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ORIGINAL ARTICLE

Development and validation of a questionnaire on the use of antimicrobials in primary health care

Desenvolvimento e validação de questionário sobre o uso de antimicrobianos na atenção primária à saúde

Desarrollo y validación de un cuestionario sobre el uso de antimicrobianos en la atención primaria de salud

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ABSTRACT

Background and Objectives: Antimicrobial resistance is a global threat to public health and is related to excessive and inappropriate use of antimicrobials. In Brazil, there are few studies on infection prevention and control strategies and antimicrobial management in primary healthcare. In this study, we developed and validated a questionnaire to assess these strategies. The aim of this study was to develop and validate an evaluation tool designed to investigate the strategies adopted by primary healthcare services to prevent and control infections and manage the use of antimicrobials. **Methods:** Between February and April 2022, the study involved five Steps: literature review, question development, expert validation, questionnaire finalization, and dissemination. The Content Validity Index was calculated to assess the expert agreement. **Results:** The final questionnaire with 102 questions was refined based on feedback from experts. The overall average CVI was 0.74, indicating good agreement between experts regarding the representativeness of the items. These suggestions resulted in improvements in the vocabulary and structure of the questionnaire. **Conclusion**: The questionnaire developed and validated is an accurate and reliable tool for evaluating infection prevention and control strategies and antimicrobial stewardship in primary healthcare. Its use can provide important data for improving health practices, with a view to reducing antimicrobial resistance and improving the quality of services. This study highlights the importance of research in this area to promote the rational use of antimicrobials and strengthen the health system in primary health care.

Keywords: *Primary Health Care. Antimicrobial Stewardship. Infection Control. Surveys and Questionnaires. Validation Study.*

RESUMO

Justificativa e Objetivos: A resistência antimicrobiana é uma ameaça global à saúde pública, relacionada ao uso excessivo e inadequado de antimicrobianos. No Brasil, há poucos estudos sobre estratégias de prevenção e controle de infecções e gerenciamento de antimicrobianos na atenção primária à saúde. O objetivo deste estudo foi desenvolver e validar uma ferramenta de avaliação destinada a investigar as estratégias adotadas pelos serviços de atenção primária à saúde para a prevenção e controle de infecções e o gerenciamento do uso de antimicrobianos. **Métodos:** Realizado entre fevereiro e abril de 2022, o estudo envolveu cinco etapas: revisão da literatura, desenvolvimento das questões, validação por especialistas, finalização do questionário e disseminação. O Índice de Validade de Conteúdo foi calculado para avaliar a concordância dos especialistas. **Resultados:** O questionário final, com 102 questões, foi refinado com base no feedback dos especialistas. O IVC médio geral foi de 0,74, indicando boa concordância entre os especialistas quanto à representatividade dos itens. As sugestões resultaram em melhorias no vocabulário e estrutura do questionário. **Conclusão:** O questionário desenvolvido e validado é uma ferramenta precisa e confiável para avaliar estratégias de prevenção e controle de infecções e gerenciamento de antimicrobianos na Atenção Primária à Saúde. Sua utilização pode fornecer dados importantes para melhorar as práticas de saúde, visando à redução da resistência antimicrobiana e à melhoria da qualidade dos serviços. Este estudo destaca a importância de pesquisas nesta área para promover o uso racional de antimicrobianos e fortalecer o sistema de saúde.

