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Original

Pharmaceutical care in the dispensation of antimicrobials: flowchart development and standardization of dispensation

Cuidado farmacêutico na dispensação de antimicrobianos: desenvolvimento de fluxograma e padronização de dispensação

Atención farmacéutica en la dispensación de antimicrobianos: desarrollo de diagramas de flujo y estandarización de la dispensación

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ABSTRACT

Objective: To develop a dispensing flow chart in order to assist in the decision making of the pharmacist and collaborators and to formulate an explanatory folder for the patients who use antimicrobials, considering the reality of a community pharmacy. **Methods**: A methodological study of the creation of a flowchart for the dispensation of antimicrobial agents, taking into account specific peculiarities such as care of the use, treatment time, resistance prevention with steps of information to be passed on to patients at the time of dispensing. **Results**: The flow chart and the educational folder were elaborated as educational information strategies to be disseminated to the population. **Conclusion**: Antimicrobial dispensing can be performed according to the proposed flowchart model, since it is proposed for the reality of dispensing in community pharmacies, which makes the whole process standard, thus guaranteeing the quality of care and treatment of the patient from better adherence to the treatment of the patient

Keywords: Anti-Infectious; Bacterial drug resistance; Good Dispensing Practices; Pharmaceutical care.

RESUMO

Objetivo: Desenvolver um fluxograma de dispensação afim de auxiliar na tomada de decisão do farmacêutico e colaboradores e formular um *folder* explicativo aos pacientes que utilizam antimicrobianos, considerando a realidade de uma farmácia comunitária. **Métodos:** Estudo metodologico de criação de fluxograma para dispensação de antimicrobianos levando em considerações particularidades específicas como cuidados do uso, tempo de tratamento, prevenção de resistência com etapas de informações a serem repassadas aos pacientes no momento da dispensação. **Resultados:** Foi elaborado o fluxograma e do *folder* educativo como estratégias educativa de informações à serem difundidas para a população. **Conclusão**: A dispensação de antimicrobianos pode ser executada de acordo com modelo de fluxograma proposto, pois é proposto para a realidade da dispensação em farmácias comunitárias, o que torna todo o processo padrão, sendo assim garantindo a qualidade no atendimento e tratamento do paciente a partir da melhor adesão ao tratamento do paciente.

Descritores: Anti-Infecciosos; Farmacorresistencia Bacteriana; Boas Práticas de Dispensação; Assistência Farmacêutica.

RESUMÉN

Objetivo: Desarrollar un diagrama de flujo de dispensación para ayudar en la toma de decisiones del farmacéutico y los colaboradores y formular una carpeta explicativa para los pacientes que usan antimicrobianos, considerando la realidad de una farmacia comunitaria. **Métodos**: estudio metodológico de la creación de un diagrama de flujo para la administración de agentes antimicrobianos, teniendo en cuenta las particularidades específicas, como el cuidado del uso, el tiempo de tratamiento, la prevención de la resistencia y los pasos de información que deben transmitirse a los pacientes en el momento de la administración. **Resultados**: El diagrama de flujo y la carpeta educativa se elaboraron como estrategias de información educativa que se difundirán a la población. **Conclusión**: la administración de antimicrobianos se puede realizar de acuerdo con el modelo de diagrama de flujo propuesto, ya que se propone para la realidad de la administración en farmacias comunitarias, lo que hace que todo el proceso sea estándar, garantizando así la calidad de la atención y el tratamiento del paciente con una mejor adherencia a la tratamiento del paciente.

Palabras clave: Antiinfeccioso; Resistencia bacteriana a los medicamentos; Buenas prácticas de dispensación; Cuidado farmacéutico.

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INTRODUCTION

The first antimicrobials, better known as antibiotics, were developed in the mid-1940s and have since been widely used to treat and prevent infectious diseases, significantly reducing deaths from infections. However, its extensive use has caused pathogenic microorganisms to adapt and resist due to the development of resistance mechanisms.[1-3]

According to statistics published by the World Health Organization 25% of the world's deaths are caused by infections.[4] Every year in the United States, at least 2 million people become infected with antibiotic-resistant bacteria and at least 23,000 people die every year as a direct result of these infections. In Brazil, due to underreporting of infections with the Ministry of Health, which leads to a reduced consolidation of information by several hospitals, knowledge about the extent of the problem in the country is impaired.[5] In 2017, the Ministry of Health (MS) evaluated the seriousness of the infections in 99 outpatient hospitals attended by the Unified Health System (SUS), located in the Brazilian capitals, identifying a hospital infection rate (IH) of 13.0% and are classified as a contributing factor in 87.1% of deaths.[6] In addition, morbidity and mortality associated with infections by difficult-to-treat pathogens such as *Pseudomonas aeruginosa* or *Acinetobacter baumannii* are exacerbated by the development of resistance and lack of effective therapeutic options for eradication.[7-8]

Bacterial resistance is a serious health problem today, leading to recurrent nosocomial infections, reduced antimicrobial efficacy, expensive and imprecise treatments, resulting in high rates of morbidity and mortality. The ease of access to antimicrobials, as well as their irrational use, lack of sanitary and social control, difficulties in proper diagnosis, lack of supervision in sales, errors in prescription and administration, among others contributed to the development of resistance.[9]

