Pharmacotherapeutic follow-up in a respiratory intensive care unit: description and analysis of results

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ABSTRACT
Objective: To describe and evaluate the pharmacotherapeutic follow-up by a clinical pharmacist in an intensive care unit. Methods: A descriptive and cross-sectional study carried out from August to October 2016. The data were collected through a form, and pharmacotherapeutic follow-up conducted by a clinical pharmacist at the respiratory intensive care unit of a tertiary hospital. The problems recorded in the prescriptions were quantified, classified and evaluated according to severity; the recommendations made by the pharmacist were analyzed considering the impact on pharmacotherapy. The medications involved in the problems were classified according to the Anatomical Therapeutic Chemical Classification System. Results: Forty-six patients were followed up and 192 pharmacotherapy-related problems were registered. The most prevalent problems were missing information on the prescription (33.16%), and those with minor severity (37.5%). Of the recommendations made to optimize pharmacotherapy, 92.7% were accepted, particularly those on inclusion of infusion time (16.67%), and dose appropriateness (13.02%), with greater impact on toxicity (53.6%). Antimicrobials, in general, for systemic use were drug class most often related to problems in pharmacotherapy (53%). Conclusion: Pharmacotherapeutic follow-up conducted by a pharmacist in a respiratory intensive care unit was able to detect problems in drug therapy and to make clinically relevant recommendations.

Keywords: Critical care; Pharmacists; Pharmaceutical services; Pharmacy service, hospital; Drug prescriptions

RESUMO
Objetivo: Descrever e avaliar o acompanhamento farmacoterpéutico do farmacêutico clínico em uma unidade de terapia intensiva. Métodos: A descrição e avaliação do acompanhamento farmacoterpéutico por um farmacêutico clínico em uma unidade de terapia intensiva. Os dados foram coletados por meio de uma ficha de registro, com acompanhamento farmacoterapêutico realizado pelo farmacêutico clínico em uma unidade de terapia intensiva respiratória de um hospital terciário. Os problemas registrados nos prescrições foram quantificados e classificados, sendo avaliados quanto à gravidade; as recomendações realizadas pelo farmacêutico foram analisadas em relação ao impacto na farmacoterapia. Os medicamentos envolvidos nos problemas foram categorizados utilizando o Anatomical Therapeutic Chemical Classification System. Resultados: Foram acompanhados 46 pacientes, sendo 192 problemas relacionados à farmacoterapia. Os mais prevalentes foram dados ausentes na prescrição (33.16%) e aqueles com menor gravidade (37.5%). Daqueles recomendados para otimização da farmacoterapia, 92.7% foram aceitos, particularmente aqueles de inclusão de tempo de infusão (16.67%), e dose adequada (13.02%), com maior impacto na toxicidade (53.6%). Antibacterianos, em geral, para uso sistêmico foram a classe de medicamentos mais relacionada a problemas na farmacoterapia (53%). Conclusão: O acompanhamento farmacoterpéutico realizado por um farmacêutico em uma unidade de terapia intensiva respiratória foi capaz de detectar problemas em relação ao uso de medicamentos e para fazer recomendações relevantes.

Keywords: Assistência crítica; Farmacêuticos; Serviços farmacêuticos; Serviço de farmácia, hospital; Prescrições medicamentosas
The Pharmacy Department of the Associação de Medicina Intensiva Brasileira [Brazilian Intensive Care Medicine Association] was established in 2008, emphasizing the importance of the participation of this professional in the intensive care team. In 2010, Agência Nacional de Vigilância Sanitária [ANVISA] [National Heath Surveillance Agency] issued the Collegiate Board Resolution Number 7, providing about the general care conditions in ICU, to ensure the presence of a clinical pharmacist at the bedside.

Pharmacists may participate in many different activities, such as follow-up and monitoring of the medical prescriptions regarding medications, dose, interval, route, dilution, and administration, drug incompatibility; individual assessment of risks; search for updated scientific literature to identify drug administration standards and prepare protocols; participation in promotion of continuing education, fostering knowledge sharing in the multiprofessional team, and providing appropriate technical support; conduction of training sessions; monitoring of adverse events and drug interactions; treatment optimization to reduce hospital costs and thus ensure safe prescription, use and administration of drugs.