Descritores: *Atenção Primária à Saúde. Gestão de Antimicrobianos. Controle de Infecções. Inquéritos e Questionários. Estudo de Validação.*

RESUMEN

Justificación y Objetivos: La resistencia antimicrobiana representa una amenaza global para la salud pública, asociada al uso excesivo e inadecuado de antimicrobianos. En Brasil, hay pocos estudios sobre estrategias de prevención y control de infecciones y gestión de antimicrobianos en la atención primaria de salud. Este estudio desarrolló y validó un cuestionario para evaluar dichas estrategias. El objetivo de este estudio fue desarrollar y validar una herramienta de evaluación destinada a investigar las estrategias adoptadas por los servicios de atención primaria de salud para la prevención y control de infecciones, así como para el manejo del uso de antimicrobianos. **Métodos:** Realizado entre febrero y abril de 2022, el estudio comprendió cinco etapas: revisión de literatura, desarrollo de preguntas, validación por expertos, finalización del cuestionario y difusión. Se calculó el Índice de Validez de Contenido para evaluar la concordancia de los expertos. **Resultados:** El cuestionario final, con 102 preguntas, se refinó según la retroalimentación de los expertos. El IVC medio general fue de 0,74, indicando una buena concordancia entre los especialistas en cuanto a la representatividad de los elementos. Las sugerencias resultaron en mejoras en el vocabulario y estructura del cuestionario. **Conclusión:** El cuestionario desarrollado y validado es una herramienta precisa y confiable para evaluar estrategias de prevención y control de infecciones y gestión de antimicrobianos en la Atención Primaria de Salud. Su uso puede proporcionar datos importantes para mejorar las prácticas de salud, con el objetivo de reducir la resistencia antimicrobiana y mejorar la calidad de los servicios. Este estudio destaca la importancia de la investigación en esta área para promover el uso racional de antimicrobianos y fortalecer el sistema de salud.

Palabras Clave: *Atención Primaria de Salud. Programas de Optimización del Uso de los Antimicrobianos. Control de Infecciones. Encuestas y Cuestionarios. Estudio de Validación.*

INTRODUCTION

Antimicrobial resistance (AMR) is a global public health threat that is intrinsically linked to the use of antimicrobial agents (AMAs). Estimates from 2019 indicate that there were approximately 4.95 million deaths worldwide associated with bacterial AMR, with 1.27 million of these deaths directly attributable to this resistance.[1] A recent study reveals that approximately three-quarters of AMA consumption occurs in the community, where Primary Health Care (PHC) professionals play a key role in prescribing.[2]

Although Primary Health Care (PHC) is fundamental to reducing the use of AMA, allowing direct interaction with users and their families, there is still a gap in knowledge about the impact of Infection Prevention and Control (IPC) strategies and AMA Management Measures in the Brazilian context. This study seeks to fill this gap by proposing the construction of a tool capable of measuring AMA management actions and strategies in PHC. The aim of this study was to develop and validate a precise tool that evaluates the interactional triad between IPC, AMA and PHC.

METHODS

During the months of February to April 2022, this study was dedicated to designing and validating a questionnaire for PHC professionals. The questionnaire addressed IPC strategies and AMA management measu-

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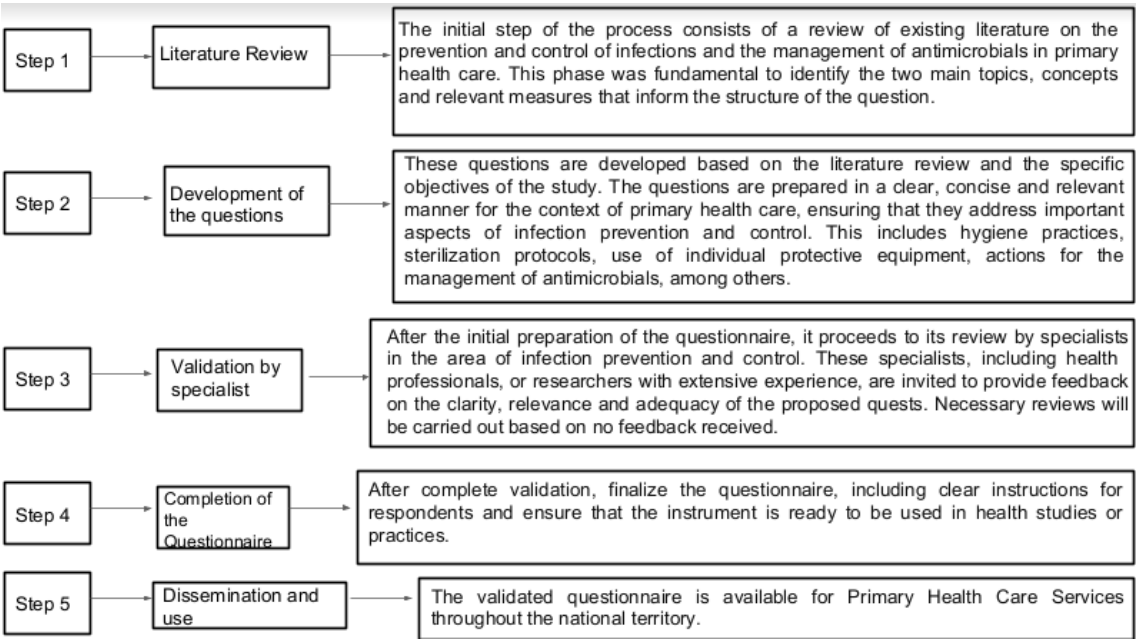

