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Evaluation of the essential elements of an antimicrobial stewardship program: perspective of health care professionals in a teaching hospital

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Abstract

Objectives: To assess the essential elements of the antimicrobial stewardship programs (ASP) from the perspective of healthcare professionals in a public teaching hospital in the Southeastern Brazil. **Methods:** A questionnaire based on the guidelines of the *Agência Nacional de Vigilância Sanitária* (Anvisa) and the recommendations of the Centers of Disease Control and Prevention (CDC) were applied in this cross-sectional study. The questionnaire was made available on the Google Forms platform and an invitation was sent to the healthcare team and the hospital board with an access link to the survey. The responses were tabulated using the Excel software version 2003 (Microsoft Corporation, Redmond, Washington, USA). **Results:** Thirty participants responded to the questionnaire, encompassing professionals working in the following departments: hospital pharmacy (17; 56.7%), clinical analysis laboratory (3; 10.0%) and hospital infection control service (2; 6.7%), board of directors and leaderships (2; 6.7%) and other healthcare workers (6; 20.0%). All the participants were aware of the existence of the ASP at the hospital. **Conclusions:** Great similarity was observed between the evaluated ASP and the Anvisa guideline. The level of ASP development in the studied hospital may contribute to increase the effectiveness and safety of treatment, to reduce microbial resistance and the morbimortality, as well as healthcare costs. Continued actions are recommended to evolve ASP strategies and monitor its results in hospital settings.

Keywords: microbial resistance to antimicrobials; antimicrobial stewardship; hospital infections; patient safety.

Avaliação dos elementos essenciais de um programa de gerenciamento de antimicrobianos: perspectiva dos profissionais de saúde em um hospital de ensino

Resumo

Objetivos: Avaliar os elementos essenciais de um programa de gerenciamento de uso de antimicrobianos (PGA), sob a perspectiva dos profissionais de saúde, em um hospital público de ensino no sudeste do Brasil. **Métodos:** Neste estudo transversal foi aplicado um questionário baseado nas diretrizes da Agência Nacional de Vigilância Sanitária (Anvisa) e nas recomendações do *Centers of Disease Control and Prevention* (CDC). O questionário foi disponibilizado na plataforma *Google Forms* e foi enviado convite à equipe de saúde e à direção do hospital com um *link* de acesso ao questionário. As respostas foram tabuladas utilizando o *software* Excel versão 2003 (Microsoft Corporation, Redmond, Washington, USA). **Resultados:** Trinta participantes responderam ao questionário, englobando profissionais que trabalham nos seguintes departamentos: farmácia hospitalar (17; 56,7%), laboratório de análises clínicas (3; 10,0%) e serviço de controle de infecções hospitalares (2; 6,7%), diretoria e lideranças (2; 6,7%) e outros profissionais de saúde (6; 20,0%). Todos os participantes demonstraram ciência sobre a existência do PGA no hospital. **Conclusão:** Observou-se grande semelhança entre o PGA avaliado e a diretriz da Anvisa. O nível de desenvolvimento da PGA no hospital estudado pode contribuir para aumentar a efetividade e segurança do tratamento, para reduzir a resistência microbiana e a morbimortalidade, bem como os custos dos cuidados de saúde. São recomendadas ações contínuas para desenvolver estratégias de PGA e monitorizar os seus resultados em ambientes hospitalares.

Palavras-chave: resistência microbiana aos antimicrobianos; programas de gerenciamento do uso de antimicrobianos; infecção hospitalar; segurança do paciente.

Introduction

Microbial resistance to antimicrobials is considered a global Public Health emergency. The treatments for many infections have become less effective, impacting hospitalization times, health care costs and the number of patient deaths[1,2]. It is estimated that the infections caused by resistant microorganisms cause 700,000 deaths every year, and this number is predicted to increase to 10 million deaths per year by 2050. It is considered that most of the direct and indirect impacts will affect low- and middle-income countries[3].

Among the factors that contribute to the emergence of microbial resistance to antimicrobials is excessive or inappropriate use of these medications[4]. For example, antibacterials are the second class of medications most used in hospitals, representing from 20.0% to 50.0% of the hospital expenses on medications, and are also highly prescribed for outpatients. This widespread use significantly affects the person's microbiota, whether in the community or in the hospital environment[5]. In a global context, more than half of the antibacterials are improperly prescribed, distributed or sold[2,6].

