

## **Performance of Pharmacy students in a comprehensive medication management service in a Primary Health Care Setting**

**Desempenho de estudantes de Farmácia em um serviço de gerenciamento da terapia medicamentosa em uma Unidade de Atenção Primária à Saúde**

**Desempeño de estudiantes de Farmacia en un servicio de gestión integral de la farmacoterapia en una Unidad de Atención Primaria de Salud**

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### **Abstract**

This study aims to assess the performance of pharmacy students in the provision of a comprehensive medication management (CMM) service in a primary health care setting. Methods: A retrospective, descriptive, observational study spanning one academic semester of the provision of the CMM service by pharmacy students was conducted. The data on the profile of patients attended, drug therapy-related problems (DRPs) identified, and the interventions proposed to resolve the DRPs were collected from electronic medical records held by the service. Key findings: A total of 20 patients were attended, predominantly women (65%), with a mean age of 69.2 years. The mean number of health problems per patient was 4.8 and mean medications per patient was 6.8. Of the total 35 DRPs identified, the most common were those related to indication (40%) and effectiveness (22.9%) of the drug therapy. The two most frequent interventions to resolve the DRPs involved starting new therapy and changing dosage, respectively. Conclusions: The results allowed inferences to be made about the effectiveness of pharmacy practice experience for developing clinical competencies of pharmacy students, given that the performance of students proved comparable to that of pharmacists in established CMM services reported in the literature.

**Keywords:** Pharmaceutical education; Pharmacy students; Clinical performance assessment; Comprehensive medication management service; Teaching.

### **Resumo**

Este estudo tem como objetivo avaliar o desempenho de estudantes de Farmácia na prestação de serviço de gerenciamento da terapia medicamentosa (GTM) em uma unidade de atenção primária à saúde. Métodos: Foi realizado um estudo retrospectivo, descritivo e observacional, abrangendo um semestre acadêmico da prestação do serviço de GTM em uma unidade de atenção primária à saúde como experiência educacional na graduação em Farmácia. Os dados sobre o perfil dos pacientes atendidos, problemas relacionados ao uso de medicamentos (PRM) identificados e as intervenções propostas para resolvê-los foram coletados em prontuários eletrônicos mantidos pelo serviço. Principais resultados: Foram atendidos 20 pacientes, predominantemente mulheres (65%), com idade média de 69,2 anos. O número médio de problemas de saúde por paciente foi de 4,8 e a média de medicamentos por paciente foi de 6,8. Do total de 35 PRM identificados, os mais comuns foram aqueles relacionados à indicação (40%) e eficácia (22,9%) da terapia medicamentosa. As duas intervenções mais frequentes para resolver PRM envolveram o início de uma nova terapia e a mudança da dose, respectivamente. Conclusões: Os resultados permitiram inferir sobre a efetividade da experiência educacional no desenvolvimento de competências clínicas de estudantes de Farmácia, uma vez que o desempenho dos estudantes se mostrou comparável ao dos farmacêuticos em serviços de GTM descritos na literatura científica.

**Palavras-chave:** Educação farmacêutica; Estudantes de farmácia; Avaliação de desempenho clínico; Serviço de gerenciamento da terapia medicamentosa; Ensino.