Source: elaborated by the authors, 2024.

Figure 1. Steps for developing and validating the questionnaire.

res and was evaluated by experts who analyzed the representativeness of the content areas and the relevance of the objectives.

In this study, questionnaires with consolidated scales were used to collect data from health research, providing valuable insights into clinical and prescriptive AMA practice. This has contributed to improving strategies for managing and controlling the use of these drugs. The process of developing and validating the questionnaire consisted of five distinct Steps: Step 1 - Literature Review; Step 2 - Question Development; Step 3 - Expert Validation; Step 4 - Questionnaire Finalization; Step 5 - Questionnaire Dissemination. The steps for developing and validating the questionnaire are detailed in the flowchart below.

Content validation is fundamental in the validation of psychometric instruments, guaranteeing the accuracy of the items in measuring the proposed construct, as well as their relevance and representativeness for the target population and specific context; thus, Pasquali highlights methods and criteria for this validation, emphasizing the participation of experts in assessing the clarity, relevance and comprehensiveness of the items.[3]

Under this theoretical methodology, a convenience method was adopted to select the experts, taking into account criteria such as professional experience and involvement with the State Coordination Offices and the Ministry of Health. Initial communication took place via an e-mail invitation letter, detailing the aspects of the study. A total of 31 experts were contacted, and those who did not respond within 7 days were excluded from the evaluation process. The experts who responded were directed to take part in the validation via a virtual form. In this way, 15 experts actively contributed to the validation of the tool.

In order to make it easier for the experts to evaluate the questions, spaces were included adjacent to each item so that they could record their evaluations, as well as specific areas for comments and suggestions, guaranteeing comprehensive feedback. The experts analyzed the instruments in isolation and context, considering criteria such as vocabulary and the instructional sequence of the domains. They were responsible for determining whether each domain was adequate, inadequate or required changes.

The Content Validity Index (CVI) was calculated to assess the experts' agreement as to the representativeness of the items in relation to the content studied. According to Coluci et al,4 this index is calculated using the following formula:

$$CVI = \frac{\text{N of experts who rated the item as adequate with changes or adequate}}{\text{Total number of specialists}}$$

In this study, only the items considered adequate by the experts were used to calculate the Content Validity Index (CVI). To determine the overall average CVI of the instrument, all the CVIs calculated individually were added together and divided by the total number of items. A minimum index of 0.75 was established as acceptable for both the evaluation of each item and the overall evaluation of the instrument.[5]

In accordance with the rules contained in Resolution No. 466/2012, this research project was submitted to and approved by the Research Ethics Committee on March 17, 2022, under Certificate of Presentation and Ethical Appreciation No. 5.413.514. The favorable opinion of the Research Ethics Committee was obtained under CAAE: 57866222.3.1001.5343.

