Kaplan, Anderson, 2007).

Analysis of costs

Total costs, costs per patient, and costs per activity were calculated. The cost to offer the medicine dispensing service to one patient was estimated considering 85% of the theoretical capacity (1,920 hours) in both perspectives through the year of 2018 (Kaplan, Anderson, 2004; Kaplan, Anderson, 2007). Theoretical capacity was calculated considering 40 hours per week and 48 weeks a year (vacation month was not considered). The cost to suit one patient is the relation between costs per activity of the process, cost per hour and average time of each activity identified, following the equation: "*Cost per patient = [(cost per hour x time "pharmaceutical interview"/60 minutes)] + [(cost per hour x time "pharmacotherapy assessment"/60 minutes)] + [(cost per hour x time "medicine delivery")/60 minutes]*".

We considered two scenarios: deployment and implementation of the service. The deployment scenario

happened when the service had initiated in the base year and required capital outlays related to adequacy on infrastructure and office equipment. Implementation scenario would take place when the adequacy mentioned above is not necessary, predominating the recurrent costs. The adjustment of the values for inflation at the base year of 2018 (until October, 2018) took place when necessary. The operating life was used to depreciate capital outlays in the established time horizon according to Brazilian legislation. Data analysis was conducted in Excel[®] and the results are expressed in American dollars: US\$ (US\$ 1 = R\$ 3.8310 in December 4th, 2018) (Banco Central do Brasil, 2018).

Ethical aspects

This study was approved by Ethics Committee of Federal University in state of Goiás (protocol number: 1.249.472).

RESULTS

Total cost of the medicine dispensing service

Capital outlays of the medicine dispensing service (costs to deploy the service) in community pharmacies amounted to a total of US\$ 984.75 and US\$ 285.37 in the public and private health system perspectives, respectively. Recurrent costs amounted US\$ 36,929.73 and US\$ 24,451.61 to implement this service in public and private health system perspectives, respectively. Then, considering deployment followed by implementation, total cost of the service amounted to US\$ 37,914,48 and US\$ 24,736,98 in public and private health system perspectives, respectively (capital outlays plus recurrent costs). Human resources and professional training had the largest contribution on total cost considering deployment followed by implementation (Table IV).

TABLE IV – Costs per centers costs of medicine dispensing service per perspective and service situation

Perspective	Costs	Center cost	Costs components	Costs items	Total (US \$)	%		
Public	Recurrent	Dispensing cost center	Infrastructure	Water and sewage	55.99	0.15		
				Eletricity	290.58	0.80		
				General services	19.33	0.05		
				Building maintenance	117.60	0.33		
				Cleaning service	302.16	0.84		
				Surveillance	454.56	1.26		
				Fixed telephony/ internet	23.17	0.06		
				Management software	164.90	0.46		
				Office supplies	Office supplies	272.48	0.75	
				Human resources	Salary	29,142.57	80.65	
				Training	Post-graduate at the interest area	3,889.64	10.76	
				Individual protection equipment	Coat	28.55	0.08	
				Patient handout	Advertising and informative leaflets	61.27	0.17	
				Information sources to pharmacist	Scientific journals and databases	0.00	0.00	
				Public	Outlay	Management cost center	Infrastructure	Water and sewage
Eletricity	2.36	0.01						
General services	0.16	0.00						
Building maintenance	0.96	0.00						
Cleaning service	2.46	0.01						
Surveillance	3.70	0.01						
Fixed telephony/ internet	0.19	0.00						
Management software	33.33	0.09						
Human resources	Salary – management cost center	1,267.70	3.51					
Dispensing cost center	Infrastructure	Physical structure	693.28					70.40
Office equipment	Office equipments	261.42	26.55					
Management cost center	Infrastructure	Physical structure	6.10					0.62
Office equipment	Office equipments	23.95	2.43					

(continuing)

TABLE IV – Costs per centers costs of medicine dispensing service per perspective and service situation