## Resumen

Este estudio tiene como objetivo evaluar el desempeño de los estudiantes de Farmacia en la prestación del servicio de gestión integral de la farmacoterapia (GIF) en una unidad de atención primaria de salud. Métodos: se realizó un estudio retrospectivo, descriptivo y observacional, que abarcó un semestre académico de la prestación del servicio GIF en una unidad de atención primaria de salud como una experiencia educativa en farmacia de pregrado. Los datos sobre el perfil de los pacientes atendidos, los problemas relacionados con el uso de medicamentos (PRM) identificados y las intervenciones propuestas para resolverlos se obtuvieron de los registros médicos electrónicos mantenidos por el servicio. Resultados principales: se atendió a 20 pacientes, predominantemente mujeres (65%), con una edad media de 69,2 años. El número promedio de problemas de salud por paciente fue de 4.8 y el número promedio de medicamentos por paciente fue de 6.8. Del total de 35 PRM identificados, los más comunes fueron los relacionados con la indicación (40%) y la efectividad (22,9%) de la terapia farmacológica. Las dos intervenciones más frecuentes para resolver PRM involucraron comenzar una nueva terapia y cambiar la dosis, respectivamente. Conclusiones: Los resultados nos permitieron inferir sobre la efectividad de la experiencia educativa en el desarrollo de habilidades clínicas de los estudiantes de Farmacia, ya que el desempeño de los estudiantes fue comparable al de los farmacéuticos en los servicios de GIF descritos en la literatura científica.

**Palabras clave:** Educación farmacéutica; Estudiantes de farmacia; Evaluación del desempeño clínico; Servicio de administración de terapia farmacológica; Enseñanza.

## 1. Introduction

Actively practicing in a reflective manner is essential for developing professional competencies (Kolb, 2015). Developing knowledge, skills and attitudes for pharmaceutical care by experiencing this professional practice in the context of the healthcare system is beneficial for the educational process (McGivney, 2009; Kassam, Kwong & Collins, 2013; Freitas & Ramalho de Oliveira, 2015; Silva, Mendonça, Chemello & Ramalho de Oliveira, 2017; Mendonça, Meireles & Ramalho de Oliveira, 2017). In Brazil, there is a gap in the literature on experiential learning practice programs for training of clinical competencies of pharmacy degree students. Consequently, Mendonça (2017) and Mendonça, Freitas and Ramalho de Oliveira (2017) developed an educational program based on the experiential learning theory to promote training for pharmaceutical care on pharmacy degree courses in Brazil. This program was piloted at a federal institution of higher education in the state of Minas Gerais. The practice scenario to execute the program was developed through a university extension project in partnership with the local healthcare system (Silva, Ramalho de Oliveira, Mendonça, & Meireles, 2016). Seven pharmacy degree students, under the supervision of three graduate students, provided comprehensive medication management (CMM) services to users of a primary health care setting during one academic semester. The students actively participated in the different stages of the patient care process, conducted case studies, took part in clinical discussions with the healthcare team, and performed interventions to resolve drug therapy-related problems (DRPs) (McGivney, 2009; Cipolle, Strand & Morley, 2012). In parallel with activities in the healthcare service, meetings were held at the university to discuss clinical cases and the experiences of students within the healthcare service. Thus, the educational process followed the logic of the experiential learning cycle proposed by Kolb (2014), in which concrete experience, reflective observation, abstract conceptualization and active experimentation allowed students to translate clinical experience into the building of clinical knowledge.

The aim of this study was to assess the performance of the students in the provision of CMM services as an educational experience. To this end, the study sought to report the profile of patients attended, the DRPs identified, and the interventions proposed to resolve these DRPs.

## 2. Methodology

Study design: A retrospective, descriptive and observational study was conducted.

The study is a description of clinical results and identification of problems analyzed in quantitative terms, featuring a statistical method (Pereira, Shitsuka, Parreira & Shitsuka, 2018). This methodology is commonly used to assess pharmaceutical practice (Isetts et al., 2008; Ramalho de Oliveira, Brummel & Miller, 2010; Mendonça et al. 2016; Santos et al., 2021).

Study site: The venue was a CMM service provided by the pharmacy professional and graduate students to users of a primary health care clinic through a university extension project (Silva, Ramalho de Oliveira, Mendonça, & Meireles, 2016). The professional and graduate students spent four hours per week at the healthcare clinic throughout one semester, providing comprehensive medication management clinical consultations. The pharmacy professional students provided the consultations under the supervision of a graduate student. In addition to the consultations at the healthcare clinic, home visits were also carried out. Whenever necessary, students also attended healthcare team meetings for discussion and referrals of the cases being followed. They also used the forum for courses offered by the university to reflect on and discuss the clinical consultations, experiences in the healthcare service and to plan future actions (Silva, Ramalho de Oliveira, Mendonça, & Meireles, 2016).