RESULTS

This study was conducted in five main methodological Steps, each playing a crucial role in the construction and validation of the tool for assessing the interaction between IPC, AMA and PHC.[6-7]

Step 1 - Literature Review: The review was conducted by accessing the LILACS (Latin American and Caribbean Health Sciences Literature) and SciELO (Scientific Electronic Library Online) databases. The health science descriptors in Portuguese or the corresponding terms in Spanish or English used in the search were: questionnaire; infection control; antimicrobial stewardship; primary health care. It was found that there were no previous studies that simultaneously addressed the topics of IPC and AMA management in Brazilian PHC. The questionnaire was segmented and organized into "domains" (D), i.e. sets of questions that addressed the same aspect. The multiple-choice variables were structured as dichotomous variables.

Step 2 - Developing the questions: given the difficulty in finding literature on the topics, we decided to use the texts of the National Program for the Prevention and Control of Healthcare-Related Infections (PNPCIRAS 2021-2025) of the National Health Surveillance Agency (ANVISA) and the National Action Plan for the Control of Antimicrobial Resistance in the Single Health Sector 2018 (PAN-BR) as guidelines.

Thus, the first two domains of the "D" questionnaire were designed to cover the following domains, respectively: D1) Health service profile and D2) Clinical and epidemiological profile of the health service.

For the preparation of the questions related to precautionary measures contained in domain D3): Actions related to the prevention and control of infections, we used as a reference the study "The role of Primary Care in the prevention of Healthcare-Related Infections" carried out by Maria Clara Padoveze and Rosely Moralez de Figueiredo.[8] In the same domain, but in the subdomain entitled biosafety and waste management, the questions were based on RDC No. 222 of February 28, 2018, which provides for Technical Regulations for the management of health service waste.

With regard to domain D4) Actions for managing the use of AMA; D5) Health education on IPC measures; D6) Health education focusing on managing the use of AMA, the following were used as a basis, respectively: the National Guideline for Preparing a Program for Managing the Use of Antimicrobials in Health Services, published by Anvisa (2017)[9], o (PAN-BR)[6] and the Centers for Disease Control and Prevention's Checklist of Basic Elements for Antibiotic Use in Outpatient Settings (CDC, 2016).[10] (Table 1)

Step 3 - Validation of Experts: there was a predominance of females (86.6%), and the majority lived in the Midwest region (60%), followed by the Southeast region (20%). Around 53.3% had a degree in nursing, while 26.6% were pharmacists. All the experts were linked to public bodies related to Primary Health Care and Health Surveillance at state level. Representatives from the General Coordination for Guaranteeing Primary Care Attri-

Table 1. Description of the domains and the main questions included in the questionnaire.

Domain / Questions
D1) Health service profile
- Average number of visits per month; main visits; and number of health professionals involved.
- Existence of computers; computerized system; and network access.
D2) Clinical and epidemiological profile of the health service
- Main age groups of patients seen.
- Main pathologies.
D3) Actions related to IPC measures
- General PCI measures; hand hygiene; precautionary measures; biosafety and waste management; cleaning, disinfection and sterilization of articles (instruments).
D4) Actions to manage AMA use
- Existence of dispensing of AMA without prescription.
- There is pressure from patients to prescribe AMA.
- Existence of control and dispensing of AMA by the responsible professional.
- Existence of a formal document/protocol for the diagnosis and treatment of the main infections.
- Existence of a policy/protocol obliging prescribers to record: dose, duration and indication of treatment.
- Existence of training to adopt the measures provided for in these protocols.
- Existence of a standardized list of these medicines in accordance with the National List of Medicines (RENAME), State (REM) or Municipal (REMUME).
- Existence of AMA prescriptions guided by laboratory tests, including antibiograms, with an interface with a clinical/microbiological analysis laboratory.
D5) Health education on infection prevention and control measures
- The health service provides ongoing education on IPC measures. For what reasons does the health service have no ongoing education on IPC measures?
- Permanent education actions include periodic training on IPC measures for all professionals.
- What topics are covered in the training so that professionals are able to implement IPC measures.
- The health service promotes actions aimed at patients, which include the distribution of printed material, such as pamphlets and booklets, containing guidance on the importance of IPC measures.
D6) Health education with a focus on ATM use management
- Carrying out continuing education actions for its professionals to improve awareness of the use of AMA: frequency and topics covered in training.
- Training topics that healthcare professionals need to know and master in order to implement antimicrobial stewardship measures.
- Patient guidance on AMA use: the way in which AMA guidance is passed on to patients, including strategies to improve patient understanding.
- Distribution of printed material (pamphlets, booklets, etc.) containing guidance on the correct and rational use of AMA.