With the pandemic caused by the new coronavirus (COVID-19), it is estimated that microbial resistance has been driven by increased antibacterial use in the context of treating patients with COVID-19. This was due to concerns about bacterial co-infections. At the beginning of the pandemic it was difficult to differentiate COVID-19 from these infections due to overlapping signs and symptoms. In addition to that, health systems became overwhelmed causing changes in infection prevention and control practices and reallocation of human and financial resources that were previously devoted to antimicrobial resistance surveillance and response[6]. Clinical protocols were also interrupted due to difficulties supplying health inputs, including antimicrobials[7].

Faced with growing concern about microbial resistance, together with member countries of the United Nations (UN), including Brazil, the World Health Organization (WHO) encouraged the development of national plans related to the global fight against microbial resistance[5]. In 2018, Brazil launched the National Action Plan for Antimicrobial Resistance Prevention and Control in the Unified Health Scope (*Plano de Ação Nacional de Prevenção e Controle da Resistência aos Antimicrobianos no Âmbito da Saúde Única*, PAN-BR), containing interventions and activities aligned with the strategic objectives of the Global Action Plan. These strategic objectives included preventing and controlling microbial resistance to antimicrobials through educational actions, sanitation and hygiene measures, infection prevention and adoption of good agricultural practices, among others. In general terms, national plans must ensure the ability to treat and prevent infectious diseases with safe and effective medications that are used responsibly and are accessible to everyone who needs them[8]. Developing antimicrobial stewardship programs is seen as an instrument to optimize the prescription of antimicrobials in health services, preserve the effectiveness of these medications, reduce the occurrence of adverse events in patients and prevent the selection and dissemination of resistant microorganisms, in addition to reducing the assistance costs[9-11]. The activities would be carried out by a duly trained multidisciplinary team, with institutional support, following recommended policies in accordance with international patient safety standards[12,13].

In 2017, the Brazilian Health Surveillance Agency (*Agência Nacional de Vigilância Sanitária*, ANVISA) published the Guideline for the Preparation and Implementation of an Antimicrobial Stewardship Program (ASP) in Brazil. This Guideline presents the essential elements that should be adapted to each hospital reality, varying according to local needs, epidemiological and microbiological profiles, resources and services, aiming to optimize antimicrobials in these environments[5]. In general, the essential elements include support from the hospital's senior management, definition of responsibilities of all professionals involved, educational measures, development of actions to improve the prescription of antimicrobials, monitoring of the program and disclosure of the results[5,13].

The current paper aimed at evaluating the availability/presence of the essential elements of an ASP at a public teaching hospital in Brazil, from the health professionals' perspective and by applying a questionnaire following the ANVISA guidelines and recommendations from the Centers for Disease Control and Prevention (CDC) of the United States of America[5,13].

Methods

The situational assessment from the workers' perspective was carried out based on elements considered essential in am ASP, in accordance with the model provided by ANVISA (supplementary material) and the CDC recommendations[5,13]. The cross-sectional study was developed in a public hospital linked to the Unified Health System (*Sistema Único de Saúde*, SUS), a reference within the urgency, emergency and maternal-child care scope in the Brazilian Southeast region, with a convenience sample made up of professionals who answered the questionnaire disclosed throughout hospital. The teaching hospital has nearly 400 beds and is a reference for more than 1.2 million inhabitants. This data survey is part of the strategic planning of the study institution, whose methods were improved to deepen the discussion in this paper. It is also worth noting that ASP actions at the institution have been gradually implemented since 2008 with the implementation of the Hospital-acquired Infection Control Service (*Serviço de Controle de Infecção Hospitalar*, SCIH) and improved over the years[14]. The study was approved by the Research Ethics Committee (*Comitê de Ética em Pesquisa*, CEP) of the Federal University of Minas Gerais, under CAAE code 54060321.8.0000.5149.