Perspective	Costs	Center cost	Costs components	Costs items	Total (US \$)	%			
Private	Recurrent	Dispensing cost center	Infrastructure	Water and sewage	55.99	0.23			
				Eletricity	290.58	1.21			
				General services	19.33	0.08			
				Building maintenance	117.60	0.49			
				Cleaning services	302.16	1.25			
				Surveillance	454.56	1.89			
				Fixed telephony/ internet	23.17	0.10			
				Management software	164.90	0.68			
				Office supplies	Office supplies	272.48	1.13		
				Recursos humanos	Salary	17,610.85	73.07		
				Training	Post-graduate at the interest area	3,889.64	16.14		
				Individual protection equipment	Coat	28.55	0.12		
				Patient handout	Advertising and informative leaflets	61.27	0.25		
Private	Management cost center	Infrastructure	Information sources to pharmacist	Scientific journals and databases	0.00	0.00			
				Water and sewage	0.46	0.00			
				Eletricity	2.36	0.01			
				General services	0.16	0.00			
				Building maintenance	0.96	0.00			
				Cleaning services	2.46	0.01			
				Surveillance	3.70	0.02			
				Fixed telephony/ internet	0.19	0.00			
				Management software	33.33	0.14			
				Human resources	Salary – management Center cost	766.07	3.18		
				Outlay	Dispensing cost center	Infrastructure	Physical structure (rent per m ²)	347.78	54.66
							Office equipment	Office equipments	261.42
					Management cost center	Infrastructure	Physical structure (rent per m ²)	3.06	0.48
Office equipment	Office equipments	23.95	3.77						

Cost per activity of the process and per patient

The cost per hour of the medicine dispensing service ranged between US\$ 12.74 and US\$ 19.75 depending on perspective and service situation. The pharmaceutical interview came to be the most expensive in all process

activities, with cost ranging values between US\$ 1.59 and US\$ 2.46. The cost to offer the medicine dispensing service to one patient presented values between US\$ 2.43 and US\$ 3.77 depending on perspective and service situation (Table V).

TABLE V – Costs of medicine dispensing service per perspective and service situation

Analysis perspective	Service situation	Cost per hour (US\$)	Pharmaceutical interview (US\$)	Pharmacotherapy assessment (US\$)	Medicine delivery (US\$)	Total cost per patient (US\$)
Private health system	Implemented service	12.74	1.59	0,39	0.46	2.43
	Service to be deployed	12.88	1.60	0.39	0.47	2.46
Public health system	Implemented service	19.23	2.40	0.59	0.69	3.68
	Service to be deployed	19.75	2.46	0.60	0.71	3.77

DISCUSSION

The results obtained by mixed costing methodology in this work showed that the cost per patient can range from US\$ 2.43 to US\$ 3.77 depending on the required adjustments for the service proposed by this Brazilian community pharmacy (Ferreira, 2014). Those values are higher than the values that the public health system in Brazil pays for a consultation with a non-medical health professional at a specialized care, which is US\$ 1.64. However, this value is lower than US\$ 11.54, the value of a diagnostic procedure or urgent care with general practice, which can occur by the misuse of medicines (US\$ 1 = R\$ 3.8310 in December 4th, 2018) (Banco Central do Brasil, 2018, Brasil, 2018).

The component that contributed most to total cost was human resources. This component was US\$ 11,531.73 higher at public health perspective when compared to private health system. This may mean that the pharmacist is better paid and recognized in public health perspective. The difference between these two perspectives may also increase considering the rise in salary in public health system perspective due the conclusion of continued

education courses. This incentive may also encourage the pharmacist to engage more effectively to improve the quality of the service. However, it is noteworthy for that to happen, post-graduation education (such as master degree and Ph.D.) must be linked to a professional development (update courses) to be the key to promote qualification, revitalization and personal/ professional development in practical and social experience, inter and transdisciplinary (Brasil, 2004). In addition, professional training was considered as an extra onus in both perspectives. Despite the pharmacist being select according to his training, the cost of this component cannot be null due a need to professional update (Oliveira *et al.*, 2005; Araújo, Freitas, 2006).

Also in human resources cost component, we considered as an appropriate case when one pharmacist performs the service and the other one is committed to the management. This could minimize overload assignments, which according to Araújo and Freitas (2006) and Oliveira *et al.* (2005), is a major obstacle to implement pharmaceutical services in Brazil (Oliveira *et al.*, 2005; Araújo, Freitas, 2006).