Source: Elaborated by the authors, 2024.

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butes (CGGAP), the Family Health Department (DESF), the Primary Health Care Secretariat (SAPS) and the Ministry of Health (MS), as well as members of ANVISA's Health Services Surveillance and Monitoring Management (GVIMS), participated as experts at the federal level. We present the particularities recommended by experts for each domain addressed in the questionnaire (Table 2).

The experts proposed changes to the questionnaire's vocabulary, totaling a significant 91 suggestions. These suggestions reflect the importance of using precise and appropriate language to ensure the clarity and effectiveness of the questionnaire. By making changes to the vocabulary, the experts may have sought to make the questions more comprehensible to the target audience by eliminating

Table 2. Special features suggested by the experts according to each domain of the questionnaire.

Domain	Special features suggested for amendment		
D1) Health service profile	- No suggested changes.		
D2) Clinical and Epidemiological profile	- Ask questions about the main services provided at the healthcare facility.		
D3) Actions related to PCI measures	**Improved question formulation** - Exclude subjective questions. - Objectivity / Simplification. - Remove personal opinions. - Add to the alternatives if there are records. - Change the terms of the questions. - Change the order of the questions.	**Inclusion of specific information and questions** - Specify whether sanitizing products are related to the sterilization process. - Add information on disinfection, including types and products used. - Include details on chemical and physical sterilization methods. - Insert questions about tests used as sterilization indicators. - Insert utensils used in the cleaning and disinfection process. - Cover more details about the sterilization process, including equipment and packaging. - Include other sanitizing products in the cleaning and disinfection process. - Include other cleaning and sanitizing products. - Include details on the process of hand hygiene by workers.	**Organizing and refining questions** - Insert question about the availability of alcohol gel for teams. - Insert question about protocols related to infection prevention and control measures. - Insert question about the frequency of hand hygiene training. - Insert question about the frequency of hand hygiene training. - Insert question about written records of periodic procedures.
D4) Actions to manage AMA use	**Adjustments and clarifications** - Adjust RDC No. 222/2018, which provides for good practices in the management of healthcare waste - Clarify whether the questions are aimed at HAIs or infections found in establishments. - Change the term AMA dispensation to supply or delivery of medicines.	**Adding Information** - Include the State Medicines List. - Add other professions that prescribe antimicrobials in PHC. - Add questions about the regularity of AMA supplies.	**Other changes** - Exclusion of Subjective Questions. - Insert a third option that considers clarifying and guiding the patient and then prescribing because we think it may reflect the reality of some services, in the question about health professionals in the health service being pressured by patients to prescribe AMA.
D5) Health education on IPC measures	- Changing the wording of questions.		
D6) Health education with a focus on AMA use management	- No suggested changes.		

Source: Elaborated by the authors, 2024.

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excessively complex or ambiguous technical terms.

All the items in domains 1, 2, 5 and 6 had a CVI of over 0.75. However, in domains 3 and 4, the CVI was lower than the reference value (0.75), and the main changes made, based on the suggestions of the expert-evaluators, were terminological adjustments, spelling corrections and text detailing. The overall average CVI was 0.74 with standard deviation (SD ± 0.29) (Table 3).