In an attempt to stop the onset of resistance, reduce self-medication and abusive use of antimicrobials by the population on May 5, 2011, the Resolution of the Collegiate Board of Directors (as per its portuguese acronym, RDC 20/2011) was created by the National Agency of Sanitary Surveillance of Brazil (as per its portuguese acronym, ANVISA). This RDC decrees that, as of the date of publication, all private and private pharmacies and drugstores must dispense antimicrobials, through retention of revenue and bookkeeping in the National Controlled Products Management System (NCPMS).[10]

For the rationalization of the use of antimicrobial some changes are necessary in order to minimize the harmful consequences of the use of antimicrobial, as the toxicity, the selection of less sensitive pathogens and the development of resistance. Rational use of antimicrobials should be an essential part of ensuring patient safety.[11]

At the time of the dispensing of antimicrobial drugs, the pharmacist should clearly and thoroughly explain to the patient/user/purchaser the benefits of the treatment. It should be ensured that it does not present any uncertainty as to the reason for the

prescription, contraindications, posology (dosage, dose, pharmaceutical form, technique, route and times of administration), adverse reactions and drug interactions, treatment time, condition of conservation and discard.[12] The disinformation of the Brazilian population on the rational and adequate use of antibiotics is a concern, as observed by a study carried out in 2005[13] at a Health Center in Porto Alegre, RS, which revealed that two-thirds of antibiotic users were unaware of certain basic information for the correct use of these medications, such as dose, frequency of administration, adverse effects, duration of treatment and drug incompatibility.

Another important point in the case of antimicrobials is the dispensation; in a study carried out in 2004[14] it was found that a common practice in most pharmacies in Curitiba-PR is the dispensing of antibiotics without any guidance to patients. The authors argued that this is an act neglected by ethical responsibility, and results in ineffective therapy, which can lead to problems such as bacterial resistance and potentiation of adverse effects.

Pharmaceutical care actions influence the correct use of antimicrobials, and the role of the pharmacist, as it is based on helping the buyer/patient understand the treatment and perform it properly. Since treatment is effective, it also decreases the cost of future treatments, resulting from the recurrence of the disease. Emphasizing the importance of the responsibility of the pharmacist in the dispensing of drugs in drugstores, especially when they are antibiotics. The pharmacist should have a role of health care provider, always trying to be close to consumers, suitably dressed and identified, to guide them in their needs. It is known that not only the pharmacist is a dispenser, but it is the responsibility of the pharmacist to manage and train the other employees or employees of the drugstore to perform this function correctly, promoting the rational and adequate use of antimicrobials. In this way, the consumer will have more security to administer medicines to their relatives, especially if they are children, or even for themselves.[15]

In view of the above, the objective of this work was to develop a dispensing flow chart in order to assist in the decision making of the pharmacist, as well as formulate an explanatory material for patients using antimicrobials, considering the reality of a community pharmacy.

MÉTHODS

This is a methodological study of content creation and validation. Refers to the development of an antimicrobial dispensing flow chart for use in community-based, public and manipulative dispensing dispensers of antimicrobials. With the creation of this flowchart, it is sought to facilitate the understanding for beginning attendant employees and to standardize the care and pharmaceutical care in dispensing antibiotics. The flowchart model was adapted for the dispensing of antimicrobials, from models described in the literature.[16-18]

The flowchart was elaborated based on the daily attendance of a community pharmacy, with the purpose of standardizing the care by all favoring the well being and good care of the

patient and to try to guarantee a correct treatment. The flow chart represents an antimicrobial dispensing feature, highlighting the care and information that should be passed on to the patient. Guidelines for directing and defining decisions were developed for each stage of the dispensing process.

The folder was developed after realizing the lack of knowledge that the population has about bacterial resistance, aiming to make people aware of the correct use and respect of antimicrobial schedules, encouraging the change in the behavior of society.