In the literature, Gregorio, Russo and Lapão (2015) found an average cost of € 3.66 or US\$ 4.23 for dispensing service and € 1.34 or US\$ 1.55 for counseling without dispensing (exchange rate: EUR 1 = US\$ 1.1567 in October, 2018) (Gregorio, Russo, Lapão, 2015). The usage of a top-down approach in the first stage of our work may justify this difference (Chapko *et al.*, 2009). However, it was necessary due the available data source. However, it is also necessary to consider the exchange rates for conversion of values and the base year of the cost analysis.

Furthermore, the methodology used in bottom-up approach, has in time its key point to costing (Demeere, Stouthuysen, Roodhooft, 2009; Kaplan, Anderson, 2007; Kaplan, Anderson, 2004). Observing the average time to offer the service, it is noteworthy that the time of our study took longer than the one found by Gregorio, Russo and Lapão (2015): 7 minutes and 12 seconds versus 11 minutes and 28 seconds. Nevertheless, both are higher than the three minutes recommended by the World Health Organization (Organización Mundial de la Salud, 1993).

The structuring of service is important and necessary when we observe that the activity that most contributes to total cost per patient is the pharmaceutical interview and as this activity influences on another two activities of the process. Thus, structuring a model and training human resources optimizes the cost of the service through the learning curve (Brouwer, Rutten, Koopmanschap, 2001).

It is also noteworthy that patients have shown preference on paying for structured services in private or semi-private sites (Sriram *et al.*, 2015). The average on willingness to pay value ranged from \$5 by a five or more minutes dispensing service to US\$ 15.77 (exchange rate: AUD 1 = US\$ 0.7221 in October, 2018) for a structured dispensing service with counseling (Hong *et al.*, 2005), such as the service analyzed in this work.

However, studies on willingness to pay and contingency assessments are necessary to determine the feasibility of deployment and implementation of the service by identifying the barriers that would cause the patients not to pay for the service. One of the main barriers for the feasibility of deployment and implementation of this service in community pharmacies is the “lack of need” indicated by patients. According to Freeman, Jones and Blumenschein (2014), patients do not recognize the pharmacist as a health professional that can promote benefits to their health,

mainly in silent diseases. Therefore, the willingness to pay for pharmaceutical service is often less than what the pharmacist expects when offering these services (Wang, Hong, 2015). Thus, it is necessary to highlight the professional skills of pharmacists since studies show that the care of minor ailments in community pharmacies costs less than visiting an emergency department or a general practice (Paudyal *et al.*, 2013).

Limitations

Despite the effort to transmit the reality of the data costs of health programs and interventions, there often is an underestimation due to data sources limitations, mainly on secondary data and due usage of attributable fractions in mixed costing. However, this methodology remains as the best option when there are no randomized clinical trials or primary data, since generalization from studies of other countries may not be the optimum option due to cultural differences and in the non-existence of a gold standard amongst researchers (Drummond *et al.*, 2015; Mogyorosy, Smith 2005). Moreover, the time horizon does not include all the depreciation of considered items. Besides, if there is the need to acquire tools as information sources to pharmacists the total costs in both perspectives will increase.

Another limitation is related to the extent of this study on community pharmacies in Brazil. These results cannot be extrapolated to all pharmacies since this is a new service model and studies on dispensing service are still incipient in Brazil.

CONCLUSIONS

This study involves an exploratory approach of mixed costing that will provide necessary information for pharmacies, managers, health managers and pharmacists mainly in accounting and management of pharmaceutical clinical services. It also affords evidences to discuss on remuneration, fixed fees and creation of public policies that address this service since the management of minor ailments and identification, resolution and prevention of DRPs in community pharmacies presents potential to reduce costs relates to health care. From these approaches, most relevant costs were obtained and analyzed.

The pharmaceutical interview was found to be the most expensive of all activities of process. Furthermore, this work shows an opportunity to improve the medicine

dispensing service, since it represents the most relevant costs to provide the service in every activity of the process. Further studies covering a larger number of pharmacies and contingencies information would help improve the costing results.

The change of scenario of entry to the health system through the management of self-limited diseases and identification, resolution and prevention of PRMs by the pharmacist in community pharmacies presents potential for reducing the costs associated with health care.

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