Step 4 - Finalizing the Questionnaire: a comparison was made between the initial and final versions of the document. They observed a significant reduction in the number of questions, from a total of 135 in the first version to 102 in the final version. (Table 4)

The average time taken to complete a questionnaire is a crucial aspect to consider in its design and application. This metric not only affects the respondent's experience, but also influences the quality and integrity of the answers. Authors state that the questionnaire is a valuable tool for collecting data in research, due to its time savings, practicality, accuracy in obtaining answers, standardization, uniformity and greater openness on the part of the participants.[11] In this context, it is essential to understand the estimated time needed to complete the questionnaire, thus guaranteeing the active participation of the respondents and the accuracy of the data collected. In the current survey, the average time taken to complete the questionnaire was approximately 20 minutes.

Step 5 - Dissemination of the questionnaire: this took place by sending a link and a letter containing instructions on how to fill it out to the emails of the State Health Secretariats, State Health Surveillance Centers and Health Coordinating Offices. The questionnaire is now called: "National evaluation of strategies for infection control and management of antimicrobial use in Primary Health Care", which can be accessed in full through supplementary data.

Table 3. Experts' assessment of the questionnaire's related items in different regions of Primary Care in Brazil.

Domain	Assessment		CVI	CVI mean
	Suitable items with changes n (%)	Suitable items n (%)		
D1) Health service profile	0 (0.0)	15 (100)	1	
D2) Clinical and epidemiological profile	1 (6.7)	14 (93.3)	0.93	
D3) Actions related to infection prevention and control measures	11 (73.3)	4 (27.0)	0.27	0.74
D4) Actions to manage AMA use	9 (60)	6 (40)	0.40	
D5) Health education on infection prevention and control measures	1 (6.7)	14 (93.3)	0.93	
D6) Health education focusing on the management of AMA use	1 (6.7)	14 (93.3)	0.93	

Source: Elaborated by the authors, 2024.

Table 4. Comparison of the questionnaire between the pre and post expert validation Step.

Domain	Pre-Validation Step No. of Questions	Post-Validation Step No. of Questions	Overall opinion
D1) Health service profile	8	5	Exclusion of 3 questions
D2) Clinical and epidemiological profile	5	3	Exclusion of 2 questions
D3) Actions related to infection prevention and control measures	77	57	
D4) Actions to manage AMA use	28	20	Exclusion of 20 questions
D5) Health education on infection prevention and control measures	8	8	Exclusion of 8 questions
D6) Health education focusing on the management of AMA use	9	9	Maintained

Source: Elaborated by the authors, 2024.

DISCUSSION

According to experts, improving the wording of questions is essential for the quality and effectiveness of questionnaires. Removing subjective questions and ensuring objectivity eliminates personal opinions, making the questionnaire more reliable and impartial. In addition, simplifying questions makes them easier to understand and increases the accuracy of responses. Changing terms avoids ambiguities and improves interpretation, while rearranging the order of questions positively influences participants' perception and response, organizing the questionnaire in a logical and fluid manner.

This emphasis on adjustments is essential, as well-designed questionnaires are an effective research technique, consisting of a specific set of questions presented in writing to a group of individuals, with the aim of obtaining information about their opinions. This

approach offers several advantages, including the ability to reach a large number of participants, even in geographically distant areas, the flexibility to answer questions at their convenience, and minimizing the influence of the interviewer on the respondents' responses.