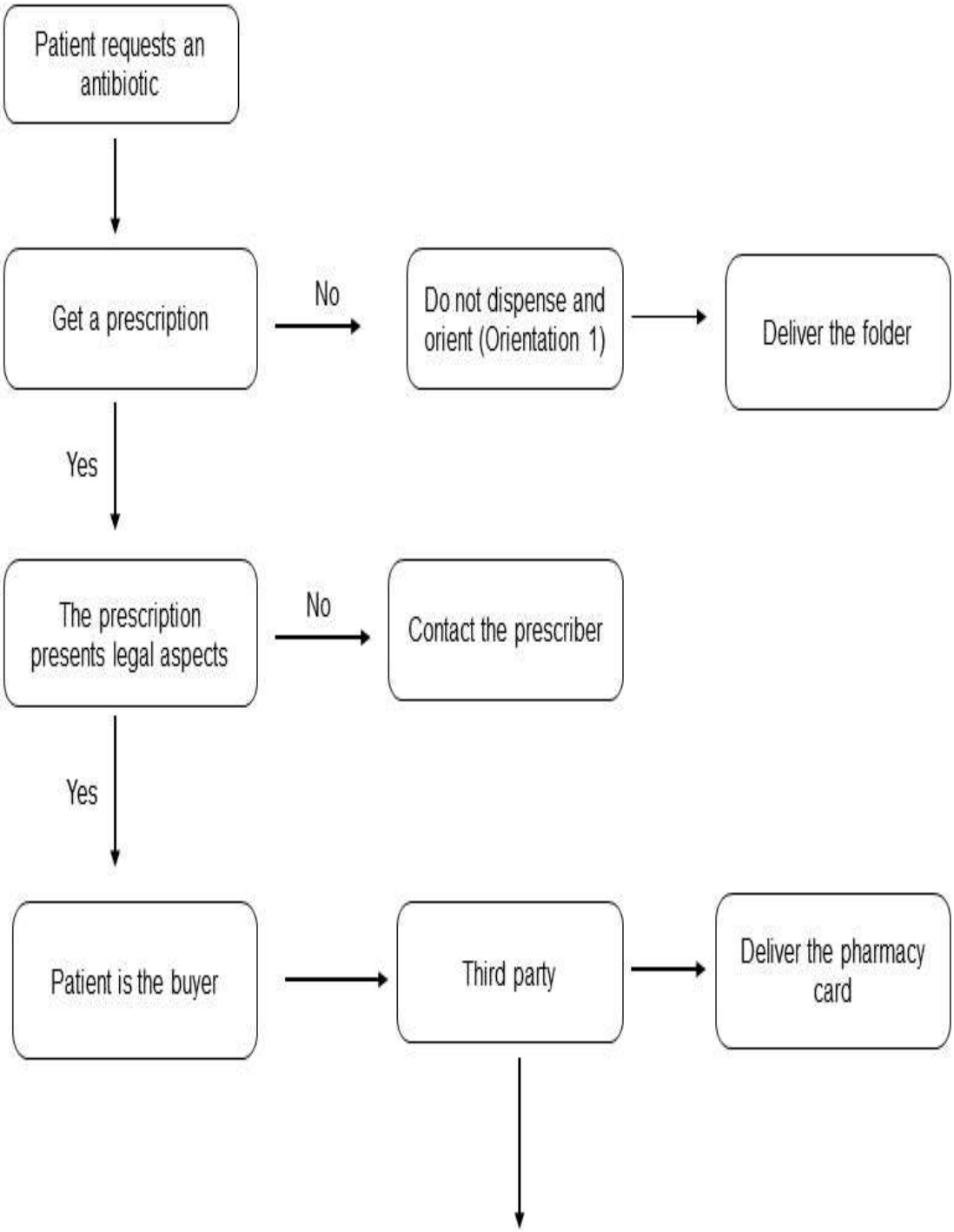
RESULTS

The purpose of the patient care process that makes use of an antimicrobial, through the use of the flowchart, is to direct and standardize the behavior of the pharmacist during the dispensing of this type of medicine. At the time of dispensing, the pharmacist receives information, analyzes and makes decisions regarding guidance on the proper use of the medicine and identifies possible problems requiring referral to other services. In the dispensation, the care process presented in this study is in the flowchart format, according to Figure 01, and with this it is intended to define a standard procedure to be practiced in any establishment that performs the dispensing of antimicrobials, as will be described next.

A flow chart was developed (Figure 01) to be used in community pharmacies, public and manipulation. A flowchart model (APPENDIX A) was designed to guide the pharmacist and the collaborators with the purpose of standardizing the dispensing and directing which guidelines should be passed on to the patient. The flowchart model was adapted for the dispensing of antimicrobials, from models described in the literature.[16-18]

In addition, an explanatory folder (Figure 02) was developed to be distributed to the patients at the end of the dispensation with the purpose of clarifying about bacterial reisistence and preventing the misuse of antibacterials.

Figure 01: Dispensing flowchart for use in community pharmacies, public and manipulation.