All consultations were documented in the form of electronic medical records held on Excel by the extension project team. The patient care process devised by Cipolle, Strand and Morley (2012) was employed to produce the electronic medical records and to guide the consultations. The pharmaceutical care process proposed by these authors entails: - initial assessment (pharmaceutical anamnesis with collection of sociodemographic data, clinical history and previous and current pharmacotherapy, subjective experience with medications and other information allowing the identification of DRPs); - care plan (definition of therapeutic goals and pharmaceutical interventions to resolve and prevent DRPs); - assessment of outcomes (assessment of the effectiveness and safety of the pharmacotherapy and the clinical situation of the patients).

Study participants: All patients receiving CMM services provided by the team of students at the health clinic were included in the study. Patients were referred to the CMM service by the health team based on the following criteria: “hyper users” of the system; in use of multiple medications; individuals with chronic diseases; and having difficulties meeting the goals of their respective pharmacological treatment.

Data analysis and collection: The data collection instrument developed by Mendonça *et al.* (2016) for assessing clinical outcomes of an CMM service provided under the Family Health Strategy of a city in Minas Gerais was used. This instrument is based on studies assessing clinical outcomes of CMM services reported in the literature (Isetts *et al.*, 2008; Ramalho de Oliveira, Brummel & Miller, 2010; Mourão *et al.*, 2013). In the present study, data on the clinical status at last consultations were not collected because patients’ care cycles were not concluded during the study period. The data were collected from the records of the CMM service provided by pharmacy students.

Ethical aspects: The present study was approved by the ethics committee for human research of the educational and health institutions involved (permit CAAE 25780314.4.3001.5140). This study was conducted in conformance with all requirements regarding ethics in research involving human subjects. All study participants signed the Free and Informed Consent Form.

### 3. Results

A total of 20 patients were attended by the CMM team. The mean age of the patients was 69.2 years. Most patients were elderly, with 75% older than 60 years of age. There were no patients younger than 30 years. Of the 20 patients followed, 65% were women.

A total of 96 health problems were recorded, comprising 30 different problems. The mean number of health problems per patient was 4.8. The most prevalent health problems were systemic arterial hypertension (HT), affecting (n=16) 80% of the patients, and diabetes mellitus (type II) (DM II) (n= 14), affecting 70% (Table 1).

**Table 1.** Most common health problems among patients attended in the CMM service.

Health problem/Indication for drug use	Number of patients	
	n	%
HT	16	80
DM II	14	70
Cardiovascular Event Prevention	12	60
Dyslipidemia	10	50
Depression	6	30

CMM - comprehensive medication management; DM II - diabetes mellitus Type II; HT – hypertension.  
Source: Authors.

The 20 patients followed-up used a total of 136 drugs, comprising 48 different drugs, and a mean of 6.8 drugs per patient. The most frequently used drugs were NPH insulin and Simvastatin, both (n=11) in use by 55% of the patients, followed by Enalapril (n=10), used by 50% of patients (Table 2). These drugs corresponded with the treatment of the most prevalent health problems detected among the patients studied.

**Table 2.** Drugs most commonly used by patients attended in the CMM service.

Drugs	Number of patients	
	n	%
NPH Insulin	11	55
Sinvastatin	11	55
Enalapril	10	50
Furosemide	9	45
Losartan	8	40
Metformin	8	40
ASA	6	30
Amlodipine	5	25
Omeprazole	5	25
Carvedilol	4	20

CMM – comprehensive medication management; ASA – aspirin.  
Source: Authors.

