PUBLICAÇÃO OFICIAL DO NÚCLEO HOSPITALAR DE EPIDEMIOLOGIA DO HOSPITAL SANTA CRUZ E PROGRAMA DE PÓS GRADUAÇÃO EM PROMOÇÃO DA SAÚDE - DEPARTAMENTO DE BIOLOGIA E FARMÁCIA DA UNISC

ISSN 2238-3360

Revista de Epidemiologia e Controle de Infecção

Original Article

Antimicrobial switch therapy: barriers and facilitators from the perspective of nurses, pharmacists and physicians

Transição de via de antimicrobianos: barreiras e facilitadores na perspectiva de enfermeiros, farmacêuticos e médicos
Conversión de la vía antimicrobiana: barreras y facilitadores desde la perspectiva de enfermeras, farmacéuticos y médicos

Site doi: https://doi.org/10.17058/reci.v15i2.19994

Submitted: 10/29/2024
Accepted: 04/23/2025
Available online: 06/25/2025

Corresponding author:
E-mail: tativaleriano@yahoo.com.br
Address: Franscislo Lopes Street, 200, Santa Felicia Park, Sao Carlos, Sao Paulo, Brazil.

Tatiane Garcia do Carmo Flausino[1,2]
Darlyani Mariano da Silva[1]
Lívia Cristina Scalon da Costa Perinoti[1,3]
Rosely Moralez de Figueiredo[1]

[1]Federal University of São Carlos, Postgraduate Program in Nursing. São Carlos, São Paulo, Brazil.
[2]University Hospital of the Federal University of São Carlos (HU-UFSCar). São Carlos, São Paulo, Brazil.
[3]University Center of Associated Teaching Colleges, São João da Boa Vista, São Paulo, Brazil.

ABSTRACT

Background and Objectives: The antimicrobial switch therapy is an easy-to-implement intervention that can generate savings in resources and nursing service time and contribute to the impact of antimicrobial resistance. However, it does not occur at the right time for hospitalized patients. Thus, the objective of this study is to identify the barriers and facilitators of the antimicrobial switch therapy from the perspective of these nurses, pharmacists, and physicians. **Methods:** This is an online survey study, descriptive and quantitative, conducted in the city of São Carlos, São Paulo, Brazil, with nurses, pharmacists, and physicians working in a hospital environment. Data collection was done through an online questionnaire. A descriptive analysis of the data was performed using absolute and relative frequency tables. **Results:** A total of 167 participants answered the questionnaire, of which 79 were pharmacists, 71 were nurses, and 17 were physicians. The main barriers identified by the participants were the lack of medication with adequate oral bioavailability, lack of engagement of prescribers, and oral medication not available at the institution. The facilitators were the possibility of hospital discharge, hospital infection control service operating at the institution, and cost. **Conclusion:** The present study identified the barriers and facilitators that contribute to the development of institutional strategies within the antimicrobial stewardship programs, enabling the switch therapy to occur at an opportune time and safely.

Keywords: *Antimicrobial Stewardship. Drug Administration Routes. Drug Resistance. Microbial. Surveys and Questionnaires.*

RESUMO

Justificativa e Objetivos: A transição de via de antimicrobianos da endovenosa para oral é uma intervenção de fácil implementação, capaz de gerar economia de recursos, de tempo de serviço da enfermagem e contribuir para o impacto da resistência antimicrobiana, entretanto, ela não acontece no momento oportuno para os pacientes hospitalizados. Face ao exposto, o objetivo deste estudo é identificar as barreiras e facilitadores da transição de via de antimicrobianos sob a perspectiva de enfermeiros, farmacêuticos e médicos. **Métodos:** Estudo do tipo *survey online*, descritivo e de abordagem quantitativa, realizado no município de São Carlos, São Paulo, Brasil, com enfermeiros, farmacêuticos e médicos assistenciais que atuam em ambiente hospitalar. A coleta de dados foi feita a partir da disponibilização de questionário *online*. Foi realizada análise descritiva dos dados, a partir de tabelas de frequência absoluta e relativa. **Resultados:** Responderam o questionário 167 participantes, sendo 79 farmacêuticos, 71 enfermeiros e 17 médicos. As principais barreiras apontadas pelos participantes foram ausência de medicamento com biodisponibilidade oral adequada, falta de engajamento dos prescritores e medicamento via oral não disponível na instituição. Já os facilitadores foram a possibilidade de alta hospitalar, serviço de controle de infecção hospitalar atuante na instituição e custo. **Conclusão:** O presente estudo identificou as barreiras e facilitadores que contribuem para a elaboração de estratégias institucionais dentro dos Programas de Gerenciamento de Antimicrobianos, possibilitando que a transição de via aconteça em momento oportuno e com segurança. As principais barreiras encontradas incluem a ausência de opção oral com biodisponibilidade adequada e falta de engajamento dos prescritores. A redução de custos, possibilidade de alta precoce e presença de comissão de controle de infecção hospitalar atuante foram os principais facilitadores encontrados.