The questionnaire model suggested by ANVISA has 50 questions divided into eight blocks: Support from senior management; Definition of responsibilities; Education; Policies; Strategic actions to manage antimicrobial use; Process/Use and consumption indicators; Result/Outcome indicators; and Disclosure of the results[5]. The model suggested by the CDC has 34 questions divided into seven blocks: Hospital Leadership Commitment; Accountability; Pharmacy Expertise; Action: Implement Interventions to Improve Antibiotic Use; Tracking Antibiotic Use and Outcomes; Reporting Antibiotic Use and Outcomes; and Education[13].

Two meetings were held with representatives from the SCIH, pharmacy and laboratory to adjust the questionnaire format and improve the established language, aiming for complete understanding by the team. The final questionnaire, adapted for the institution, contained 56 questions (supplementary material). The inclusion criteria were hospital professionals, regardless of their performance area, who agreed to participate in the study. No exclusion criteria were applied. The form was made available through the *Google Forms* virtual platform and structured so

that each participant answered questions directed only to their professional category. Strategies were also developed at the hospital to increase circulation of the link to access the questionnaire and recruit participants. The Communications counseling department created a poster for disclosure containing diverse information on the topic, explaining the importance of the participation of professionals of interest that included workers from the Pharmacy, Laboratory analysts, SCIH, clinical staff and management personnel. The poster was sent via the Intranet and messaging app groups made up of these professionals who were more actively encouraged to participate given the natural composition of the ASP management and operational team. The other professionals were invited, but without much sensitization. In addition to that, three alerts were sent to reassert the importance of participating in the study.

The study was conducted in 2021. The data were tabulated in an Excel 2003 (Microsoft Corporation, Redmond, Washington, USA) spreadsheet, analyzed using absolute and relative frequencies, and presented in table format.

Results

Thirty participants out of a total of 2,323 invited individuals answered the questionnaire, encompassing professionals working in the Hospital Pharmacy (17; 56.7%), in the Clinical Analysis Laboratory (3; 10.0%), at the SCIH (2; 6.7 %), in Management (board and leadership) (2; 6.7%) and care teams (6; 20.0%), including four physicians (66.7%), one nursing professional (16.7%) and a professor (16.7%). All participants proved to be aware of the ASP existence in the hospital. The full form is available in the supplementary material.

According to the Management professionals' perception, there is support from senior management to comply with the essential elements of the ASP in the hospital. All the participants from the sector asserted that the institution has a formal policy to improve antimicrobial use, as well as setting goals and discussing results. The leadership also points out that activities involving antimicrobial management are integrated with other efforts to improve quality and patient safety, such as sepsis and diagnostic management (Table 1). In the care teams, 83.3% of the professionals answered that there is a lead physician responsible for the ASP results at their facility and that there is also a formal procedure for all physicians to review the appropriateness of all antibiotics 48 hours after the initial requests. All participants answered that the hospital de-escalates antimicrobials, when indicated, in addition to culture-guided therapy (Table 1).

According to pharmacy professionals, there is a pharmacist leader responsible for working to improve the use of antimicrobials in their facilities. A total of sixteen (94.1%) participants answered that the hospital performs oral sequential therapy and that there is support from the Pharmacy for antimicrobial dose adjustments in cases of organic dysfunctions in the patients. Fourteen (82.4%) pharmacists asserted that the hospital also adjusts the antimicrobial dose to optimize the treatment of microorganisms with reduced sensitivity. All participants answered that there are no automatic alerts in situations where the therapy is unnecessarily duplicated, and only two (11.8%) participants stated that the hospital has automatic time-sensitive stop requests for specific antimicrobial prescriptions (Table 1).

The three participants from the Microbiology laboratory asserted that there are automated identification or sensitivity testing systems that determine the Minimum Inhibitory Concentration (MIC). The laboratory provides culture/antibiogram results within 72 hours and performs serum monitoring of antimicrobial concentration. Two (66.7%) participants stated that serum monitoring is performed at the institution for vancomycin and one (33.3%) participant stated that gentamicin dosage is also performed. Only one (33.3%) participant asserted that the hospital manages antimicrobial use with the help of biomarkers (Table 1).

As for the SCIH block, both (100.0%) participants indicated that there is a team responsible for controlling antimicrobial use and that there is a physician or pharmacist who carries out prospective audits in the hospital. One of them (50.0%) also asserted that prescribers are informed about compliance of their prescriptions after carrying out the audit (Table 1).