In healthcare systems, pharmacists are one of the last resources to identify, correct or reduce potential risks associated with therapy. The pharmaceutical recommendations for the rational use of drugs are relevant and acknowledged, but there are still scarce reports on this activity, primarily in special groups of patients.

There are currently no studies on the role of clinical pharmacists in intensive care for specific risk groups, such as patients with respiratory problems. This fact demonstrates the need for research that contributes to professional development, promotion of rational use of drugs, by critical analysis of risks and benefits of the therapies proposed, and analysis of drug prescriptions prior to dispensing and administration to patients.

OBJECTIVE
To describe the pharmacotherapeutic follow-up by a clinical pharmacist at a respiratory intensive care unit.

METHODS
A descriptive cross-sectional study conducted at the respiratory ICU of Hospital de Messejana Dr. Carlos Alberto Studart Gomes (HM), in Fortaleza, (CE, Brazil)
Brazil, from August to October 2016. The ICU had eight beds for acute and chronic patients who required intensive life support. Patients presented varied clinical conditions, including exacerbated chronic obstructive pulmonary disease, pneumonia, tuberculosis, and other respiratory problems.

The convenience sample included all pharmacotherapeutic follow-ups of patients admitted to the ICU from August to October 2016, and conducted by a clinical pharmacist. Patients with incomplete follow-up form that hindered data analysis, and/or those admitted to the ICU for less than 24 hours were excluded.

During the pharmacotherapeutic follow-up, the results of laboratory tests and records by the multiprofessional team in the medical charts, including medical prescriptions, were analyzed.

The problems and pharmaceutical recommendations documented in the follow-up forms were quantified and classified according to an adapted version made by Costa and Martins. (8,15) The adjustment was made to include the pharmacotherapy-related problems considered frequent in adult ICU specialized in respiratory conditions.

The severity of problems related to drug therapy was analyzed by a method adapted from Overhage et al., and modified by Fernandez-Llamazares et al. and Costa. (8,16,17) The classification of Farré Riba et al., (18) was used to analyze the impact of pharmaceutical recommendations, considering as “impact on efficacy” the recommendations that enabled better use of medication by patients to achieve the planned therapeutic goals, and including the recommendations that improve care delivered. The recommendations classified as “impact on toxicity” were those that enabled reducing risks when patients used a drug.

The medications involved in the pharmacotherapy-related problems were classified according to the Anatomical Therapeutic Chemical (ATC) classification system. (19)

Data analysis was conducted using Excel software for tabulation and cross-referencing of variables using the Epi-Info program v.3.5.1. Numerical variables were described as means and standard deviations, and categorical variables as proportions.

The study was designed according to guidelines and regulatory norms of research involving human beings (CNS: 466/2012). It was submitted to the Internal Review Board of HM, and approved under number 1.536.402, CAAE: 55297316.6.0000.5039. Data collected were treated as confidential, with no identification of patients.

RESULTS

A total of 46 patients were followed up during the study period. The most frequent diagnoses were sepsis/septic shock (17.34%), chronic obstructive pulmonary disease (15.30%) and pneumonia (11.22%), with a mean of 2.1 diagnoses per patient (standard deviation (SD)±1.0; minimum: one diagnosis; maximum: four diagnoses). The mean length of stay at respiratory ICU during the study period was 14.7 days (SD±12.2; minimum: 1 day; maximum: 60 days), and 63% of patients were transferred to the ward. There were more males (63%). Most patients were aged 66-80 years (34.8%) and >80 years (21.7%), with mean age 66.5 years (SD±16.1; minimum: 25 years; maximum: 91 years) (Table 1).

Table 1. Characteristics of the study population at a respiratory intensive care unit

| Variables                  | n (%) |
|----------------------------|-------|
| Sex                        |       |
| Male                       | 29 (63.0) |
| Female                     | 17 (37.0) |
| Age group, years           |       |
| 25-35                      | 1 (2.2) |
| 36-45                      | 4 (8.7) |
| 46-55                      | 6 (13.0) |
| 56-65                      | 9 (19.6) |
| 66-80                      | 18 (38.4) |
| > 80                       | 10 (21.7) |
| Discharge from ICU         |       |
| Ward                       | 29 (63.0) |
| Death                      | 17 (37.0) |
| Length of stay at ICU, days|       |
| <10                        | 22 (48.0) |
| 11-20                      | 17 (37.0) |
| 21-30                      | 4 (8.7) |
| 31-40                      | 1 (2.2) |
| > 41                       | 2 (4.4) |

ICU: intensive care unit.