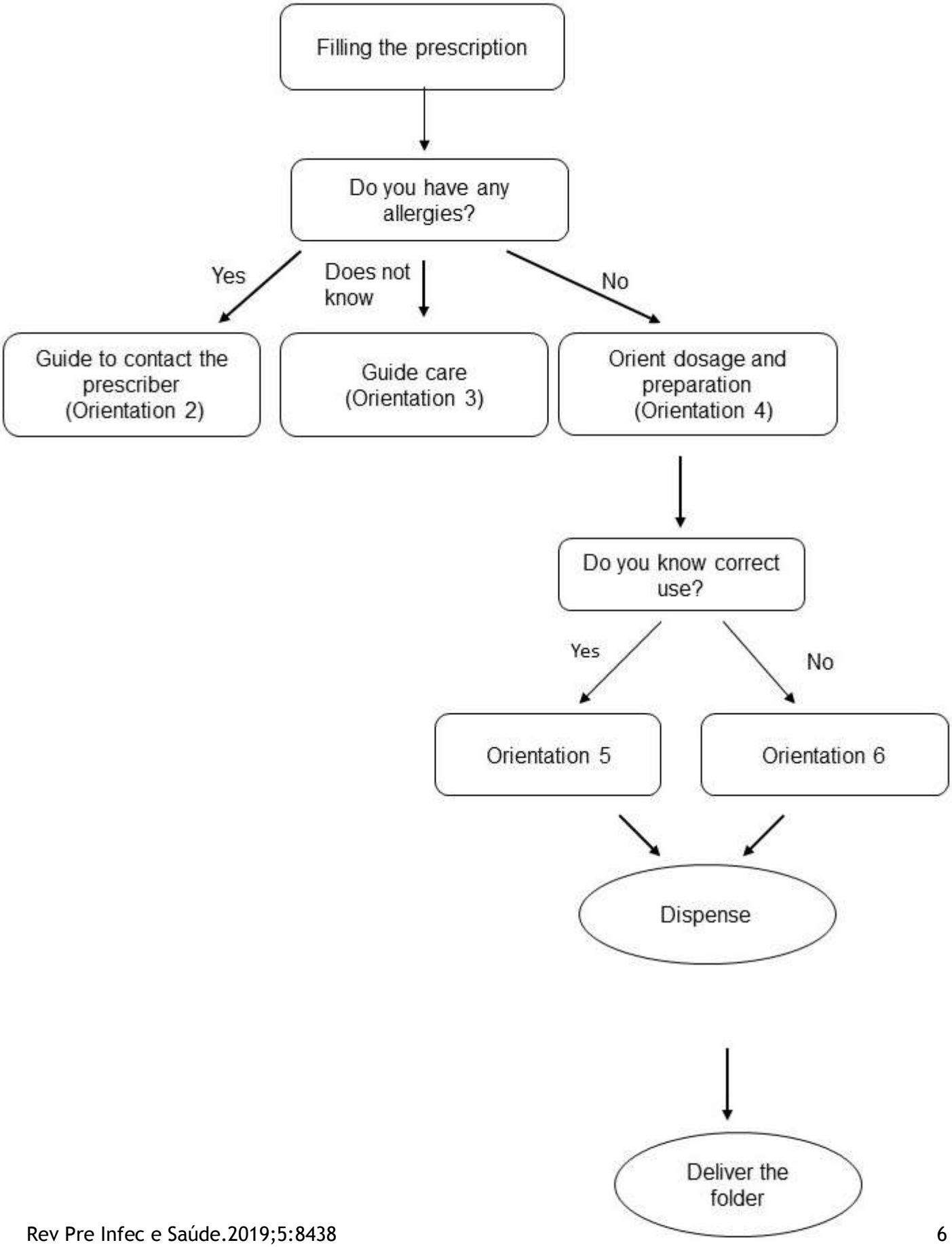
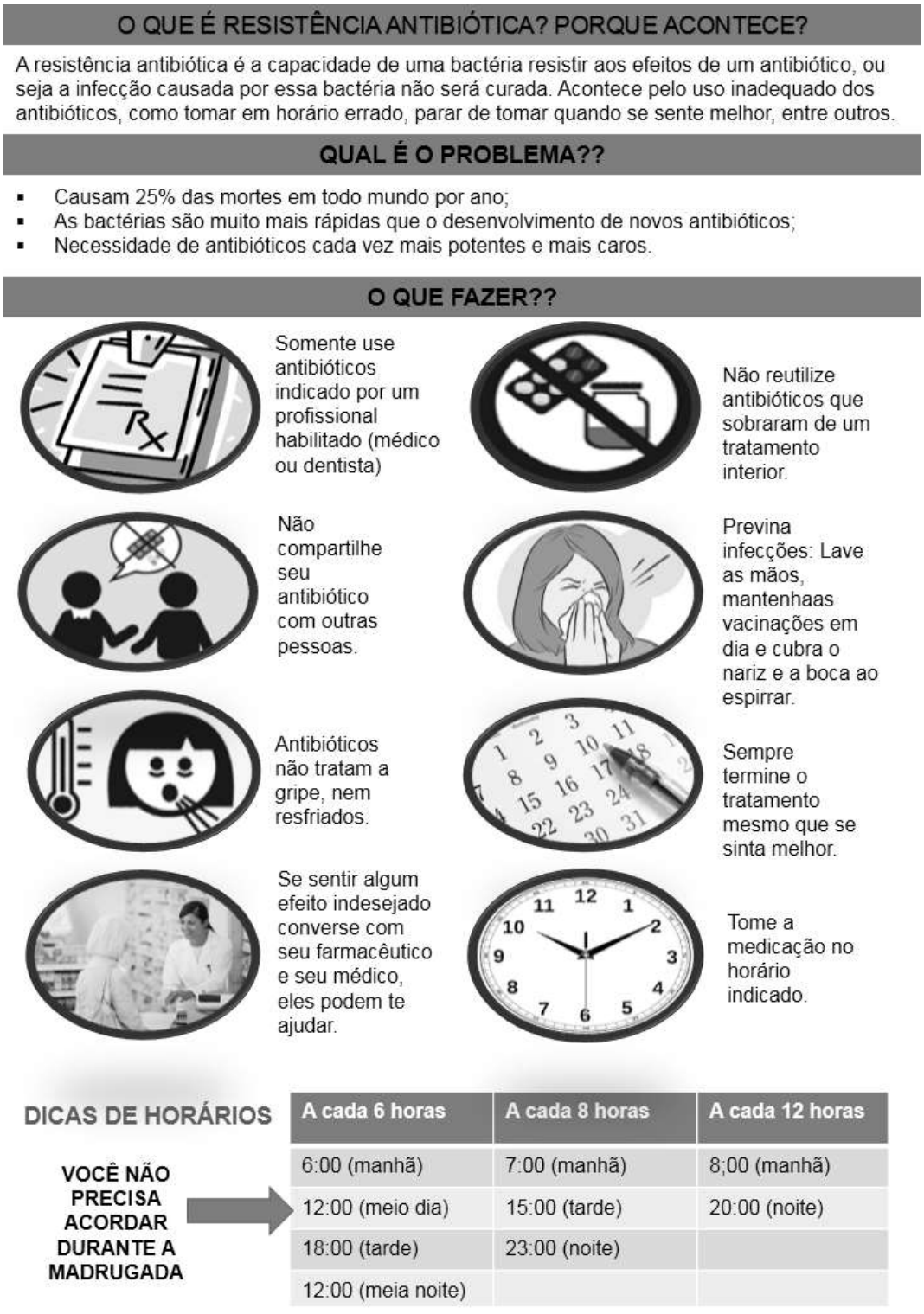