In the block of questions addressed to pharmacists and SCIH professionals (n=19), eighteen (94.7%) participants answered that the hospital has a restriction system through a form for specific antimicrobials, and all participants stated that there is a pre-authorization system for specific antibiotics and that the hospital monitors the *Clostridioides difficile* infection rates. Most of the participants in this group (89.5%) answered that there are protocols for treating community-acquired pneumonia and sepsis. Most of the respondents (78.9%) asserted that there is a data collection instrument and (73.7%) database for managing antimicrobial use and monitoring the consumptions costs for these medications. Twelve (63.2%) participants answered that there is an education program for patients and companions/caregivers on proper antimicrobial use and monitoring adherence to the documentation policies (Table 1).

The last three blocks ("Antimicrobial Stewardship Program management team", "Policies for improving antimicrobial prescriptions" and "Disclosure of the results") were targeted at all participants (n=30). The majority (76.7%) asserted that an operational management team was appointed responsible for developing and implementing the ASP. Half of the participants stated that the operational program leader is an infectious disease specialist, clinical pharmacist, or other professional with knowledge about infectious diseases. Most of the participants (90.0%) also asserted that there are protocols for the main clinical syndromes, based on national guidelines and local epidemiological and microbiological profiles, as well as an institutional policy that requires prescribers to document the dose, duration and indication of all antimicrobials prescribed (Table 2).

Only twelve (40.0%) participants stated that the results of the program are periodically disclosed to all hospital professionals and 17 (56.7%) participants asserted that specific reports on antimicrobial use are distributed to the prescribers. Nineteen (63.3%) participants confirmed that diverse information about antimicrobial use and microbial resistance is regularly passed on to all sectors of the hospital relevant to the program, as well as that results, objectives and goals were disclosed to the hospital's senior management and all sectors involved in the ASP (Table 2).

Table 1. Execution or existence of essential elements of the institution's Antimicrobial Stewardship Program, according to the respondents (questions targeted at specific groups).

Essential elements	Respostas N (%)
Support from the hospital senior management	
Existence of a formal policy to support senior management in the efforts to improve antimicrobial use in the institution.	2 (100.0%)
Existence of goals and support for the training and ongoing education of the hospital health professionals on topics related to infection control, microbial resistance and antimicrobial use management.	2 (100.0%)
Regular meetings between program manager(s), hospital leadership and/or management to discuss activities, resources and results.	2 (100.0%)
The hospital leadership ensures that the activities involving antibiotic management are integrated with other efforts to improve quality and patient safety, such as sepsis and diagnostic management.	2 (100.0%)
Assistance teams	
Functions performed by the respondents within the hospital care team.	
Physician	4 (66.6%)
Nurse or Nursing Technician	1 (16.7%)
Professor	1 (16.7%)
Existence of a lead physician responsible for the ASP results at the facility and a formal procedure for reviewing antibiotic prescriptions 48 hours after the initial requests.	5 (83.3%)
Carrying out antimicrobial de-escalation and culture-guided therapy.	6 (100.0%)
Pharmacy	
Existence of a pharmaceutical leader responsible for working to improve antibiotic use in their facilities.	17 (100.0%)
Carrying out oral sequential therapy and Pharmacy support for dose adjustments of antimicrobials in cases of organic dysfunctions in the patients.	16 (94.1%)
Adjusting the antimicrobial dose to optimize the treatment of microorganisms with reduced sensitivity.	14 (82.4%)
Existence of automatic alerts in situations where the therapy is unnecessarily duplicated.	0 (0.0%)
Existence of automatic time-sensitive interruption requests for specific antimicrobial prescriptions.	2 (11.8%)
Microbiology Laboratory	
Existence of a microbiology laboratory at the institution.	2 (66.7%)
Existence of automated identification or sensitivity testing systems that determine the minimum inhibitory concentration. There is agility in providing culture/antibiogram results within 72 hours and serum monitoring of antimicrobial concentration.	3 (100.0%)
Type of serum monitoring performed at the institution.	
Vancomycin	2 (66.7%)
Vancomycin and gentamicin	1 (33.3%)
Management of antimicrobial use with biomarkers.	1 (33.3%)
Hospital Infection Control Service	
Existence of a team responsible for controlling antimicrobial use and presence of a physician or pharmacist who carries out prospective audits in the hospital.	2 (100.0%)
Prescribers are informed about compliance of their prescriptions once the audit has been carried out.	1 (50.0%)
SCIH and Pharmacy	
Existence of a restriction system through a formulary for specific antimicrobials.	18 (94.7%)
Existence of a pre-authorization system for specific antibiotics and monitoring of the *Clostridioides difficile* infection rates.	19 (100.0%)
Existence of protocols for treating infections and syndromes.	
Community-acquired pneumonia and sepsis	17 (89.5%)
Lower urinary tract infection and meningitis	10 (52.6%)
Skin and soft tissue infection and *Clostridioides difficile* infection	14 (73.7%)
Pyelonephritis	9 (47.4%)
Surgical prophylaxis	18 (94.7%)
Empirical treatment for oxacillin-resistant *Staphylococcus aureus*	13 (68.4%)
Laboratory-confirmed bloodstream infections	15 (78.9%)
Existence of a data collection instrument for the ASP	15 (78.9%)
There is a database for managing antimicrobial use and monitoring the consumption costs for antimicrobials.	14 (73.7%)
Existence of an education program for patients and companions/caregivers on proper antimicrobial use and monitoring adherence to the documentation policies (dose, duration and indication).	12 (63.2%)
Monitoring adherence to the institution's clinical protocols (e.g., by Defined Daily Dose – DDD or Length of Therapy (LOT).	13 (68.4%)