Descritores: *Gestão de antimicrobianos. Vias de administração de medicamentos. Resistência microbiana a medicamentos. Inquéritos e questionários.*

RESUMEN

Justificación y Objetivos: La transición de la vía antimicrobiana intravenosa a la oral es una intervención de fácil implementación, capaz de ahorrar recursos, tiempo del servicio de enfermería y contribuir al impacto de la resistencia a los antimicrobianos, sin embargo, no ocurre en el momento adecuado para los pacientes hospitalizados. Por tanto, el objetivo de este estudio es identificar las barreras y facilitadores de la transición de la ruta antimicrobiana desde la perspectiva de estos enfermeros, farmacéuticos y médicos. **Métodos:** Estudio de encuesta online, descriptivo y con abordaje cuantitativo, realizado en la ciudad de São Carlos, São Paulo, Brasil, con enfermeros, farmacéuticos y médicos clínicos que actúan en el ambiente hospitalario. La recopilación de datos se realizó mediante la puesta a disposición de un cuestionario en línea. El análisis descriptivo de los datos se realizó mediante tablas de frecuencia absoluta y relativa. **Resultados:** Respondieron al cuestionario 167 participantes, 79 farmacéuticos, 71 enfermeros y 17 médicos. Las principales barreras destacadas por los participantes fueron la falta de medicamentos con biodisponibilidad oral adecuada, la falta de compromiso de los prescriptores y los medicamentos orales no disponibles en la institución. Los facilitadores fueron la posibilidad de alta hospitalaria, el servicio de control de infecciones hospitalarias que opera en la institución y el costo. **Conclusión:** El presente estudio identificó las barreras y facilitadores que contribuyen al desarrollo de estrategias institucionales, dentro de los Programas de Optimización del Uso de los Antimicrobianos, permitiendo que la transición se lleve a cabo de manera oportuna y segura.

Palabras Clave: *Programas de Optimización del Uso de los Antimicrobianos. Vías de Administración de Medicamentos. Farmacorresistencia Microbiana. Encuestas y Cuestionarios.*

INTRODUCTION

Antimicrobial resistance (AMR) is a major cause of mortality, contributing to approximately 9% of all global deaths. In middle- and low-income countries, the effects of AMR-related morbidity and mortality are more severe, which could impact the loss of about 5% of the gross domestic product of these locations by 2050, exacerbating the situation of extreme poverty.[1]

Antimicrobials have been considered an indispensable resource in the treatment of previously fatal infections for decades. However, their excessive, improper, and inappropriate use has contributed to AMR and jeopardized the effectiveness of this class of drugs.[2]

In this context, Antimicrobial Stewardship Programs (ASP) have emerged as a strategy to combat and mitigate AMR.[1] Among the strategies for optimizing the use of antimicrobials in ASPs is the early transition from intravenous (IV) to oral administration(OA).[3] The transition of antimicrobial route (TAR) in patients who meet eligibility criteria enables the reduction of costs, hospitalization time, nursing work hours, the use of invasive devices, and Adverse Events (AE) associated with infusion therapy, in addition to greater patient mobility and autonomy.[4]

However, despite the benefits of early TAR, it is common for patients who meet the eligibility criteria for TAR to receive the entire course of therapy parenterally, remaining hospitalized for treatment. In fact, among hospitalized patients who meet the criteria for TAR, in 45-75% of cases, the transition is not performed.[5]

It should be noted that nurses, pharmacists, and infectious disease physicians are key professionals, along with clinical microbiologists, in the composition of the ASP management team.[6] They are directly related to antimicrobial therapy.

In this sense, the following research question was structured: "What are the barriers and facilitators of TAR from the perspective of nurses, pharmacists, and physicians?" Identifying barriers and facilitators could contribute to safe and timely TAR, enabling the transposition of identified barriers and the enhancement of facilitators. Thus, the objective of this study is to identify the barriers and facilitators of antimicrobial route transition from the perspective of these professionals.

METHODS

An online survey was conducted, which was descriptive and quantitative in nature, based on the recommendations set out in the Enhancing the Quality and Transparency of Health Research Network (Equator Network) platform, using the Checklist for Reporting Results of Internet E-Surveys (CHERRIES) tool, which is specifically designed for observational survey studies conducted via the internet.[7]

To identify the barriers and facilitators of TAR from the perspective of nurses, pharmacists, and physicians, a questionnaire-type data collection instrument was developed, whose content was defined based on the results of the previous stage of this study, which included interviews with key professionals (nurses, pharmacists, and infectious disease physicians), as well as data from a literature review.[8-9]

The questionnaire was reviewed at a research group meeting and pre-tested with one representative from each professional category. There were no changes to the instrument after the pre-test stage, only spelling adjustments.

