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Research Article

Disposal of antimicrobials in primary health care in the districts and islands of the Amazon metropolis

Descarte de antimicrobianos na atenção primária à saúde nos distritos e ilhas da metrópole da Amazônia

Eliminación de antimicrobianos en la atención primaria de salud en los distritos e islas de la metrópoli amazónica

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Abstract

Introduction: Primary Health Care, as the gateway to the Brazilian Unified Health System, plays a crucial role in health promotion and the rational use of medicines. Among the challenges faced at this level of care is the improper use and disposal of antimicrobials, a practice that jeopardizes both public health and the environment by promoting microbial resistance and contamination of bodies of water. The lack of standardized procedures and the limited training of health teams aggravate this scenario, especially in the outskirts and riverside regions. Taking this into consideration, in this study, we investigated the practices related to the use and disposal of antimicrobials in Health Centers in the districts and islands of the municipality of Belém (state of Pará, Brazil), considering the principles of the Brazilian Unified Health System and the guidelines of the National Solid Waste Policy. **Objective:** To investigate the improper use and disposal of antimicrobials in Primary Health Care, highlighting their environmental and public health implications. **Methods:** This is a descriptive and exploratory study, analyzing the perception of health professionals about the use and disposal of antimicrobials in the Health Centers of the districts and islands of Belém, in 2024. Pharmacists or those in charge of the Health Centers answered structured questionnaires, assessing awareness and knowledge of appropriate disposal methods**. Results:** According to the data, there is a heterogeneous scenario regarding the management and disposal of pharmaceuticals in the health units investigated. We identified structural weaknesses in the disposal process and gaps in professionals' awareness. There is no unified Standard Operating Procedure for all Health Centers. While 66.6% of the units follow guidelines established by the Municipal Department of Health, 7.4% adopt their own procedures, 11.1% have no formal regulations, 3.8% state there is a unified Standard Operating Procedure for the whole district, and 1% of those interviewed were unable to answer. In addition, guidance to users on proper disposal was insufficient, favoring inappropriate practices. **Conclusions:** We verified weaknesses in the disposal of antimicrobials related to the lack of standardization, insufficient training of professionals, and lack of knowledge among the population. Therefore, stricter regulations, the implementation of a unified Standard Operating Procedure, periodic training, and educational campaigns are essential to promote public and environmental health and the rational use of this drug class. All the data are described in the manuscript and are available upon request.

Keywords: Amazon ecosystem; Primary health care; One health; Anti-infective agents; Drug resistance, microbial.

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Resumo

Introdução: A atenção primária à saúde (APS), como porta de entrada do Sistema Único de Saúde (SUS), exerce papel essencial na promoção da saúde e no uso racional de medicamentos. Entre os desafios enfrentados nesse nível de atenção, destacam-se os uso e descarte inadequados de antimicrobianos, prática que compromete tanto a saúde pública quanto o meio ambiente, ao favorecer a resistência microbiana e a contaminação de corpos d'água. A ausência de padronização nos procedimentos e a limitada capacitação das equipes de saúde agravam esse cenário, especialmente em regiões periféricas e ribeirinhas. Diante disso, este estudo investigou as práticas relacionadas ao uso e descarte de antimicrobianos em unidades básicas de saúde (UBSs) dos distritos e ilhas de Belém (PA), considerando os princípios do SUS e as diretrizes da Política Nacional de Resíduos Sólidos. **Objetivo:** Este estudo investigou os uso e descarte inadequados de antimicrobianos na APS, destacando suas implicações ambientais e de saúde pública. **Métodos:** Trata-se de uma pesquisa descritiva e exploratória analisando a percepção de profissionais de saúde sobre o uso e descarte de antimicrobianos nas UBSs dos distritos e ilhas de Belém, em 2024. Farmacêuticos ou responsáveis pelas UBSs responderam a questionários estruturados, avaliando a conscientização e o conhecimento sobre métodos adequados de descarte. **Resultados:** Os dados revelaram um cenário heterogêneo quanto ao manejo e descarte de fármacos nas unidades de saúde investigadas. Foram identificadas fragilidades estruturais no processo de descarte e lacunas na conscientização dos profissionais. Verificou-se que não há um procedimento operacional padrão (POP) unificado para todas as UBSs. Enquanto 66,6% das unidades seguem diretrizes estabelecidas pela Secretaria Municipal de Saúde, 7,4% adotam procedimentos próprios, 11,1% não têm regulamentação formal, 3,8% afirmam que há um POP unificado para o distrito todo, e 1% dos entrevistados não souberam responder. Além disso, a orientação aos usuários sobre descarte adequado se mostrou insuficiente, favorecendo práticas inadequadas. **Conclusões:** O estudo demonstrou fragilidades no descarte de antimicrobianos relacionadas à falta de padronização, à capacitação insuficiente dos profissionais e ao desconhecimento da população. Assim, regulamentações mais rigorosas, implementação de um POP unificado, capacitações periódicas e campanhas educativas são essenciais para promover a saúde pública e ambiental e o uso racional dessa classe medicamentosa. Todos os dados utilizados estão descritos no manuscrito e disponíveis mediante solicitação.