We analyzed 192 problems related to drug therapy registered in the pharmacotherapy follow-up for 528 prescriptions analyzed. The most prevalent were
missing information on prescription (33.16%), doses higher than appropriate (12.43%), and unavailability (shortage) (9.84%) (Table 2). Regarding the problems identified, the clinical pharmacist registered 192 recommendations made to the multiprofessional team, with acceptance in 92.7% of cases. The most frequent recommendations were infusion time (inclusion) (16.7%), dose (appropriateness) (13.0%), dilution/reconstitution (inclusion) (13.0%), and drug withdrawal (13.0%). Regarding the recommendations not accepted, the clinical pharmacist documented the patients were monitored for possible adverse events.

The problems related to pharmacotherapy (incomplete information in the prescription, inadequate or missing information on pharmaceutical formulation, medication not included on the hospital formulary, among others) were classified regarding severity as potentially lethal (2.1%), severe (14.6%), significant (31.3%), no error (14.6%), and mostly minor (37.5%). Duplicate order, medication omitted from prescription, insufficient dose for the patient’s condition, were classified as significant (31.3%). Spelling or interpretation errors that could lead to wrong dispensing, documented drug allergy (such as prescription of dipyrone for patients reporting allergy to this drug), high dose (>10-fold the normal dose of a drug with normal therapeutic index) were classified as severe (14.6%).

Most pharmaceutical recommendations regarding impact were on toxicity, thus reducing the risk of patients on some medications (53.6%) (Table 3).

The drug class more often involved in pharmacotherapy-related problems related was antimicrobials, in general, for systemic use (53%). The pharmaceutical recommendations for these agents had an impact on effectiveness and toxicity of pharmacotherapy. Drugs for digestive system and metabolism (14%) rank second. In these groups, meropenem, piperacillin/tazobactam and omeprazole stood out (Table 4).

### Table 2. Problems related to pharmacotherapy according to the pharmaceutical recommendations documented during the pharmacotherapeutic follow-up of patients at the respiratory intensive care unit

| Pharmacotherapy-related problems                                      | n (%)    | Pharmaceutical recommendations                                      | n (%)    |
|-----------------------------------------------------------------------|----------|-------------------------------------------------------------------|----------|
| Inadequate timing                                                     | 3 (1.6)  | Timing (appropriateness)                                          | 3 (1.6)  |
| Inadequate dilution/reconstitution                                     | 15 (8.0) | Purchase of medication/health supplies                            | 2 (1.0)  |
| Dose higher than recommended                                          | 24 (12.4)| Correct writing                                                   | 4 (2.1)  |
| Dose lower than recommended                                           | 8 (4.1)  | Dilution/reconstitution (appropriateness)                         | 12 (6.3) |
| Duplicate order/prescription                                          | 9 (4.7)  | Dilution/reconstitution (inclusion)                               | 25 (13.0)|
| Unnecessary test                                                       | 1 (0.5)  | Dose (appropriateness)                                            | 25 (13.0)|
| Inadequate pharmaceutical formulation                                  | 4 (2.1)  | Dose (inclusion)                                                  | 3 (1.6)  |
| Unavailability (shortage)                                              | 19 (9.8) | Pharmaceutical formulation (appropriateness)                      | 2 (1.0)  |
| Missing information in prescription                                    | 64 (33.2)| Inclusion of medication                                           | 6 (3.1)  |
| Unsafe medication due to drug interaction                              | 10 (5.2) | Technical information on medication                               | 15 (7.8) |
| Incorrect medication due to contraindication, allergy or adverse reaction | 13 (6.7) | Dosage (appropriateness)                                          | 6 (3.1)  |
| Necessary medication not administered                                  | 1 (0.5)  | Dosage (inclusion)                                                | 2 (1.0)  |
| Necessary medication not prescribed                                    | 6 (3.1)  | Medication replaced                                               | 23 (12.0)|
| Unnecessary medication prescribed                                      | 4 (2.1)  | Cancel unnecessary test orders                                    | 1 (0.5)  |
| Adverse drug reaction (ADR)                                            | 1 (0.5)  | Withdraw medication                                               | 25 (13.0)|
| Incorrect writing                                                      | 4 (2.1)  | Infusion time (appropriateness)                                   | 5 (2.8)  |
| No problem in prescription                                            | 2 (1.0)  | Infusion time (inclusion)                                         | 32 (16.7)|
| Inadequate infusion time                                               | 3 (1.6)  | Administration route (appropriateness)                            | 1 (0.5)  |
| Inadequate administration route                                        | 1 (0.5)  |                                                                    |          |
Table 3. Correlation between pharmaceutical recommendations and impact on the study conducted at the respiratory intensive care unit