The final version of the instrument consisted of 20 multiple-choice questions organized into the following domains: participant characteristics (five questions covering professional category, area of practice, length of experience, region of practice, and prior knowledge of ASP); knowledge about ASP and TAR (seven questions); barriers to route transition (one question); facilitators of route transition (one question); contribution of professionals to TAR (four questions); and criteria for TAR (two questions).

The eligibility criteria included nurses, pharmacists, and physicians working in hospitals, with no limitation on the length of service or training of these professionals. Professionals working exclusively in management were excluded.

The questionnaire was available for completion from April 1, 2022, to August 6, 2022. Strategies for dissemination, invitation, and recruitment of potential research participants were carried out in social media groups (Instagram®, Facebook®, and LinkedIn®). All professionals who met the eligibility criteria at the national level were considered potential participants, and the study sample was non-probabilistic. This study identified the barriers and facilitators that contribute to the development of institutional strategies within Antimicrobial Stewardship Programs, enabling the transition to occur in a timely and safe manner.

This research was conducted in accordance with the ethical standards required by Resolutions 466/2012, 510/2016, and 580/2018 of the Ministry of Health and was approved by the Research Ethics Committee (REC) under opinion number 5.142.045 and registration CAAE 51677721.0. 000.5504 on December 2, 2021. All those who agreed to participate in the research signed the Free and Informed Consent Form (FICF).

RESULTS

A total of 167 participants responded to the questionnaire, of whom 79 (47.3%) were pharmacists, 71 (42.5%) were nurses, and 17 (10.2%) were

physicians. In terms of the geographical origin of the respondents, there was a predominance of participants from the southeast region with 124 participants (74.3%), followed by the midwest region with 14 participants (8.4%), the south region with 13 participants (7.8%), the northeast region with 11 participants (6.6%), and the north region with five participants (3.0%).

Regarding the length of experience in the hospital context, 24 participants (14.4%) had up to two years of experience, followed by 44 participants (26.3%) with between two and five years of experience, 40 participants (24%) with between six and 10 years of experience, and 24 (35.3%) with more than 10 years of experience. The participants' areas of practice are listed below (Table 1).

Table 1. Participants' area of activity. São Carlos, SP, Brazil, 2022 (n=167).

Area of expertise	N (%)
Clinical Pharmacy	53 (31.7)
Hospital Pharmacy	43 (25.7)
Intensive Care Unit	37 (22.2)
Other	36 (21.6)
HICS*	33 (19.8)
Emergency Room/Urgent Care Unit	23 (13.8)
Medical Clinic Unit	21 (12.6)
Oncology Unit	7 (4.2)
Surgical Clinic Unit	6 (3.6)

Abbreviations: * HICS: Hospital Infection Control Service.

Regarding respondents' familiarity with the topic of ASP, it is noteworthy that 14% of respondents were unfamiliar with the term. The results are shown below (Figure 1).

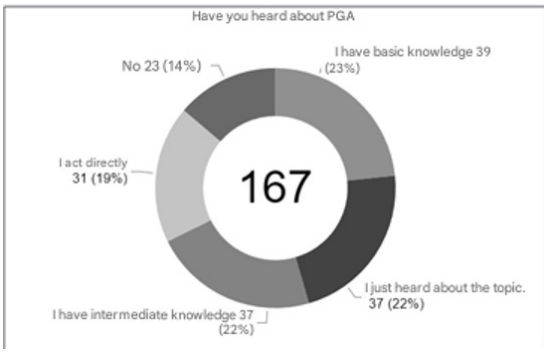

Figure 1. Knowledge about the topic Antimicrobial Stewardship Programs. São Carlos. SP. Brazil, 2022.
Abbreviations: ASP: Antimicrobial Stewardship Programs

With regard to knowledge about ASP and TAR, it is noteworthy that 143 (86%) participants agree that the discussion with the prescriber for TAR can be initiated by either a nurse or a pharmacist. On the other hand, 46 participants (28%) pointed out that TAR, although economical, can contribute to the worsening of the patient's condition, since they consider that oral medications do not have the same potency or efficacy (Table 2).

Table 2. Knowledge about antimicrobial stewardship programs and antimicrobial transition pathways. São Carlos, São Paulo, Brazil, 2022. (n=167).