Palavras-chave: Ecossistema amazônico; Atenção primária à saúde; Saúde única; Anti-Infecciosos; Resistência microbiana a medicamentos.

Resumen

Introducción: La Atención Primaria de Salud (APS), como puerta de entrada al Sistema Único de Salud (SUS), desempeña un papel esencial en la promoción de la salud y en el uso racional de los medicamentos. Entre los desafíos enfrentados en este nivel de atención está el uso y descarte inadecuado de antimicrobianos, práctica que compromete tanto la salud pública como el medio ambiente, al favorecer la resistencia microbiana y la contaminación de los cuerpos de agua. La falta de procedimientos estandarizados y la escasa formación de los equipos de salud agravan este escenario, especialmente en las regiones periféricas y ribereñas. Frente a esto, este estudio investigó las prácticas relacionadas al uso y descarte de antimicrobianos en las Unidades Básicas de Salud (UBS) de los distritos e islas de Belém (Pará, Brasil), considerando los principios del SUS y las directrices de la Política Nacional de Residuos Sólidos (PNRS). **Objetivo:** Este estudio investigó el uso y el descarte inadecuado de antimicrobianos en la Atención Básica de Salud, destacando sus implicaciones ambientales y de salud pública. **Métodos:** Se trata de un estudio descriptivo y exploratorio, que analiza la percepción de los profesionales de la salud sobre el uso y la eliminación de antimicrobianos en las Unidades Básicas de Salud (UBS) de los distritos e islas de Belém, en 2024. Los farmacéuticos o responsables de las UBS respondieron a cuestionarios estructurados, evaluando la concienciación y el conocimiento sobre los métodos de eliminación adecuados. **Resultados:** Los datos revelan un escenario heterogéneo en cuanto a la manipulación y eliminación de productos farmacéuticos en las unidades sanitarias investigadas. Se identificaron deficiencias estructurales en el proceso de eliminación y lagunas en la concienciación de los profesionales. Se constató que no existe un Procedimiento Operativo Estándar (POE) unificado para todas las UBS. Mientras que el 66,6% de las unidades sigue las directrices establecidas por la Secretaría Municipal de Salud (SESMA), el 7,4% adopta sus propios procedimientos, el 11,1% no tiene una reglamentación formal, el 3,8% afirma que existe un POE unificado para todo el distrito y el 1% de los entrevistados no supo responder. Además, la orientación a los usuarios sobre la eliminación adecuada era insuficiente, lo que favorecía las prácticas inadecuadas. **Conclusiones:** El estudio mostró debilidades en la eliminación de antimicrobianos, relacionadas con la falta de normalización, la formación insuficiente de los profesionales y la falta de conocimiento entre la población. Por lo tanto, una reglamentación más estricta, la implementación de un PNT unificado, la formación periódica y campañas educativas son esenciales para promover la salud pública y ambiental y el uso racional de esta clase de medicamentos. Todos los datos utilizados se describen en el manuscrito y están disponibles previa solicitud.

Palabras clave: Ecosistema Amazónico; Atención primaria de salud; Salud única; Antiinfecciosos; Farmacorresistencia microbiana.

INTRODUCTION

Inadequate use and disposal of antimicrobials constitute a growing challenge for public health and the environment, especially within the Primary Health Care (PHC) context, the main gateway to the Brazilian Unified Health System (SUS). PHC, through the Family Health Strategy, is responsible for actions of promotion, prevention, and continuous care, and plays a strategic role in the rational prescription of medicines.[1]

The most commonly used medicines in Health Centers (*Unidades Básicas de Saúde* – UBSs) are the so-called antimicrobials, natural or synthetic substances with the ability to inhibit or eliminate microorganisms. Its inadequate use, however, has significantly contributed to the increase of microbial resistance, a phenomenon driven both by failures in prescription and indiscriminate consumption by the population.[2]

Another worrisome aspect is the improper disposal of these drugs, which, when disposed of in general waste or sewage, can contaminate soil and water and affect ecosystems and human health. To mitigate this problem, Brazil instituted the National Solid Waste Policy, the Plan for Managing Health Services Waste and, more recently, the reverse logistics of medicines, which establishes guidelines for the return of expired or unused products by pharmacies and drugstores.[3,4]

In this study, we aimed to investigate the use and disposal of antimicrobials in PHC UBSs in the districts and islands of the city of Belém (state of Pará), capital of the Brazilian Amazon. The municipal health network aims to cover a population estimated at more than 1.3 million inhabitants, distributed between urban and rural areas, many of which are difficult to access.[5] Based on this territorial section, we sought to understand the environmental and health impacts related to the management of these medicines, in addition to contributing to the improvement of local public policies.