ASP: Antimicrobial Stewardship Program; SCIH: *Serviço de Controle de Infecções Hospitalares* (Hospital Infection Control Service)

Table 2. Execution or existence of the institution's Antimicrobial Stewardship Program essential elements, according to the respondents (questions addressed to all participants, N=30).

Essential elements	Answers N (%)
Antimicrobial Stewardship Program management team	
An operational management team responsible for developing and implementing the program was formally appointed.	23 (76.7%)
The operational leader of the program is a specialist in infectious diseases, clinical pharmacist, or other professional with knowledge about infectious diseases.	15 (50.0%)
The program management team is interdisciplinary.	24 (80.0%)
Policies to improve antimicrobial prescriptions	
Existence of protocols for the main clinical syndromes, based on national guidelines and local epidemiological and microbiological profiles; as well as of an institutional policy that requires prescribers to document the dose, duration and indication of all prescribed antimicrobials in the prescription.	27 (90.0%)
The protocols are widely disseminated to everyone involved and the professionals are duly trained for their adoption.	23 (76.7%)
Disclosure of the results	
Periodic disclosure of the program results to all hospital professionals.	12 (40.0%)
The program's operational team disseminates specific reports on antimicrobial use to the prescribers.	17 (56.7%)
Information on antimicrobial use and microbial resistance is regularly passed on to all sectors of the hospital relevant to the program and the results, objectives and goals were disseminated to the hospital's senior management and all sectors involved in the program.	19 (63.3%)

Discussion

The current study evaluated the essential elements of an ASP, from the health professionals' perspective at a public teaching hospital in southeastern Brazil. According to the respondents, there is significant similarity between what is practiced at the institution and what is required by ANVISA. The questionnaire priority is to provide a diagnostic overview of the ASP implementation through an evaluation of the restrictive measures (such as those recommended by the SCIH), medication dispensing policies (established by the pharmacy) and the monitoring instruments followed by the institution for antimicrobial use that are known to the hospital employees. The largest participation observed was from professionals from the SCIH, Clinical Analysis Laboratory and Hospital Pharmacy.

According to the answers obtained regarding support from the hospital's senior management, which is a critical point for the success of an ASP, it was possible to identify that the program is adequate in relation to the ANVISA guidelines. Success in developing and implementing the ASP within the hospital depends on the dedication of human, financial and technological resources, as well as on the support and collaboration of medical leaders as well as hospital administration[11]. Lack of human, financial and information technology resources, for example, is generally cited as the main barrier to the success of management programs[13,15]. The hospital leadership can play a key role in enabling the acquisition of necessary resources to achieve the ASPs objectives[13].