Filling the prescription
Do you have any allergies?
Yes
Does not know
No
Guide to contact the prescriber (Orientation 2)
Guide care (Orientation 3)
Orient dosage and preparation (Orientation 4)
Do you know correct use?
Yes
No
Orientation 5
Orientation 6
Dispense
Deliver the folder

Figure 02: Educational folder to be delivered to patients after antimicrobial dispensing (in Portuguese).



Source: author

DISCUSSION

Stages of prescription evaluation

Pharmaceutical care in antimicrobial dispensing is described in the form of a flowchart (Figure 01) which shows us the procedure to be adopted during dispensing. The flow chart guides and assists in decision making, and should always be in the hands of all pharmacy employees.

In the act of dispensing medicines the pharmaceutical professional plays an important role in the correct use of them. The timing of the dispensation is one of the last opportunities to identify, repair or minimize possible risks to drug treatment. The pharmacist should complement the information passed on by the prescriber to the patient, so as to contribute to the rational use and improvement of the clinical picture of the patient, without the appearance of undesirable effects for these patients.[19-20]

Presentation of the prescription

RDC 20/2011 defines the control of drugs based on substances classified as antimicrobial, isolated or in associations.[10]

This RDC instituted new rules for the dispensation, causing an important impact on the culture of self-medication, highlighting the importance of the pharmacist in the dissemination of these medicines actively and information and access to medicines. Under this view, RDC 20/2011 is an important tool both for promoting the health of the population when regulating access to antimicrobials, but self-medication is still a challenge to be overcome in drugstores, since the population presents certain incomprehension in accepting the criteria imposed for the dispensation.[19] According to the RDC the prescription must be in simple, two-way prescription and contain information such as name and surnames, age and gender of the patient, as well as the prescriber's identifications, such as the name of the professional with their registration in the Professional Class Councils or name of the institution, full address, telephone, signature and graphic markup as a stamp. In addition, the RDC states that the dispensation must respond essentially to what has been prescribed. Regarding the quantity of dispensation, the RDC decrees that in situations of prolonged treatment the revenue can be used for later acquisitions within a period of ninety (90) days from the date of its issuance, being dispensed the quantity for 30 days in 3 withdrawals.

Therefore the pharmacist should only dispense antibiotics independent of their pharmaceutical form upon presentation of adequate prescription, as described above.

At this stage the pharmacist or clerk will pass on the first customer orientation requesting the purchase of an antimicrobial.

Guideline 1: The patient should be advised of the health risks of taking nonprescription antibiotics. A brief inquiry by the pharmacist should be made to find out the reason for the antibiotic search and to assess whether it is needed.[21] If it is concluded that it is necessary the patient should be referred to the physician. Given the role of the pharmacist in health promotion, this professional should alert the client:

- Taking an antibiotic when it is not needed can lead to the development of

resistance by explaining to the patient about the concept and problems of resistance.

• When resistance develops, antibiotics may not be effective in future infections

• Whenever someone uses an antibiotic they do not need, they increase the risk of developing a resistant infection in the future.

The prescription presents legal aspects

When submitting the prescription, the dispensing professional must evaluate compliance with the legal requirements relating to it. According to Law no. 5.991/738 only a prescription that shows written pen, the name of the medicinal product written in extensible and legible, with nomenclature and the system of official weights and measures, the name and address of the patient, how to use the medicine, date and the data of the prescriber as signature, office address and registration number in the professional class council.[10]

It is known that despite Law 5.991/1973 and Resolution 1,931 of 2009 of the Code of Ethics of the Federal Medical Council exist and that the prescription is legible, in practice this does not always occur. It is worth noting that the prescription must be at least legible and if there is any doubt of understanding the pharmacist should contact the prescriber to avoid any error of dispensing.[22-23]

The pharmacist should contact the prescriber to clarify any misunderstandings at the time of the evaluation of the prescription. If necessary, the patient should be referred back to the doctor or dentist for correction or supplementation of the prescription for later dispensation.[16]

Patient Identification Stage

In order to identify who the medication is going to be dispensed with it is necessary to ask such questions: "Is this medication for you?" "Or are you the (patient's name of the prescription)?" When the response refers to other patients it is necessary to investigate the buyer's connection with the patient to make sure that the information passed will reach the patient. In this case the pharmacist should provide the information with maximum clarity being available to clarify any questions that the patient has. At that moment a card will be delivered from the drugstore with the phone number and name of the pharmacist.

If the buyer is the patient her/himself the medication will be dispensed according to the flow chart, because the information will be passed on correctly.