METHODS

This is a descriptive and exploratory study, with a quantitative and qualitative approach, conducted between February and September 2024, with the objective of analyzing the perception of health professionals about the use and disposal of antimicrobials in the UBSs of the metropolitan region of Belém, including its urban districts and adjacent islands.

A total of 32 UBSs were selected to compose the study sample, of which 24 are located in the urban districts and eight in the island regions. In each unit, one professional (pharmacist) was interviewed, totaling 32 participants, but only 26 professionals completed the questionnaire — 10 men and 16 women —, thus composing the final sample analyzed in this study. The inclusion criteria were: professionals with active employment relationship in the health center during the collection period and who directly worked in the management and disposal of medicines. Professionals who took a leave of absence or had no relation to the antimicrobials disposal process were excluded.

Data were collected through a structured questionnaire of face-to-face application (Appendix 1), manually completed by researchers themselves based on the answers given orally by the interviewees, in order to ensure standardization in the data collection and minimize losses. The instrument was composed of multiple-choice questions, allowing the selection of one or more alternatives, with fields for discursive and justifiable answers. The questions addressed topics such as: existence of standard operating procedures (SOP), knowledge and practices related to the disposal of antimicrobials, user guidance, storage options, frequency of collection, waste destination, and perception of necessary improvements in the disposal process.

The collected data were systematized in Microsoft Excel spreadsheets (version 2021) for descriptive quantitative analysis and categorization of open-ended responses, in order to grasp nuances in the perception of professionals. The study was conducted according to the methodological guidelines of the RATS Guidelines (Recruitment, Approach, Transparency, Sampling), ensuring scientific rigor and transparency. The project was approved by the Research Ethics Committee of the responsible institution.

RESULTS

According to the obtained data, there is a heterogeneous panorama on the indiscriminate use and disposal of antimicrobials in the UBSs of the metropolitan region of Belém and adjacent islands. A total of 26 pharmacists effectively participated in the study, 10 of which were men and 16, women. All of them fully completed the applied form. We identified gaps in professionals' awareness of the importance of adequate disposal, weaknesses in the collection structure, and inconsistencies in the training of pharmacy workers in relation to the guidelines established for managing these drugs.

The majority of respondents (92.3%; n=24) acknowledge the importance of correct disposal, especially regarding the prevention of environmental contamination and the reduction of microbial resistance. In addition, the perception of most pharmacists (76.9%, n=20) about the knowledge of SUS users regarding the disposal of antimicrobials is that these individuals do not have adequate instruction on how to proceed with expired or unused drugs.

Regarding institutional protocols, we verified that there is no unified SOP for all UBSs. In this study, SOP is understood as a technical document that establishes, in a standardized way, the routines and responsibilities in the management and disposal of pharmaceutical waste, including antimicrobials. The aim of this protocol is to complement the local Plan for Managing Health Services Waste, ensuring uniformity in health and environmental actions and safety.[4] While 69.3% (n=18) of the health centers follow guidelines established by the Municipal Department of Health, 7.7% (n=2) adopt their own procedures, 11.5% (n=3) have no formal regulation, 3.8% (n=1) state that there is a unified SOP for the whole district, and 7.7% (n=2) of the interviewees did not know how to respond. This lack of standardization contributes to disparities in the process of segregation and disposal of antimicrobials, directly impacting health and environmental safety.

Regarding the control of the expiration date of the drugs, we verified that most of the UBSs (57.7%; n=15) use the Hórus system[1] for monitoring expiration dates and stock management; nevertheless, 15.4% (n=4) of the health centers still perform this control manually, through paper records,19.2% (n=5) use both options, and 7.7% (n=2) did not specify how this control is carried out. This diversity of methods evidences the absence of the implementation of a unified Hórus system, which can lead to failures in traceability and proper disposal of antimicrobials.

Furthermore, according to the data, user guidance on the disposal of antimicrobials is not uniform. Although most professionals (69.2%; n=18) inform patients about the possibility of returning drugs to the very UBS, there are still units (19.2%; n=5) lacking instructions or adequate place for disposal, leading the user to dispose of drugs inadequately in general waste, toilet, sink, or sewage and to the consumption of the drug beyond the prescribed recommendation, and a portion (11.6%; n=3) of units' professionals did not specify the information provided to UBS users concerning the medication prescribed to them. This reinforces the need for educational campaigns aimed both at professionals and the population.