However, questionnaires can produce unexpected results due to the different interpretations that respondents may have of the items. Furthermore, excessive questionnaire length may result in a low response rate.[12] Given the vast territory of Brazil, the use of online questionnaires makes it possible to reach a wide variety of health professionals in different locations throughout the country. This ensures a more comprehensive and representative sample, while eliminating the need for printing, physical distribution and manual collection of questionnaires, resulting in a significant reduction in the costs associated with the survey.[13]

An online questionnaire offers the convenience of being accessed and answered at any time and place, providing greater flexibility and facilitating participation. For this reason, the development and validation of this online questionnaire was carefully planned and executed based on the latest evidence and demands on aspects related to infection prevention and control, with a view to meeting the need for actions aimed at the rational use of AMAs and the reduction of antimicrobial resistance in PHC. Health professionals working in Primary Health Care often deal with intense workloads. In this sense, it is essential that the tools available are resolutive, of high quality and capable of giving healthcare providers greater autonomy. This would make it easier for these professionals to access innovations.[14]

The items in a questionnaire should be designed to assess the desired results, and their psychometric properties should be evaluated for construct validity, internal consistency, reliability and other relevant aspects. The internal consistency of the instrument's items indicates how well they relate to each other and similarly represent the construct that the instrument aims to measure. On the other hand, reliability is measured by the squared correlation between the true score and the observed score, reflecting the stability and precision of the measures obtained.[15]

The antibiotic stewardship program assessment tool consists of the Core Elements of Hospital Antibiotic Stewardship Programs. It offers examples of the implementation of these elements, aimed at optimizing antibiotic prescribing, and can be applied according to the need or feasibility of each healthcare institution. Periodic use of the assessment tool provides data that is collected instantly and can be compiled and analyzed quickly and efficiently, making it possible to document the infrastructure and activities of the ongoing program and helping to identify areas for improvement. It is suggested to include specific details, such as points of contact or particular guidelines with dates, in the "comments" column, in order to provide useful references for the team responsible for antibiotic stewardship.[16]

Content validity is essential to ensure that the elements of the measuring instrument adequately represent the concept to be assessed. Therefore, when constructing a questionnaire, it is essential to address all relevant aspects of the phenomenon in question. The authors suggest guidelines for content validation, such as defining the scope of the questionnaire, involving experts in generating, evaluating and correcting the content, and using additional analyses to improve the instrument.[17]

It is commonly stated that ensuring the quality of health services on a global level requires a uniformly high approach, maintaining consistent standards. The first step to achieving this uniformity is to understand the contextual and cultural determinants specific to different countries and, from there, develop strategies to deal with these nuances. Decision-making in health is an intricate process, deeply influenced by context, which encompasses multiple participants and actions. This complexity is especially visible in decision-making related to antibiotic use, where different priorities and contextual factors influence clinical behavior.[18]

Content validity is the extent to which the content of an assessment instrument adequately reflects the construct being measured. As there is no specific statistical test to assess content validity, a qualitative approach is generally used, involving evaluation by a committee of experts. Subsequently, a quantitative approach can be carried out using the CVI.[19] In this study, validation with a group of experts was essential, generating valuable comments that guided the revision of the questionnaires, this Step served to improve the questions, ensuring greater understanding.

In relation to the CVI, the score found ranged from 0.23 to 1.00, while the overall average was 0.74 (SD ± 0.29), in another study[20] the score given by the experts ranged from 0.777 to 1.00, with a mean of 0.902 (SD ± 0.076).

Thus, this study resulted in the creation of an accurate tool for assessing the interaction between IPC, AMA and PHC, with the aim of continuously improving the quality of health services, suggesting that the instruments assessed in this study showed a more consistent and stronger correspondence with the construct being measured, compared to the overall average found.

The changes implemented were a result of the feedback received, especially in relation to questions that proved difficult to interpret. Improving the wording of questions is essential for the quality and effectiveness of questionnaires. Excluding subjective questions and ensuring objectivity eliminates personal opinions, making the questionnaire more reliable and impartial. Simplifying questions makes them easier to understand, increasing the accuracy of responses. Changing terms avoids ambiguity and improves interpretation, while rearranging the order of questions positively influences the participants' perception and response, organizing the questionnaire in a logical and fluid manner.