Domain 1: questions 1 to 6					
Question	Completely agree N (%)	Agree N (%)	Disagree N (%)	Completely disagree N (%)	I don't want to answer N (%)
1) To work in ASP*, nurses, pharmacists, and doctors need basic knowledge about microbial resistance and the smart use of antimicrobials	129 (77.2)	32 (19.2)	4 (2.4)	1 (0.6)	1 (0.6)
2) Although other professionals can contribute to ASP*, nurses, pharmacists, and physicians can directly contribute to the transition of antimicrobial routes	124 (74.3)	40 (24.0)	2 (1.2)	0 (0.0)	1 (0.6)
3) The IV†/OA‡ transition generates savings, but does not impact the reduction or control of resistance	26 (15.6)	62 (37.1)	59 (35.3)	18 (10.8)	2 (1.2)
4) The IV†/OA‡ transition is an intervention that can be discussed with the prescriber by both nurses and pharmacists	69 (41.3)	74 (44.3)	19 (11.4)	5 (3.0)	0 (0.0)
5) The IV†/OA‡ transition is economical, but has the disadvantage of contributing to the patient's worsening condition, as medications administered orally do not have the same potency/efficacy as intravenous medications	15 (9.0)	31 (18.6)	72 (43.1)	48 (28.7)	1 (0.6)
6) To be eligible for route transition, the patient must meet specific conditions, such as hemodynamic stability, absence of fever spikes, and preserved swallowing ability	87 (52.1)	66 (39.5)	12 (7.2)	1 (0.6)	1 (0.6)

Abbreviations: *ASP: antimicrobial stewardship program. †IV: intravenous. ‡OA: oral.

As for barriers to TAR (Figure 2), the absence of oral medication with adequate bioavailability was highlighted by 127 (76%) participants, the lack of engagement by prescribers was pointed out by 124 (74%) participants, and the unavailability of oral medication equivalent to parenteral medication was pointed out by 123 (74%) participants.

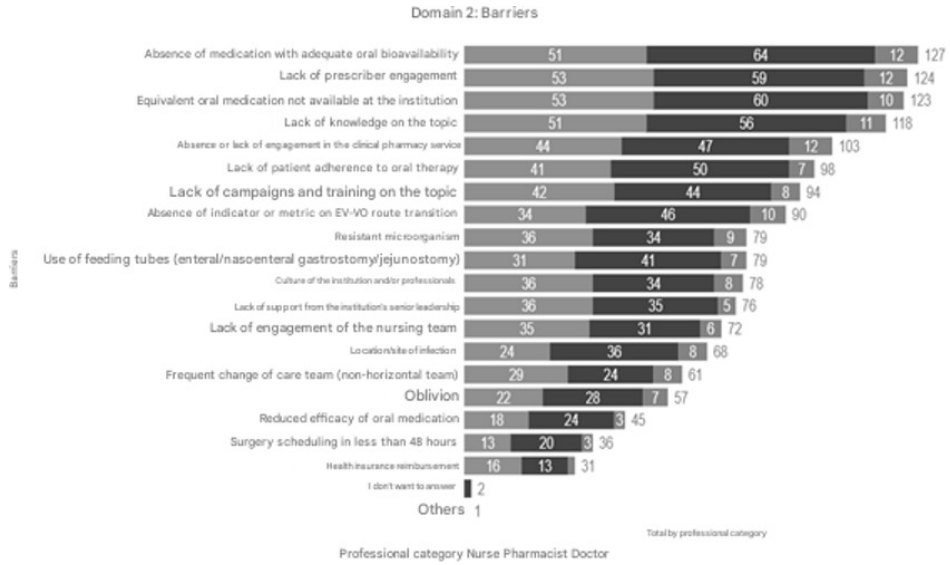

Figure 2. Barriers to transitioning off medication. São Carlos. São Paulo. Brazil, 2022.
Abbreviations: IV/OA: intravenous, oral.

Among the facilitators for TAR, the possibility of hospital discharge was highlighted by 142 (85%) participants, the presence of an active Hospital Infection Control Committee (HICC) was highlighted by 137 (82%) participants, and the cost of oral therapy was highlighted by 136 (81%) participants (Figure 3).