As for the employees from the Pharmacy sector, it was possible to verify that there is a pharmaceutical leader responsible for contributing to improving antimicrobial use in the institution. Clinical pharmacists specialized in infectious diseases and antimicrobial use play important roles in the appropriate use of these medications, which includes prospective auditing with intervention and feedback, educational actions, development and monitoring of metrics, and establishment of the clinical policies and protocols[5,13,16]. They can also carry out a systematic review of antimicrobial prescriptions and optimize pharmacotherapy, based on pharmacokinetic and pharmacodynamic knowledge, improving clinical and financial health outcomes[16,17].

At the institution, it was observed that there is a need to improve the electronic systems to improve antimicrobial use. Time-sensitive automatic stop requests for specific antimicrobial prescriptions have not yet been fully implemented at the institution[14]. Time-sensitive alert systems and discontinuation requests may improve therapy outcomes with these medications[18-20]. It has already been shown, for example, that a positive blood culture alert system associated with the intervention of a pharmacist managing antimicrobials resulted in a reduction in therapy time, hospitalization time and mortality related to Gram-negative bacteremia[19]. In turn, antimicrobial discontinuation requests can prevent unnecessary use, although acceptance of this practice by professionals has been lower due to the therapy inappropriate discontinuation risk[18,20].

Many actions of an ASP are performed by pharmacists together with SCIH professionals, such as pre-authorization for specific antimicrobials and developing and monitoring adherence to the hospital clinical protocols, as well as measures that reflect the impact of the program and its interventions. To this end, antimicrobial consumption and use in hospitals can be measured and evaluated[5,16,17]. Nearly half of the professionals (52.6%) answered that the hospital carries out this monitoring through the Defined Daily Dose (DDD), which is the most widely used consumption measure, recommended by the WHO and the *Infectious Diseases Society of America* (IDSA)[5]. However, IDSA considers that the Days of Therapy (DOT) measure has some important advantages over the DDD. DOT corresponds to the number of days that a patient receives an antimicrobial agent (regardless of the dose); therefore, this number is not affected by dose adjustments and can be used both in adult and in pediatric populations. DDD has more limited use in Pediatrics due to the weight-based dose[17]. DOT is also employed in the hospital in question according to 31.6% of the participants. ANVISA recommends that these indicators should be calculated once a month, globally for all antimicrobials used in the hospital or by specific sectors[5].

As for the Microbiology laboratory, it is possible to conclude that fundamental actions for the ASP implementation are developed by the hospital and are known to most of the professionals in the sector who answered the questionnaire. Clinical Microbiology laboratories play important roles in optimizing antimicrobial prescriptions because they isolate, identify and determine the

pathogens' sensitivity profile to antimicrobials. These results enable developing reports and antibiograms, in addition to reassessing and readjusting empirical antimicrobial therapy[5,17]. It was observed that the institution's Microbiology laboratory has a large technological park and automated systems for culture, isolation, identification and sensitivity testing of bacterial species. However, mass spectrometry (Maldi-TOF) is not available, which might reduce the time to initiate the appropriate antimicrobial therapy, recurrent infection rates, hospitalization times, mortality and, consequently, hospital expenses[17].

According to the participants, the institution's laboratory also carries out serum monitoring of the antimicrobial concentrations (vancomycin and gentamicin in a standardized way, and of others if required for specific cases). This action can help adapt the prescribed antimicrobial dose, improve serum concentrations within the therapeutic range and reduce adverse effects such as nephrotoxicity in the patients[17,21]. The participants' knowledge level regarding biomarker use was lower, considered complementary by ANVISA, but no less important in the ASP[5]. It is worth noting that biomarkers play an important role as additional tools to accelerate clinical diagnoses in determining the presence of the relevant bacterial infection and response to the treatment. Using procalcitonin, C-reactive protein and interleukin, for example, can improve the infection assessment and guide clinical reasoning in pharmacotherapy[22]. Therefore, the need to discuss the implementation of these biomarkers in the hospital's clinical routine was shown, as frequent use is only observed for C-reactive protein.

The care team participation was not significant (four medical professionals [66.7%], one nursing professional [16.7%] and one teacher [16.7%]) when compared to the total number of professionals in the institution. However, the research is better disclosed among the actors from the ASP operational team, raising awareness about the relevance of participating among the managers. It is also possible that professionals with less knowledge and involvement in infection control actions have less interest in participating. During the questionnaire application period, the Nursing team, for example, was made up of 1,055 professionals, whereas the Medical team and the Multidisciplinary team had 478 and 452 professionals, respectively. Given the strategic weight of these professionals in direct antimicrobial management and their proximity to the patients, this strategy of greater awareness raising in these professionals outside the ASP operational team in future research studies would be essential for a complete diagnosis about which gaps need to be better addressed in the institution.