Filling the prescription

According to RDC 20 of 2011 at the time of dispensing, the following information should be recorded, such as date of dispense, quantity delivered, batch number of the drug, and pharmacists' invoice on the back of both ways.[10]

Stage of identifying possible PRM (drug related problems)

It will be necessary to question whether the patient has any allergy to the medication, regardless of whether it is the first time the drug is being used. If the answer is undefined, or if the patient does not know, it is held the fellowship but must be done the warning that the appearance of any unpleasant symptoms the patient should seek an answering service to the nearest health. If the answer is positive, the dispensing should not be done and the patient should be referred back to the prescriber with a

booklet stating that the patient reported having already had an allergic reaction to that medication.[24]

In this step they are passed on to the following orientations:

Guideline 2: Assessment of whether the patient has any allergy to prescribed medication should occur with all patients who are prescribed antimicrobials. The patient should be referred back to the prescriber if reports that he/she has ever had an allergic reaction to the prescribed medication to make the substitution.[24]

Guideline 3: The patient should be instructed to immediately seek a health service if they present any unpleasant symptoms after starting treatment with the prescribed medication. These reactions may range from mild rashes and itching to severe skin reactions with blisters, swelling of the face and throat, and respiratory problems.[24]

Guideline 4: It is necessary to construct an individual treatment plan for each type of patient, respecting the daily routine, that is, to try to adjust the schedules that facilitate the medication, trying to avoid schedules in the middle of the night whenever possible. It should be clear that the patient can not abandon the treatment without the antibiotic finish killing and controlling all the microorganisms present in the infectious process. That small number of microorganisms that are still present begin to multiply and generate reinfection. With this, one must take the medicines again and, gradually, the microorganisms create resistance.[21]

Correct usage

It is of the utmost importance that patients and/or caregivers know and are encouraged to correctly perform the use and administration of the medicines in order to contribute to the best effectiveness and safety of the treatment. The correct use is defined by the use of the prescribed dose, the route and the prescribed intervals and the stipulated time.[16]

The pharmacist should make sure that the patient clearly knows the mode of administration, but should not restrict himself to closed questions such as: Do you know how to use the medicine? It is important that the practitioner verify the way in which the patient uses or intends to use the medicine and, from this, re-evaluate whether it is appropriate or not and thus inform him.

In this step the following guidelines are passed:

Guideline 5: Even if the patient reports that he or she knows the correct use of medication, information such as posology and time of intake should be fixed on the medicine package.[25]

Guidelines 6: Knowledge of the reason for use is important for adherence to treatment, so the patient should leave the facility with clarity of understanding. The pharmacist should make sure the patient knows the mode of administration. It is worth remembering that for the treatment to be effective the antibiotic must be taken at the prescribed time, for example if it is every eight hours it is not at breakfast, lunch and dinner. One should negotiate a schedule according to the routine of each patient to facilitate adhesion and fix a

label on top of the package with the correct dosage and schedule.[25]

Dispensing stage

The dispensation is the pharmaceutical act of dispensing and delivering medicines to the patient according to what has been rewritten by a prescriber.[13] This act is one of the last opportunities to recognize, correct or minimize possible risks, so the pharmacist can contribute to the rational use of medicines and promotion of the health of the population.[26]

The dispensation in pharmacies and public and private drugstores will be obtained by means of the retention of the second (second) way of the prescription, and the 1st (first) route should be returned to the patient.[10]

In the act of dispensing prescription drugs, such as antimicrobials, it is essential that information about the prescribed medication be passed on clearly to the patient/user, as to their indications and objectives to be achieved, or to the correct form of their use mainly on dosages and intervals between sockets. Reinforcing the need for adherence to therapy is one of the decisive factors for achieving positive results and cure of the disease, in this way the professional actively assumes as a health promoting agent.[3,17,27]

It is necessary that all the patients know the correct use and preparation of the medicines, as is the case of the antibiotics that have as pharmaceutical form powder for suspension in this case one must always guide the use of drinking water can be boiled water but cold. And the following guideline must be passed. Water should be added in the bottle to the mark indicated on the bottle itself and then shaken. It should be advised that air bubbles may appear due to agitation so the bottle should stand still for a few minutes and then fill with water to the indicated mark. Each time the drug is used it must be previously shaken.[28]

At the end of dispensing, the pharmacist should evaluate the physical integrity of the package and its shelf life, which must be compatible with the patient's treatment time. At this point, you can reinforce past information and clarify possible patient doubts..[16,21,25,28]

Folder delivery

The preparation of the educational folder (Figure 02) had as a premise educational strategies of information to be disseminated among the population, using this knowledge to carry out preventive measures to try to minimize possible errors during antimicrobial treatment and consequently a possible bacterial resistance.

Due to the diversity of levels of schooling and understanding among the target audience, the preparation of the information folder had the concern of avoiding the use of technical terms that could harm and compromise the use and understanding of the folder, making it easy to understand.

This material has as its intuition to help, guide and inform the population about the importance of the correct use of antimicrobials, and the consequences that bacterial resistance can bring to society.

CONCLUSION

Antimicrobial dispensing can be implemented from the proposed model because it was constructed to be useful in the dispensing reality, making all the steps of a standard

dispensing procedure that assures quality in the service provided and treatment of the patient from the best adherence to the treatment of the patient.