These improvements suggested by the evaluators demonstrate a deep understanding of the importance of precise and objective questions. Ensuring clarity in the language used and a logical sequence in the questions

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promotes a better experience for respondents and increases the validity of the results obtained. In short, these strategies reflect a commitment to excellence in questionnaire design, aiming to maximize efficiency and validity in data collection.

The comparison between the questionnaire in the pre- and post-validation Steps of the experts shows that the reduction in questions can be attributed to factors such as the elimination of redundant or irrelevant questions for the research objectives. This analysis simplifies the questionnaire, making it easier to answer and reducing the time required to complete it. In addition, the experts may have identified questions that are not aligned with the research focus or that do not contribute significantly to the desired data collection.

Therefore, these questions were removed to ensure that the questionnaire remained concise and targeted. In summary, the reduction from 135 to 102 questions in the final version of the questionnaire indicates a process of refinement and optimization, aimed at improving the effectiveness and usability of the research instrument. Adapting the vocabulary was essential to ensure that the questionnaire was suitable for different demographic groups, taking into account linguistic and contextual variations. Overall, the revision of the questionnaire vocabulary reflects the experts' commitment to improving the quality of the research, which allowed for greater understanding by the participants.

Although the results of this study are promising, it is important to consider some limitations, such as: variable interpretation of the questions by participants may result in inconsistent responses, affecting the reliability of the data collected. The lack of direct comparison between the questionnaires used in these two key areas of public health may undermine the external validity and generalizability of the results. Without a reference point to compare the effectiveness and accuracy of the domain-specific questionnaires, it is difficult to determine whether the instruments are adequately capturing the nuances and complexities of infection prevention and control practices, as well as AMA management. Due to time constraints, it was not feasible to conduct a second round of evaluation with the experts, and it is suggested that future studies consider two-Step validation to ensure a more complete and robust evaluation. Conducting research on AMA management and infection prevention in primary health care in Brazil is crucial to promote the rational use of AMA, prevent adverse events, and improve the quality of health care provided to patients. These studies also contribute to optimizing health resources, strengthening epidemiological surveillance, and reducing the burden of infectious diseases, in addition to strengthening the Brazilian health system and contributing to global public health.[21]

A limitation of this study is the possible variability in the responses of PHC professionals due to regional and contextual differences in clinical practice and health policies. In addition, self-assessment may introduce biases, such as social desirability, where respondents may provide answers that they consider more acceptable than true.

This study contributes significantly to clinical practice by offering a validated tool that can be used to assess and improve IPC strategies and AMA management in PHC. The tool will allow more accurate monitoring of antimicrobial use, facilitating targeted interventions to reduce AMR. Furthermore, the application of the tool can promote greater awareness among health professionals about best practices in AMA use, encouraging a more rational and evidence-based approach.

The validation presented in this work showed that the developed questionnaires can be used as accurate and reliable tools to measure the implementation of AMA management programs at the national level, and can be replicated safely and reliably. The main objective was to build a robust and reliable instrument capable of providing relevant data to improve practices in this specific context, aiming at the continuous improvement of the quality of health services.

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Rochele Mosmann Menezes contributed to the literature search, writing of the abstract, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions, review and statistics. **Paula Trevisan** contributed to the project administration, literature search, writing of the abstract, introduction, methodology, discussion, interpretation and description of results, conclusions, review and statistics. **Mara Rubia Santos Gonçalves and Magda Machado de Miranda Costa** contributed to the writing of the abstract, methodology, interpretation of results, conclusions, review and statistics**. Mariana Portela de Assis and Adália Pinheiro Loureiro** contributed to the writing of the abstract, review and statistics. **Henrique Ziembowicz and Eliane Carlosso Krumennauer** contributed to the project administration, literature search, review and statistics. **Jane Renner Pollo Renner and Marcelo Carneiro** contributed to the project administration, literature search, writing of the abstract, introduction, methodology, discussion, interpretation and description of results, conclusions, review and statistics.

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