A total of 35 DRPs were found, of which 40% (n=14) were related to indication (11.4% equals DRP 1 - unnecessary drug therapy and 28.6% equals DRP 2 - needs additional drug therapy), 22.9% (n=8) to effectiveness (22.9% equals DRP 4 - dosage too low), 17.2% to safety (8.6% equals DRP 5 - adverse drug reaction; 8.6% equals DRP 6 - dosage too high) and 20.0% to adherence (DRP 7).

The most frequent interventions were “Start new therapy”, “Change dose” and “Remove patient barriers to treatment adherence”, representing 73% of total interventions (Table 3). These interventions corresponded to the most frequent DRPs “Needs additional drug therapy”; “Dosage too low”; and “Non-adherence”, respectively.

**Table 3.** Interventions performed by the CMM team to resolve DRPs.

Interventions performed	Number of interventions	
	n	%
Start new drug therapy	5	22.7
Change dosage	5	22.7
Remove patient barriers to treatment adherence	5	22.7
Stop treatment	3	13.6
Provide written directions on drug timing	2	9.1
Change drug	1	4.5
Other	1	4.5
Total	22	100

CMM= comprehensive medication management; DRP: drug related problem.  
Source: Authors.

A total of 22 interventions were performed, of which eight (36.4%) required only direct intervention with the patient and were related to DRP 7, non-adherence. The remaining 14 interventions (63.6%) required prescriber-level collaboration. These were “Start new therapy”, “Change dosage”; “Stop treatment”; and “Change drug”.

#### 4. Discussion

The results of this study are similar to those reported in classic studies on pioneering CMM services conducted in North-America (Isetts et al., 2008; Ramalho de Oliveira, Brummel & Miller, 2010) and Brazil (Mendonça et al., 2016; Martins et al., 2013), as well as in studies assessing the clinical performance of Pharmacy degree students (McGivney, Hall, Stoehr, & Donegan, 2011; Agness & Brandt, 2011; Kassam, Kwong & Collins, 2013; Isetts & Sorensen, 1999), as depicted in Table 4.

The number of patients attended by the students in this present study was lower than that found in other studies involving Pharmacy degree students, explained by the differences in the number of students in the field and length of the experience, which were both lower in the present study. Compared with studies involving professionals (Isetts et al., 2008; Ramalho de Oliveira, Brummel & Miller, 2010), the number of consultations in the present study was much lower. This disparity is expected for educational studies assessing the clinical performance of students, given that the central focus is the teaching-learning process and not service productivity. The study by Martins et al. (2013) involving professionals attended fewer patients than the present study but was also of an educational nature and sought to assess this practice model as opposed to productivity.

**Table 4.** Comparison between the results of the present study and studies on clinical outcomes of CMM services involving Pharmacy professionals and students.

Study characteristics	Present study	Studies involving professionals			Studies involving students			
		Isetts <i>et al.</i> (2008)	Ramalho de Oliveira <i>et al.</i> (2010)	Martins <i>et al.</i> (2013)	Isetts & Sorensen (1999)	McGivney <i>et al.</i> (2011)	Agness <i>et al.</i> (2011)	Mendonça <i>et al.</i> (2016)
Period of consultations included in study	4 months	12 months	10 years	17 months	9 months	2 semesters	12 to 16 weeks	28 months
Team providing CMM services	7 graduate students and 3 tutors with weekly time commitment of 4 hours	7 pharmacists on full-time basis	10 pharmacists on full-time basis	2 pharmacists	105 graduate students	215 graduate students, 13 tutors and 23 final year students as monitors	-	2 tutors, graduate students and 1 pharmacist from health service
Number of patients	20	285	9.068	14	56	361	53	92
Mean age	69.2	-	-	61.6	54	-	80.5	63
Percentage of female patients	65.0%	66.0%	75.9%	85.7	78.6%	-	72.0%	67.4%
Mean health problems per patient	4.8	6.4	6.8	-	5.2	-	5.5	3.5
Most common health problems	HT (80%) and DM (70%)	-	HT (8.4%) and dyslipidemia (7.9%)	-	-	-	-	HT (29.5%) & DM (22%)
Mean drugs per patient	6.8	7.9	12.4	-	7.8	-	6.5 and 3.9*	-