It was observed that there is a management team for the interdisciplinary program, although only half of the participants asserted that the operational leader of the program is a specialist in infectious diseases, a clinical pharmacist or other professional with knowledge about infectious diseases; in addition, there was variation among the answers regarding the professionals who are part of the program management team. This team should be responsible for defining policies and regulations, as well as general guidelines, continuous monitoring, improvement proposals and feedback on the ASP results. In addition to that, it must regularly disclose the results of the program throughout the hospital[5].

It was observed that, according to the participants, the hospital adopts policies to improve antimicrobial prescriptions, as recommended by ANVISA. Actions aimed at improving antimicrobial use range from educational approaches to restrictive measures, such as the adoption of clinical protocols, which have already proved to be effective in promoting rational use of these drugs and, therefore, this strategy has been adopted by several countries. These protocols should be developed according to clinical characteristics and local epidemiological and microbiological profiles[5].

Periodic disclosure of the results proved to be low, considering that only 40.0% of the professionals corroborated its occurrence in the hospital. This disclosure should be updated and regular to all professionals involved in the process of using the institution's antimicrobials, including hospital management. Disseminating diverse information about antimicrobial use and microbial resistance, as well as results, objectives and goals can be an instrument for feedback. In addition to that, it can contribute to motivating better prescription practices in the hospital and compliance with other actions essential to success of the ASP[5].

The study presented some limitations. The questionnaire was applied to a non-randomized sample and remotely due to the COVID-19 pandemic context and the need for social distancing. The professionals' low participation can be related to using a virtual dissemination means or to little knowledge about the topic. Another limitation refers to the alternatives for answering the questionnaire. Most of the questions only had "Yes" or "No" as an answer option and, as a result, many participants who did not know the answer to some questions might have selected one of these options to continue the questionnaire, resulting in the possibility of a bias in the study. In addition to that, the quantitative format of the situational diagnosis does not qualify the conformity degree of the elements evaluated. Ideally, it would be important not only to know whether the professionals understand whether the hospital carries out or not a given process, but also whether it develops it with adequate quality.

The current study suggested that the challenges faced in the hospital under study when implementing an ASP are in line with the challenges pointed out in the national and international literature[23-25]. The aspects that need to be improved include the need for broader dissemination of protocols and results, as well as awareness raising among professionals regarding the importance of an ASP. In addition to that, improvements are required in the institution's computerized system. The perspectives include the need for actions that are capable of causing sustainable and effective changes in the hospital, such as a robust feedback system for all professionals, as a self-evaluation and learning method. There is also a need to raise awareness about the responsibility for having a successful ASP to be collective and multi-professional[23,25].

The applicability of this study includes the possibility of helping other institutions understand the challenges that may be experienced when developing and implementing an ASP, according to their specific realities. In addition to that, this study sought to analyze an institutional scenario, which is fundamental for developing strategies, considering the differences in the various areas, and for standardizing internal policies aiming for a more efficient ASP[24]. A well-developed ASP can contribute benefits to patients, institutions and society as a whole, such as therapy optimization and safety, in addition to reduced morbidity/mortality and related costs.

Conclusion

This study presented a diagnosis of the ASP implementation in a teaching hospital, according to the perspective of a convenience sample made up by professionals from the institution. Significant similarity was observed between the ASP evaluated and the

ANVISA guideline. The ASP development level in the hospital under study can contribute to increasing treatment effectiveness and safety and to reducing microbial resistance and patient morbidity and mortality, as well as health care costs. Continuous actions are recommended for developing ASP strategies and monitoring their results in hospital environments.

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Collaborators

AFM, MAPM, EMML and AS designed the study. AS collected the data and performed the statistical analyses. EMML, AFM, MAPM, AS, CMB and WJFNS participated in data interpretation. CCV wrote the manuscript. All authors critically reviewed the text and approved the final version of the manuscript.

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Declaration of conflict of interests

The authors declare that there are no conflicts of interests in relation to this article.

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