| Pharmaceutical recommendations | Impact | Total % |
|--------------------------------|--------|---------|
|                                | Effectiveness % | Toxicity % |
| Timing (appropriateness)       | -      | 100 (n=3) |
| Purchase of medication/health supplies | 100 (n=2) | - |
| Correction in writing          | 50 (n=2) | 50 (n=2) |
| Dilution/reconstitution (appropriateness) | 16.7 (n=2) | 83.3 (n=10) |
| Dilution/reconstitution (inclusion) | 100 (n=25) | - |
| Dose (appropriateness)         | 16 (n=4) | 84 (n=21) |
| Dose (inclusion)               | 66.7 (n=2) | 33.3 (n=1) |
| Pharmaceutical formulation (adequacy) | 100 (n=2) | - |
| Inclusion of medication        | 100 (n=6) | - |
| Technical information on medication | 33.3 (n=5) | 66.7 (n=10) |
| Dosage (appropriateness)       | 33.3 (n=2) | 66.7 (n=4) |
| Dosage (inclusion)             | 100 (n=2) | - |
| Medication replaced            | 78.3 (n=18) | 21.7 (n=5) |
| Cancel unnecessary test orders | -      | 100 (n=1) |
| Medication withdrawal          | 8 (n=2) | 92 (n=23) |
| Infusion time (appropriateness) | 60 (n=3) | 40 (n=2) |
| Infusion time (inclusion)      | 37.5 (n=12) | 62.5 (n=20) |
| Administration route (appropriateness) | - | 100 (n=1) |

n: represents the number of pharmaceutical recommendations given and classified according to impact.

Table 4. Correlation between classification of the drugs involved according to the Anatomical Therapeutic Chemical classification system and impact of pharmacotherapy-related problems

| ATC Classification | Impact | Total % |
|--------------------|--------|---------|
|                    | Effectiveness % | Toxicity % |
| A Digestive system and metabolism | 67.9 (n=19) | 32.1 (n=9) |
| B Blood and hematopoietic organs | 7.7 (n=1) | 92.3 (n=12) |
| C Cardiovascular system | 23.5 (n=4) | 76.5 (n=13) |
| D Dermatological medications | 100 (n=1) | - |
| H Systemic hormone preparations, excluding sex hormones and insulin | 33.3 (n=3) | 66.7 (n=6) |
| J Antimicrobials in general for systemic use | 51.9 (n=55) | 48.1 (n=51) |
| M Musculoskeletal system | 50 (n=1) | 50 (n=1) |
| N Nervous system | 15 (n=3) | 85 (n=17) |
| P Antiparasitary, insect repellents | 100 (n=2) | - |
| R Respiratory system | - | 100 (n=2) |

χ² test: p<0.05. n: represents the number of medications implied in the pharmacotherapy-related problems and classified according to impact. ATC: Anatomical Therapeutic Chemical.

DISCUSSION

The multiprofessional residency program allowed the inclusion of pharmacists in the wards, ICU, and outpatient clinics of the hospital, as well as implementation of clinical activities. Pharmacotherapeutic follow-up of patients in the HM respiratory ICU is done by monitoring medications used and duration of use, including antimicrobials and treatment of comorbidities, to identify problems related to medications, prevent and/or solve them, with a focus on patient safety. The form employed has a field to document pharmaceutical recommendations and results of laboratory tests used for monitoring.
In a study conducted by Bohomol et al.,\(^{20}\) the mean age was 58 years and the mean length of stay 12.4 days. However, a study carried out in a Dutch hospital found different data; there was predominance of male patients, with a mean age of 63.22 years and an mean length of stay of 2.06 days.\(^{11}\) These data corroborate our findings. A prospective cohort study in Japan had mostly male patients, with mean age of 66 years and mean length of stay of 10 days.\(^{6}\) The main issue faced when studying an older population, with more than one diagnosis and hospitalized for many days at an ICU, is the increased risk of adverse events. These are defined as unwanted complications arising from care provided, not attributed to the natural course of the underlying disease, caused mainly by problems related to prescription.\(^{22}\)