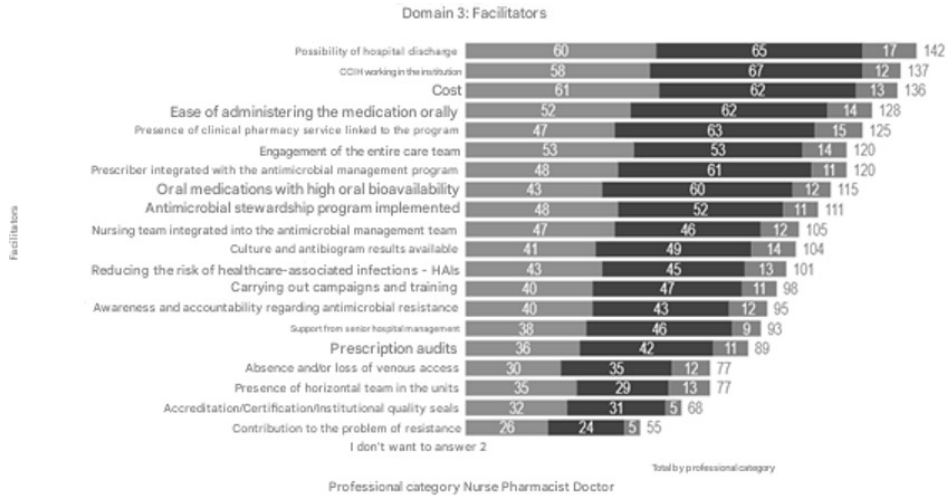

Figure 3. Facilitators for the transition of care. São Carlos. SP. Brazil, 2022.
Abbreviations: HICC: hospital infection control committee.

With regard to the contributions of professionals to TAR, the main contributions of nurses were identified as effective communication with the team about the patient's parameters and condition (86.8%), assessment of the presence of diarrhea, nausea, and vomiting (85.6%), and assessment of the patient's swallowing condition (82.0%). The main contributions of pharmacists were the assessment of the availability of the appropriate oral option for TAR (88.0%), the assessment of the technical aspects of oral antimicrobials (81.4%), and the monitoring of treatment time (73.7%). Finally, the main contributions of the physician were switching the antimicrobial to the oral route in the prescription when appropriate (92.2%), assessing the clinical response to the antimicrobial (85.6%), and assessing the patient's hemodynamic and clinical stability (79.6%).

Finally, with regard to the domain addressing the criteria and parameters for TAR, for more than 85% of the participants, the following criteria and parameters should be considered for TAR: availability of adequate oral medication, patient's willingness to receive oral medication, patient's vital signs, and hemodynamics. On the other hand, participants indicated that they would not recommend TAR in the following situations: suspected gastrointestinal bleeding (79%), critically ill patients (77%), and infection by multidrug-resistant pathogens (66%).

DISCUSSION

Despite Brazil's continental dimensions and regional diversity in relation to the implementation of health policies, and considering that the first version of

ANVISA's guideline for the implementation of ASP in health services was only published in 2017, it is surprising that 64.1% of participants reported having knowledge about ASP.

A Brazilian study evaluated the implementation of PHC in adult intensive care units (ICUs) throughout Brazil, with the significant participation of 954 hospitals, and also presents surprising data, since the findings pointed to the implementation of the program in almost 50% of these institutions.[10]

Considering Primary Health Care (PHC), it is emphasized that more research is needed to investigate this issue. In fact, a Brazilian study conducted only with PHC nurses showed that 74.1% of participants reported no knowledge of the existence of PHC in the municipality where they worked.[11] This fact corroborates the need to also look at PHC for the optimization of antimicrobial use.

PHC is present throughout the national territory and is the main gateway to the Health System, as well as an important link in the continuity of care for hospitalized patients. It is therefore of utmost importance to disseminate the principles of optimizing the use of antimicrobials and ASP in these units.

Regarding the knowledge necessary to work in PHC, topics such as microbial resistance and rational use of antimicrobials were mentioned by 96% of participants, which is consistent with findings in the literature addressing the skills and knowledge necessary for nurses, pharmacists, and physicians working in PHC.[12-13]

Regarding knowledge about TAR, it is concerning that 28% of participants consider that TAR, despite being economical, may lead to worsening of the patient's condition, since oral medications do not have the same potency or efficacy. This position is corroborated by the findings in the literature, where data indicate that professionals mistakenly believe that oral antimicrobials are not as effective as parenteral antimicrobials or are not capable of adequately treating infections.[5,14] These findings reinforce the need to work on specific concepts about antimicrobials, including the pharmacokinetics, pharmacodynamics, and spectrum of action of these drugs.[15]

Considering the barriers to TAR, the absence of drugs with adequate oral bioavailability was the condition most cited by participants (76%). The development of new antimicrobials with good oral availability in recent decades, such as quinolones, cephalosporins, and metronidazole, has enabled a more favorable outlook for TAR, including the challenging scenario of severe gram-positive infections, since the introduction of oral linezolid on the world market.[5]

Even so, the pharmaceutical industry is increasingly challenged to produce new antimicrobials, including oral formulations. However, it should be noted that the list of agents in research or registration phase published by the WHO in 2024 points to 40 items in the investigation or registration phase with oral formulation.[16] Of these, 13 options are intended for priority pathogens, 19 are intended for the treatment of tuberculosis, and nine represent options for non-traditional antibacterial agents.