The pharmacist as manager and health professional needs to include in their field of skills the administrative knowledge, since it will be the professional that will have attributions in the management of people and processes and will, on many occasions, be the decision maker. In addition, it will be responsible for strategic definitions within the environment in which it is, focusing on positive results, and on the excellence of the quality of the service offered to the client.

Through the educational practice, the folder can contribute in order to increase the knowledge and sensitize the population about bacterial resistance and to assist the patient in the care with their treatment, from this the pharmacist can even indirectly participate in the care to the antimicrobial users of in the results of drug therapy.

Future studies are needed to evaluate the proposed care/dispensation model with practice results and to provide data for studies of the impact of antimicrobial dispensing.

REFERENCES

1. Tavares W. Bactérias gram-positivas problemas: resistência do estafilococo, do enterococo e do pneumococo aos antimicrobianos. Rev Soc Bras Med Trop on line [Internet]. 2000 [cited 2018 Fev 13]; 33(3):281–301. Available from: http://www.scielo.br/pdf/rsbmt/v33n3/2477.

2. Oliveira AC de, Silva RS da. Desafios do cuidar em saúde frente à resistência bacteriana: uma revisão. Rev Eletrônica Enferm [Internet] 2008 [cited 2018 Jan 20]; 10(1):189-197. doi:10.5216/ree.v10i1.8011. Available from: https://www.fen.ufg.br/revista/v10/n1/pdf/v10n1a17.pdf.

3. Mota RA, Silva KPC da, Freitas MFL de, Porto WJN, Silva LBG da. Utilização indiscriminada de antimicrobianos e sua contribuição a multirresitência bacteriana. Braz J Vet Res Anim Sci [Internet]. 2005 [cited 2018 Mar 10]; 42(6):465–470. Available from: http://www.revistas.usp.br/bjvras/article/view/26406.

4. About Antibiotic Prescribing and Use | Community | Antibiotic Use | CDC. 2019. [cited 2019 Apr 11]. Available from: https://www.cdc.gov/antibiotic-use/community/about/index.html.

5. Souza ES, Belei RA, Carrilho CMD de M, Matsuo T, Yamada-Ogatta SF, Andrade G, et al. Mortality and risks related to healthcare-associated infection. Texto Amp Contexto - Enferm [Internet]. 2015 [cited 2018 Jan 20]; 24(1):220–228. Available from: http://www.scielo.br/pdf/tce/v24n1/pt_0104-0707-tce-24-01-00220.pdf.

6. Pereira JQ, Silva MT, Galvão TF, Pereira JQ, Silva MT, Galvão TF. Use of antibiotics by adults: a population-based cross-sectional study. Sao Paulo Med J [Internet]. 2018 [cited 2018 Jan 20]; 136(5):407–413. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1516-31802018000500407.

7. Vincent J-L, Rello J, Marshall J, Silva E, Anzueto A, Martin CD, et al. International study of the prevalence and outcomes of infection in intensive care units. JAMA [Internet]. 2009 [cited 2018 Jan 8]; 302(21):2323–2329. Available from: https://www.ncbi.nlm.nih.gov/pubmed/19952319.

8. Zavascki AP, Barth AL, Fernandes JF, Moro ALD, Gonçalves ALS, Goldani LZ. Reappraisal of Pseudomonas aeruginosa hospital-acquired pneumonia mortality in the era of metallo-ß-lactamase-mediated multidrug resistance: a