The participation of the pharmacist in the daily clinical activities of inpatients units was a major advance at the HM during the study period, and enabled identifying the problems related to pharmacotherapy that were not perceived at pharmacy, such as drug interactions, incompatibilities, timing, dilution, inadequate doses, among others. All prescriptions made during the patients’ stay were evaluated and validated, i.e., one prescription per day for each patient. Based on the problems found, the pharmacist made pharmaceutical recommendations to prevent them from harming patients.

The benefit of having a pharmacist involved in clinical activities can be confirmed by the number of pharmacotherapy-related problems identified in the prescriptions analyzed in the study. This result is similar to that found by Agalu et al., who reported a 23.8% rate of missing information in the prescriptions (dose, frequency, route of administration, and unit of measurement), and 15.1% related to dose errors.\(^{22}\) Klopotowska et al., also demonstrated that most problems related to pharmacotherapy were linked to dose errors or omission (31.6%).\(^{11}\)

In this study, the importance of individualizing pharmacotherapy was demonstrated by the clinical pharmacist through the most frequent recommendations. Studies conducted at university hospitals in Fortaleza (CE, Brazil), Curitiba (PR, Brazil), and in the Netherlands, also detected the need for management of dilution and infusion time, dose adjustment and drug withdrawal.\(^{15,23}\) Costa, in a study carried out at a university hospital in Campinas (SP, Brazil), showed acceptance of 86.14% of pharmaceutical recommendations made in one year.\(^{10}\) Leape et al., however, in a study conducted in the United States, had 99% acceptance.\(^{15}\)

The drug classes more often involved in pharmacotherapy-related problems study were antimicrobials, in general, for systemic use, and agents for the digestive system and metabolism. Such drugs are usually prescribed for critical patients, for being part of clinical protocols (e.g., omeprazole for prophylaxis of stress ulcer) or because they are used to treat common diseases in this population (such as meropenem, for Gram-negative bacteria infections). Other studies have also shown these drugs to be the most frequently responsible for pharmacotherapy-related problems.\(^{3,5,8,23}\)

As limitation of this study, we can mention a flaw in the documentation of pharmaceutical results for further analysis, as well as records of problems for analysis of severity.

**CONCLUSION**

Patients admitted to the respiratory intensive care unit, where pharmacotherapeutic follow-up was assessed, were on polypharmacy for presenting more than one diagnosis. Therefore, potentially lethal and severe problems were detected, and pharmaceutical recommendations were made to the multiprofessional team. The recommendations led to reduced toxicity and increased effectiveness of drug therapy prescribed.

**REFERENCES**

1. Klopotowska JE, Kuiper R, van Kan HJ, de Pont AC, Dijkstra MG, Lie-A-Huen L, et al. On-ward participation of a hospital pharmacist in a Dutch intensive care unit reduces prescribing errors and related patient harm: an intervention study. Crit Care. 2010;14(5):R174.
2. Plau R, Hegele V, Heineck I. [Role of clinical pharmacist in adult intensive care unit: a literature review]. Rev Bras Farm Hosp Serv Saude. 2014;51(1):19-24. Portuguese.
3. Silva LO, Oliveira AI, Araújo IB, Saldanha V. Prescribing errors in an intensive care unit and the role of the pharmacist. Rev Bras Farm Hosp Serv Saude. 2012;3(3):6-10.
4. Morimoto T, Sakuma M, Matsui K, Kuramoto, Yoshiki T, Murakami J, et al. Incidence of adverse drug events and medication errors in Japan: the JADE study. J Gen Intern Med. 2011;26(2):148-53.
5. Reis WC, Scopel CT, Correr CJ, Andrejevski VM. Analysis of clinical pharmacists interventions in a tertiary teaching hospital in Brazil. einstein (São Paulo). 2013;11(2):190-6.
6. Suggested definitions and relationships among medication misadventures, medication errors, adverse drug events, and adverse drug reactions. Am J Health Syst Pharm. 1998;55(2):165-6.
7. Camiré E, Moyen E, Stellox HT. Medication errors in critical care: risk factors, prevention and disclosure. CMAJ. 2009;180(9):936-43. Review.
8. Costa LS. Atuação do farmacêutico em unidade de terapia intensiva: impacto da Farmácia Clínica no acompanhamento da terapia medicamentosa [dissertation]. Campinas: Universidade Estadual de Campinas; 2014.
9. Nunes PH, Pereira BM, Nominato JC, Albuquerque EM, Silva LF, Castro IR, et al. Intervenção farmacêutica o prevenção de eventos adversos. Rev Bras Cienc Farm. 2008;44(4):691-9.
10. Organização Pan-Americana da Saúde (OPAS). Consenso Brasileiro de Atenção Farmacêutica: proposta [Internet]. Brasília: OPAS;2002 [citado 2017 Out 10]. Disponível em: http://bvsms.saude.gov.br/bvs/publicacoes/PropostaConsensoAtenfar.pdf
11. Agência Nacional de Vigilância Sanitária (ANVISA). Resolução nº 7, de 24 de fevereiro de 2010. Dispõe sobre os requisitos mínimos para funcionamento de Unidades de Terapia Intensiva e dá outras providências [Internet]. Brasília (DF): ANVISA; 2010 [citado 2018 Jan 10]. Disponível em: http://bvsms.saude.gov.br/bvs/saudelegis/anvisa/2010/res0007_24_02_2010.html