Most used drugs	NPH Insulin (55%), Sinvastatin (55%) and Enalapril (50%)	-	-	-	-	-	-	Sinvastatin (12.7%), Metformin (11.9%) & hydrochlorothiazide (11.4%)
Most frequent DRP categories	DRP 2 (28.6%) and DRP 4 (22.9%)	DRP 2 (33.9%) and DRP 4 (19.9%)	DRP 2 (28.1%) and DRP 4 (26.1%)	DRP 1 and 2 (33.8%) and DRP 3 and 4 (24.6%)	-	DRP 7 (39%) & DRP 4 (32%)	DRP 7 (26.9%) & DRP 4 (17.3%)	DRP 5 (31%) & DRP 4 (18%)
Most common interventions	Start new therapy (22.7%), change dosage (22.7%) and remove patient barriers to treatment adherence (22.7%)	-	Education (35.8%), remove patient barriers to treatment adherence (26.8%), and start new therapy (11.8%)	Pharmacological intervention to optimize treatment (45.9%) and non-pharmacological measures (31.1%)	-	-	-	Change drug (22.1%), stop treatment (16.3%) and instructions to patients (16%)

CMM – comprehensive medication management; HT – hypertension; DM – diabetes mellitus; DRP – drug related problem; DRP 1: Unnecessary drug therapy; DRP 2: Needs additional drug therapy; DRP 3: Ineffective drug; DRP 4: Dosage too low; DRP 5: Adverse drug reaction; DRP 6: Dosage too high; DRP 7: Non-adherence  
 Source: Authors.

Regarding the studies involving students, the mean age of patients found in the present study was similar to that of the study by Kassam, Kwong and Collins (2013), revealing a predominance of elderly. The study by Agness, Huynh and Brandt (2011) had a higher mean age, although the target population was older adults only. The studies conducted by Isetts et al. (2008) and by Ramalho de Oliveira, Brummel and Miller (2010), reporting the outcome of services provided by professionals, the percentage of patients aged  $\geq 65$  years was 14% and 44.5%, respectively, showing that most patients were not elderly. Regarding this difference in the mean age of the patients attended by students and those seen by professionals, there are advantages and disadvantages to consider in the planning of the activity of pharmacy practice experience. The students are exposed to more far-reaching situations in their teaching-learning process when attending elderly patients, who may have high complexity with respect to their pharmacotherapeutic needs (greater number of comorbidities, medications and risk of DRPs). However, it is important to also bear in mind that, early in the training process, seeing patients with a low level of complexity may be more manageable for students. Another consideration that should be made is the need to prepare students to deal with adults of economically active age, whose background differs of that of elderly and influences the use of medications (work context, different family responsibilities, absence of complications of chronic conditions, among others).

The percentage of females receiving CMM services was also high in the studies involving professionals and students (Agness, Huynh & Brandt, 2011; Mendonça et al., 2016; Ramalho de Oliveira, Brummel & Miller, 2010; Isetts & Sorensen, 1999; Martins et al., 2013), which is not exclusive to CMM services. The scientific literature shows that, in general, women use health services more than men (Pinheiro, Viacava, Travassos & Brito, 2002).