One possibility to overcome this barrier and, at the same time, bring clarity to the issue associated with the efficacy of oral antimicrobials would be the adoption of institutional protocols for TAR as an activity integrated with PHC, an action considered easy to implement.[17]

The second most cited barrier by participants (76%) in this study points to the lack of engagement by prescribers for the transition to occur. This point highlights the importance of involving and engaging physicians within PHC, as they are the main actors in the prescription of antimicrobials.[18]

The possibility of hospital discharge and the cost associated with IV versus OA antimicrobial therapy were cited by more than 80% of participants as facilitating factors in TAR. In this sense, establishing antibiotic therapy that can bring about the best clinical outcome, with less toxicity and lower cost, are essential principles of ASPs and the object of antimicrobial stewardship.

A recent systematic review conducted to evaluate the effectiveness of interventions related to the IV/OA transition of antimicrobials in hospitals analyzed 36 studies, concluding that all interventions resulted in the optimization of antimicrobial use and reduced healthcare costs without compromising clinical outcomes.[4]

A Brazilian retrospective study evaluated mortality as the primary outcome and costs and length of stay in the ICU as secondary outcomes, concluding that the IV/OA transition is a safe strategy that generates savings and reduces the length of stay in the unit.[19] This reaffirms the facilitating aspects of cost reduction and the possibility of early discharge from the transition of antimicrobial routes.

Knowing the barriers that most impact TAR enables strategies to be developed to overcome these barriers at the institutional level. Similarly, knowing the facilitating elements enables them to be strengthened by health service management. This knowledge has the potential to generate assertive actions that result in a cultural change in the institution regarding TAR. To this end, strengthening the participation and integration of the professionals involved in this topic is essential.

According to this study, the most relevant aspect of the nurse's contribution is effective communication with the team. This finding confirms the role of nurses as a key element in communication with other members of the PHC.[20]

Despite the various activities carried out by nurses within PHC, including TAR, a Brazilian study pointed out that their collaboration with TAR was a practice occasionally performed by these professionals.[21] However, in the present study, assessment of the presence of diarrhea, nausea, vomiting, and swallowing condition were pointed out as contributions of nurses by more than 80% of the participants, reinforcing that nurses already perform several activities related to the optimization of antimicrobial use, but may not be formally included in these programs.

The assessment of the availability of adequate oral options, the technical aspects of oral antimicrobials, and the recording and monitoring of treatment days were pointed out as important contributions of pharmacists. A Japanese study reaffirms this finding, showing that ASP led by a pharmacist specializing in infectious diseases contributes to reducing the duration of antimicrobial treatment.[22]

Promoting the rational use of antimicrobials and guiding other professionals on the technical aspects of medications are pharmaceutical duties that have been strengthened since the development of clinical duties for pharmacists. However, it was only in 2024 that the Federal Pharmacy Council (CFF) regulated the duties of pharmacists in the control of ARIs and the management of antimicrobials.[23]

Infectious disease physicians play an important role in the hospital and PHC settings, not only because they work directly with concepts and tools of epidemiology and infection control, alongside infection control nurses, but also because they actively participate in and often lead PHC teams, thus acting as coordinators of these actions.

Skills and expertise in microbiology, diagnosis and treatment of infectious diseases, infection control, antimicrobial resistance, and direct work with interdisciplinary teams place infectious disease physicians as facilitators not only among other professionals but also among other clinicians who work in direct patient care, enabling them to engage these professionals.[24]

A German study found that interprofessional collaboration between intensive care physicians, nurses, and pharmacists enabled the optimization of antimicrobial use in the ICU, as well as improved outcomes and patient care, generating significant savings for the institution.[25]

The integration of these professionals enables TAR to occur safely and without negatively impacting the patient's clinical outcome. Therefore, knowing the relevant criteria that make a patient eligible for route transition is a task that enables this intervention to occur safely and effectively.

The criteria most cited by the participants in this study corroborate those found in the literature, such as the availability of adequate oral medication, vital signs, fever spikes, the patient's willingness to receive medication enterally, improvement or stability of infectious screening tests, among others.[5,12,15]

In the current study, more than 90% of participants agree that the patient, to be eligible for TAR, needs to meet specific criteria and conditions. These findings reinforce once again the need for well-designed protocols so that this action can be performed safely and effectively.

With regard to the benefits for nursing, pharmacy, and medicine, and in particular for raising awareness about the impact of microbial resistance and actions within ASPs to address it, this study makes it possible to identify important gaps and opportunities, such as the need to formally integrate nurses into ASPs, the importance of developing the skills and abilities of all professionals involved, as well as the need to strengthen the integration of nurses, pharmacists, and physicians, with a view to implementing and strengthening ASPs.