12. Horn E, Jacobi J. The critical care clinical pharmacist: evolution of an essential team member. Crit Care Med. 2006;34(3 Suppl):S46-51. Review.

13. Leape LL, Cullen DJ, Clapp MD, Burdick E, Demonaco HJ, Erickson JI, et al. Pharmacist participation on physician rounds and adverse drug events in the intensive care unit. JAMA. 1999;282(3):267-70. Erratum in: JAMA 2000; 283(10):1293.

14. Oliveira LM, Thiesen FV, Zimmer AR, Morrone FB, Munhoz TP. O papel do farmacêutico em Unidade de Terapia Intensiva (UTI) [Internet]. São Paulo: Instituto Rancine; 2013 [citado 2018 Jan 10]. Disponível em: http://www.racine.com.br/o-papel-do-farmaceutico-em-unidade-de-terapia-intensiva-uti/

15. Martins BC. Acompanhamento farmacoterapêutico de pacientes transplantados renais: da descrição aos desfechos clínicos [dissertação]. Fortaleza: Universidade Federal do Ceará; 2015.

16. Overhage JM, Lukes A. Practical, reliable, comprehensive method for characterizing pharmacists’ clinical activities. Am J Health Syst Pharm. 1999; 56(23):2444-50. Review.

17. Fernandez-Llamazares CM, Calleja-Hermández MÁ, Manrique-Rodríguez S, Pérez-San C, Durán-García E, Sanjurjo-Sáez M. Prescribing errors intercepted by clinical pharmacists in pediatrics and obstetrics in a tertiary hospital in Spain. Eur J Clin Pharmacol. 2012;68(9):1339-45.

18. Farré Riba R, Clopés Estela A, Sala Esteban ML, Castro Cels I, Gámez Lechuga M, López Sánchez S, et al. Intervenciones farmacéuticas (parte I): metodología y evaluación. Farm Hosp. 2000;3(24):136-44.

19. World Health Organization Collaborating Centre For Drug Statistics Methodology (WHOCC). Anatomical Therapeutic Chemical Classification (ATC Code) [Internet]. Norway: WHOCC; 2015. 2015 [cited 2016 Feb 6]. Available from: https://www.whocc.no/atc_ddd_index/

20. Bohomol E, Ramos LH, D’Innocenzo M. Medication errors in an intensive care unit. J Adv Nurs. 2009;65(6):1259-67.

21. Gallotti RM. Eventos adversos: o que são? Rev Assoc Med Bras. 2004; 50(2):114.

22. Agalu A, Ayele Y, Bedada W, Woldie M. Medication prescribing errors in the intensive care unit of Jimma University Specialized Hospital, Southwest Ethiopia. J Multidiscip Healthc. 2011;4:377-82.

23. Fideles GM, de Alcântara-Neto JM, Peixoto Júnior AA, de Souza-Neto PJ, Tonete TL, da Silva JE, et al. Pharmacist recommendations in an intensive care unit: three-year clinical activities. Rev Bras Ter Intens. 2015;27(2):149-54.