A high average number of health problems per patient is a common characteristic of the population attended by CMM services (Agness, Huynh & Brandt, 2011; Isetts et al., 2008; Ramalho de Oliveira, Brummel & Miller, 2010; Isetts & Sorensen, 1999). A patient population with a higher number of health problems has been observed in studies of services that are systematized and well-consolidated, have been in place for a longer period, and that involve a larger number of patients (Isetts et al., 2008; Ramalho de Oliveira, Brummel & Miller, 2010). In addition, chronic diseases are more common among users of CMM services (Mendonça et al., 2016; Ramalho de Oliveira, Brummel & Miller, 2010). The most common disease among the CMM patients was systemic arterial hypertension, also the case in both Brazilian (Mendonça et al., 2016; Santos et al., 2021) and international (Isetts et al., 2008; Ramalho de Oliveira, Brummel & Miller, 2010; Brajković et al., 2019) studies. This points to the need for inclusion of this profile of patients in the teaching-learning process of students to prepare them for the reality they will encounter in health systems.

The mean number of drugs per patient was also very high, congruent with the average number of health problems per patient studied. Other studies have also shown a large proportion of patients on polypharmacy among CMM service users. The most frequently used drugs corresponded to the treatment of the most prevalent diseases, both in this study and that of Mendonça et al. (2016).

The most common DRPs identified mirror those found in studies investigating the outcome of services provided by professional pharmacists (Isetts et al., 2008; Ramalho de Oliveira, Brummel & Miller, 2010), namely, DRP 2 – needs additional therapy and DRP 4 – dosage too low. The study by Martins et al. (2013), assessing the frequency of DRPs, although categorized in a different manner, also found DRPs related to indication and effectiveness as the most common problems. Studies of services provided by students have also found dosage too low to be the most prevalent DRP (McGivney, Hall, Stoehr, & Donegan, 2011; Agness, Huynh & Brandt, 2011). Logically, the most frequent interventions were those related to the resolution of the most common DRPs identified. Similar interventions were identified in the study carried out by Ramalho de Oliveira, Brummel and Miller (2010). These data reveal the good performance of the students involved in the pharmacy practice experience, in as far as the pattern of identification and proposal of interventions for resolution of DRPs was like that

of experienced practitioners.

Limitations: This study has limitations stemming from adversities that arose during the course of the extension project, as outlined below. Not all patients referred by the health team met the criteria suggested by the CMM team, resulting in patients being attended that did not have the best potential for benefit (“hyper users” of the system, in use of multiple medications, individuals with chronic diseases and having difficulties meeting their goals of therapy). Under-reporting of DRPs on electronic medical records was evident, rendering it impossible to distinguish cases in which no DRPs were identified from those in which DRPs may have gone unrecorded. In addition, the educational interventions performed with patients, prevalent in classic studies of CMM services, were also not recorded. Suspected DRPs requiring laboratory exams for confirmation were also recorded. This led to the involvement of other professionals, such as nurses or physicians from the medical teams, which may have hampered the detection of DRPs in some cases. The number of DRPs detected was greater than the number of interventions proposed. This discrepancy occurred because numerous care plans were not implemented within the study period, given that the care cycles had not been concluded. The CMM service team performed the initial assessment, detected DRPs and devised care plans, discussing some of these with patients and professionals from the health team, but not fully. In the following year, one student remained on the extension project and continued seeing patients for follow-up visits to implement the needed care plans. Participation of a professional from the health service as a reference in the CMM service (preceptor pharmacist) could prevent this type of limitation, and aided with the integration of the CMM service into the health service and ensure its sustainability.

## 5. Final Considerations

The findings of the present study allow inferences to be made about the usefulness of pharmaceutical care practices to develop clinical competencies in pharmacy degree students, given that the performance of students in identifying and proposing solutions to DRPs proved comparable to that of other pharmacy practitioners in similar scenarios. Furthermore, the study revealed the importance of diversifying the characteristics of patients included in the educational process to train pharmaceutical care practitioners, thereby better preparing Pharmacy students for the reality they will encounter in healthcare systems.

Finally, it is important to continue evaluating the clinical results of patients assisted by students as an educational outcome, expanding the approach, as this study evaluated the service in a pilot project context. The expansion of the CMM service associated with educational projects can provide studies with a larger number of students and patients, highlighting the positive results of these services.

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