Considering the various positive aspects of TAR at the right time, this study highlights points of attention for strengthening this strategy as well as barriers to be overcome in order to optimize the use of antimicrobials.

This study identified barriers and facilitators for the transition of antimicrobial routes from the perspective of nurses, pharmacists, and physicians. The main barriers identified were the absence of antimicrobials with adequate oral bioavailability and the lack of engagement of prescribers; and the main facilitators were the possibility of hospital discharge, the presence of an active hospital infection control service, and the lower costs associated with oral therapy.

TAR is an intervention that involves direct actions by nurses, pharmacists, and physicians. The present study identified the main contributions of each of these professionals and highlighted the need for all actors involved in primary care to develop competencies and skills for the effective development of these activities in an integrated manner, with interdisciplinary work. The limitations of this study include the small sample size, with emphasis on the fact that the number of medical professionals who responded to the questionnaire was lower than expected, despite the wide dissemination through the technological resources provided for in the methods and approved by the REC. Thus, these limitations should be considered in the interpretation of the findings, requiring further studies to generalize the results.

REFERENCES

1. Charlotte SH, Carlos THW, Thet TA, et al. Antimicrobial resistance: a concise update. The Lancet Microbe 2024; 0(0):e100947. https://doi.org/10.1016/j.lanmic.2024.07.010

2. Aggarwal R, Mahajan P, Pandiya S, et al. Antibiotic resistance: a global crisis, problems and solutions. Crit Rev Microbiol 2024; 50(5):1-26. https://doi.org/10.1080/1040841X.2024.2313024

3. Coyle V, Forde C, Adams R, et al. Early switch from intravenous to oral antibiotic therapy in patients with cancer who have low-risk neutropenic sepsis: the EASI-SWITCH RCT. Health Technol Assess 2024; 28(14):1-101. https://doi.org/10.3310/RGTP7112

4. Garwan YM, Alsalloum MA, Thabit AK, et al. Effectiveness of antimicrobial stewardship interventions on early switch from intravenous-to-oral antimicrobials in hospitalized adults: A systematic review. Am J Infect Control 2023; 51(1):89-98. https://doi.org/10.1016/j.ajic.2022.05.017

5. Nathwani D, Lawson W, Dryden M, et al. Implementing criteria-based early switch/early discharge programmes: a European perspective. Clin Microbiol Infect 2015; 21(Suppl 2):S47-55. https://doi.org/10.1016/j.cmi.2015.03.023

6. BRASIL. Agência Nacional de Vigilância Sanitária. Diretriz Nacional para elaboração de programa de gerenciamento de antimicrobianos em serviços de saúde. 2. ed. Brasilia: ANVISA; 2023. Disponível em: https://www.gov.br/anvisa/pt-br/centraisdeconteudo/publicacoes/servicosdesaude/publicacoes/DiretrizGerenciamentoAntimicrobianosANVISA2023FINAL.pdf

7. Eysenbach G. Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES). J Med Internet Res. 2004; 6(3):e34. https://doi.org/10.2196%2Fjmir.6.3.e34

8. Akhloufi H, Hulscher M, Melles DC, et al. Development of operationalized intravenous to oral antibiotic switch criteria. J Antimicrob Chemother 2017; 72(2):543-546. https://doi.org/10.1093/jac/dkw470

9. Berrevoets MAH, Pot JHLM, Houterman AE, et al. An electronic trigger tool to optimise intravenous to oral antibiotic switch: a controlled, interrupted time series study. Antimicrob Resist Infect Control 2017; 6(81). https://doi.org/10.1186/s13756-017-0239-3

10. Menezes RM, Gonçalves MRS, Krumennauer EC, et al. Antimicrobial Stewardship Programmes in Brazil: introductory analysis. Res Soc Dev 2022; 11(7):e51011729444. https://doi.org/10.33448/rsd-v11i7.29444

11. Jarina NV, Perinoti LCSC, Couto DS, et al. Gerenciamento de antimicrobianos na atenção primária à saúde: percepção e ações dos enfermeiros. Saúde Colet 2021; 11(70): 8835-8846. http://dx.doi.org/10.36489/saudecoletiva.2021v11i70p8835-8846

12. Akhtar A, Khan AH, Zainal H, et al. Physicians' Perspective on Prescribing Patterns and Knowledge on Antimicrobial Use and Resistance in Penang, Malaysia: A Qualitative Study. Front Public Health 2020; 8:601961. https://doi.org/10.3389%2Ffpubh.2020.601961

13. Courtenay M, Castro-Sánchez E, Gallagher R, et al. Development of consensus-based international antimicrobial stewardship competencies for undergraduate nurse education. J Hosp Infect 2019; 103(3):244-250. https://doi.org/10.1016/j.jhin.2019.08.001