prospective observational study. Crit Care [Internet] 2006 [cited 2018 Fev 12]; 10(4):1-7. Available from: https://www.ncbi.nlm.nih.gov/pubmed/19952319.
9. Hoefler R, Vidotti CCF, Menezes ES de, Pinheiro S. Ações que estimulam o uso racional de antimicrobianos. Bol Farmacoter [Internet]. 2016 [cited 2018 Jun 17]; 11(4):1–4. Available from: http://www.revistas.cff.org.br/?journal=boletimfarmacoterapeutica&page=article&op=view&path%5B%5D=1501&path%5B%5D=1159.
10. Grumach AS, Telles Filho F de Q, Mendes RP, Colombo AL, Moretti ML, Kono A, et al. Consenso em criptococose – 2008. Guidelines in Cryptococcosis – 2008 [Internet]. 2008 [cited 2018 Abr 2]; 1(2):42-49. Available from: http://www.lume.ufrgs.br/handle/10183/21919
11. Aguiar PADF de, Pedroso RDS, Borges AS, Moreira T de A, Araújo LB de, Röder DVD de B. The epidemiology of cryptococcosis and the characterization of Cryptococcus neoformans isolated in a Brazilian University Hospital. Rev Inst Med Trop Sao Paulo [Internet]. 2017 [cited 2018 Jan 20]; 59(13):1-9. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5398185/
12. Movahed E, Munusamy K, Tan GMY, Looi CY, Tay ST, Wong WF. Genome-Wide Transcription Study of Cryptococcus neoformans H99 Clinical Strain versus Environmental Strains. PloS One [Internet]. 2015 [cited 2018 Jan 13]; 10(9):1-23 Available from: https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0137457
13. Verlindo de Araujo B, Farias da Silva C, Costa TD. An alternative approach to determine oral bioavailability of drugs that follow Michaelis-Menten elimination: a case study with voriconazole. Pharmacology [Internet]. 2010 [cited 2018 Jan 22]; 86(6):163–167. Available from: https://www.karger.com/Article/Abstract/317066
14. Oliveira AOT de, Pedroso CF, Miguel MD, Montrucchio DP, Zanin SMW, Dorneles D. Atenção farmacêutica na antibioticoterapia. Visão Acadêmica [Internet]. 2004 [cited 2018 Jan 20]; 5(1):7-14. doi:10.5380/acd.v5i1.536. Available from: http://www.gruponitro.com.br/atendimento-a-profissionais/%23/pdfs/artigos/farmaco_vigilancia/atencao%20farmaceutica%20na%20antibioticoterapia.pdf
15. Almeida FB de, Cabral SAA de O, Alencar MCB de, Figueirero CHA de, Silveira DC da, Farias WK de A. Atenção farmacêutica em análises da dispensação de antimicrobiano em farmácia. Rev Bras Educ E Saúde [Internet]. 2015 [cited 2018 Jul 19]; 5(4):23–29. Available from: https://www.gvaa.com.br/revista/index.php/REBES/article/view/3716
16. Angonesi D, Rennó MUP. Dispensation of pharmaceuticals: proposal of a model for dispensation. Ciênc Amp Saúde Coletiva [Internet]. 2011 [cited 2018 Jan 20]; 16(9):3883–3891. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-81232011001000024.
17. Cardoso TC, Sousa JTM, Ferreira TXAM, Morais CAE, Prudente LR, Lopes FM, et al. Serviço de dispensação: apresentação de modelo estruturado em uma farmácia universitária. Rev Eletrônica Farmácia [Internet]. 2015 [cited 2018 Jan 20]; 12(4):73-86. Available from: https://revistas.ufg.br/REF/article/view/38411
18. Manosuthi W, Chetchotisakd P, Nolen TL, Wallace D, Sungkanuparph S, Anekthananon T, et al. Monitoring and impact of fluconazole serum and cerebrospinal fluid concentration in HIV-associated cryptococcal meningitis-infected patients. HIV Med [Internet]. 2010 [cited 2018 Fev 20]; 11(4):276–81. Available from: https://www.ncbi.nlm.nih.gov/pubmed/20002501.
19. Marino PL. Compêndio de UTI. Artmed Editora, 4nd ed. São Paulo; 2015.
20. Vieira FS. How pharmacists can contribute to health promotion. Ciênc Amp Saúde Coletiva [Internet]. 2007 [cited 2018 Jan 19]; 12(1):213–220. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1413-81232007000100024.
21. Sampaio P da S, Sancho LG, Lago RF do. Implementação da nova regulamentação para prescrição e dispensação de antimicrobianos: possibilidades e desafios. Cad Saúde Coletiva [Internet]. 2018 [cited 2018 Jan 11]; 26(1):15–22. Available from: http://www.scielo.br/pdf/cadsc/v26n1/1414-462X-cadsc-26-1-15.pdf.
22. Nobre MRC, Bernardo WM. Diretrizes AMB/CFM. Rev Assoc Médica Bras [Internet]. 2002 [cited 2018 Jan 11]; 48(4):290–290. Available from: https://diretrizes.amb.org.br/.
23. Aller AI, Martin-Mazuelos E, Lozano F, Gomez-Mateos J, Steele-Moore L, Holloway WJ, et al. Correlation of Fluconazole MICs with Clinical Outcome in Cryptococcal Infection. Antimicrob Agents Chemother [Internet]. 2000

[cited 2018 Jan 19]; 44(6):1544–1548. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC89910/.
24. Guzmán M MA, Salinas L J, Toche P P, Afani S A. Alergia a beta-lactámicos. Rev Chil Infectol [Internet]. 2004 [cited 2018 Jul 19]; 21(4):285–298. Available from: https://scielo.conicyt.cl/scielo.php?script=sci_arttext&pid=S0716-10182004000400002.
25. Angonesi D. Dispensação farmacêutica: uma análise de diferentes conceitos e modelos. Ciênc Saúde Coletiva [Internet]. 2008 [cited 2018 Jul 19]; 13(1):629–640. Available from: http://www.scielo.br/scielo.php?pid=S1413-81232008000700012&script=sci_abstract&tlng=pt
26. Barretto ACP, Drumond Neto C, Mady C, Albuquerque DC de, Filho B, Falcão D, et al. Revisão das II Diretrizes da Sociedade Brasileira de Cardiologia para o Diagnóstico e Tratamento da Insuficiência Cardíaca. Arq Bras Cardiol [Internet]. 2002 [cited 2018 Jan 11]; 79(4):1–30. Available from: http://www.scielo.br/pdf/abc/v79s4/a01v79s4.pdf.
27. Ruvinsky S, Mónaco A, Pérez G, Taicz M, Inda L, Kijko I, et al. Motivos de la prescripción inadecuada de antibióticos en un hospital pediátrico de alta complejidad. Rev Panam Salud Pública [Internet]. 2011 [cited 2018 Jul 19]; 30(6):580–585. Available from: https://scielosp.org/pdf/rpsp/2011.v30n6/580-585/es.
28. Costa PQ da, Lima JES de, Coelho HLL. Prescrição e preparo de medicamentos sem formulação adequada para crianças: um estudo de base hospitalar. Braz J Pharm Sci [Internet]. 2009 [cited 2018 Jan 23]; 45(1):57–66. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1984-82502009000100007.

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