14. Hogan-Murphy D, Waqas S, Tuite H, et al. What Stops Doctors Switching from Intravenous to Oral Antibiotics? Ir Med J 2019; 112(8):987. https://pubmed.ncbi.nlm.nih.gov/31650816/

15. Gilchrist M, Wade P, Ashiru-Oredope D, et al. Antimicrobial Stewardship from Policy to Practice: Experiences from UK Antimicrobial Pharmacists. Infect Dis Ther 2015; 4(Suppl 1):51-64. https://doi.org/10.1007/s40121-015-0080-z

16. World Health Organization. 2023 Antibacterial agents in clinical and preclinical development: an overview and analysis. Suíça: WHO; 2024. Disponível em: https://iris.who.int/bitstream/handle/10665/376944/9789240094000-eng.pdf?sequence=1

17. Moehring RW, Davis A, Dodds Ashley E, et al. Harvesting the low-hanging fruit? Comparative assessment of intravenous to oral route antimicrobial conversion policy implementation. Infect Control Hosp Epidemiol 2023; 44(6):954-958. https://doi.org/10.1017/ice.2022.158

18. Centers for disease control and preention. The core elements of hospital antibiotic stewardship programs. Estados Unidos: CDC; 2019. https://www.cdc.gov/antibiotic-use/healthcare/pdfs/hospital-core-elements-H.pdf

19. Gasparetto J, Tuon FF, Oliveira DS, et al. Intravenous-to-oral antibiotic switch therapy: a cross-sectional study in critical care units. BMC Infect 2019; 19(1):650. https://doi.org/10.1186/s12879-019-4280-0

20. American Nurses Association (ANA), Centers for Disease Control and Prevention (CDC). Redefining the antibiotic stewardship team: recommendations from the American Nurses Association/Centers for Disease Control and Prevention Workgroup on the role of registered nurses in hospital antibiotic stewardship practices. JAC Antimicrob Resist 2019. https://doi.org/10.1093/jacamr/dlz037

21. Felix AMS, Jarina NV, Perinoti LCSC, et al. Self-report of nurses' antimicrobial stewardship practices. Rev Enferm Atenção Saúde 2022; 11(2):e202246. https://doi.org/10.18554/reas.v11i2.6059

22. Fukuda T, Tanuma K, Iio S, et al. Impact of a Pharmacist-Led Antimicrobial Stewardship Program on the Number of Days of Antimicrobial Therapy for Uncomplicated Gram-Negative Bacteremia in a Community Hospital. Cureus 2021; 13(4):e14635. https://doi.org/10.7759/cureus.14635

23. BRASIL. Conselho Federal de Farmácia. Resolução. Resolução CFF nº 11, de 25 de julho de 2024. Dispõe sobre as atribuições do farmacêutico no controle de infecções relacionadas à assistência à saúde e no gerenciamento de antimicrobianos. Diário oficial da União, Brasilia (DF), 2024 Set 6; Seção 1:fv143. Disponível em: https://www.legisweb.com.br/legislacao/?id=464080

24. Ostrowsky B, Banerjee R, Bonomo RA, et al. Infectious Diseases Physicians: Leading the Way in Antimicrobial Stewardship. Clin Infect Dis 2018; 66(7):995-1003. https://doi.org/10.1093/cid/cix1093

25. Schmid S, Schlosser S, Gülow K, et al. Interprofessional Collaboration between ICU Physicians, Staff Nurses, and Hospital Pharmacists Optimizes Antimicrobial Treatment and Improves Quality of Care and Economic Outcome. Antibiotics (Basel) 2022; 11(3):381. https://doi.org/10.3390/antibiotics11030381

AUTHORS' CONTRIBUTIONS

Tatiane Garcia do Carmo Flausino contributed to the bibliographic research, writing of the abstract, introduction, methodology, discussion, interpretation and description of the results, preparation of tables, conclusions, review, and statistics. **Rosely Moralez de Figueredo** contributed to the bibliographic research, writing of the abstract, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions, review and statistics, and project management. **Darlyani Mariano da Silva** contributed to writing the abstract, methodology, interpretation of results, conclusions, review, and statistics. **Lívia Cristina Scalon da Costa Perinoti** contributed to writing the abstract, methodology, interpretation of results, conclusions, review, and statistics.

All authors approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

Please cite this article as: Flausino TGC, da Silva DM, L Perinoti LCSC, de Figueiredo RM. Antimicrobial switch therapy: barriers and facilitators from the perspective of nurses, pharmacists and physicians . Rev Epidemiol Control Infect [Internet]. 2025 Jun. 25; 15(2). Available from: https://seer.unisc.br/index.php/epidemiologia/article/view/19994