We verified great heterogeneity in the segregation of expired drugs. Of the UBSs, 46.1% (n=12) have specific areas for storing these wastes, while 15.4% (n=4) store expired drugs and those within the shelf life together, with separation only by proximity to the expiration date, 23.1% (n=6) place the drugs

1 National management system for pharmaceutical care developed by the Department of Pharmaceutical Care and Strategic Inputs of the Brazilian Ministry of Health, to qualify the management of pharmaceutical care in the three spheres of the SUS and contribute to the expansion of access to medicines and health care provided to the population.

that are about to expire on the shelf in front of the drugs with a longer shelf life, so that they can be used as quickly as possible, and 15.4% (n=4) did not provide details on how the drugs are segregated at the unit.

In addition, there are flaws in the management of antimicrobial packaging, as most units (80.8%; n=21) dispose of all content (medicine, primary packaging, and drug leaflet) without separation for possible recycling processes. Only 15.4% (n=4) of the interviewees reported using the divisions into primary and secondary packaging for different disposals, and 3.8% (n=1) of them did not specify the preparation of the drugs.

Another relevant aspect is the diversity of professionals involved in the segregation and disposal stages. Although pharmacists are the main responsible for this process in 92.3% (n=24) of the UBSs, we observed that other professionals of the health centers, such as nurses and general service workers, also play this role (7.7%; n=2), often without proper training. With this finding, we highlight the need for specific training to ensure that all those involved are able to properly manage pharmaceutical waste.

Regarding the collection of discarded medicines, the vast majority of UBSs (88.5%; n=23) have third-party companies for this service, while a portion of UBSs (7.7%; n=2) professionals reported that some drugs are still discarded in general waste, considering that the frequency of collection by third-party companies in these units varies between weekly and quarterly, depending on the volume of waste generated by the units. Only one unit (3.8%) did not specify which sector is responsible for collecting discarded medicines.

As for the perception of the destination of antimicrobials after collection, we observed that 15.4% (n=4) of professionals are not sure about the destination of the waste, which raises questions about the transparency and supervision of this process, while 84.6% (n=22) of the interviewees believe that the drugs are incinerated according to the current standards. For better visualization of the data obtained in the research, in Table 1, we synthesize the main quantitative findings related to the management and disposal of antimicrobials in the investigated UBSs.

Table 1. Main findings on the management and disposal of antimicrobials in health centers (n=26).

Variable	Response category	Frequency (n)	Percentage (%)
Existence of a unified SOP	Guideline of the State Department of Health	18	69.3
	Own procedures	2	7.7
	No formal regulation	3	11.5
	Unified SOP for the district	1	3.8
	No answer	2	7.7
Expiration date control (Hórus system)	Hórus system	15	57.7
	Manual control	4	15.4
	Hórus system and manual control	5	19.2
	Not specified	2	7.7
Provides guidance on disposal to users	Yes	18	69.2
	No	5	19.2
	Not specified	3	11.6
Responsible for disposal	Pharmacist	24	92.3
	Other (nurses, general service professionals)	2	7.7
Informed destination	Incineration	22	84.6
	No answer	4	15.4

SOP: Standard operating procedures.

Finally, an optional field was made available for justifications and, when asked about improvements in antimicrobials disposal, the professionals pointed to the need for greater instruction for SUS users, the implementation of a single SOP for all UBSs, and the expansion of the frequency of waste collection. Moreover, they reinforced the importance of continuous training for health professionals involved in the process, seeking to ensure safe and environmentally adequate disposal.

DISCUSSION

According to our results, there are substantial difficulties related to the use and disposal of antimicrobials in the UBSs of the metropolitan region of Belém and its adjacent islands, reflecting persistent challenges of the SUS regarding the rational use of medicines and the adequate management of waste. The observed gaps involve the lack of awareness among health professionals and users of the correct disposal, in addition to the absence of standardization in SOP, which increases the health and environmental risks associated with the inappropriate use of antimicrobials.

Initially, we identified limited perception of some professionals regarding the relevance of the appropriate disposal of these drugs. This deficiency may be associated with the lack of continuous training, as recorded in other regions of the country.[5] Furthermore, we evidenced the insufficient preparation of professionals in relation to the stages for managing waste of health services, which points to the need for systematic educational interventions. Investment in initial and continuing training processes is fundamental to qualify waste management and integrate the topic of antimicrobials use and disposal into primary care practices.[6]

The lack of a unified SOP among the analyzed UBSs demonstrates weaknesses in local governance and in the articulation between the levels of SUS management. This absence contributes to inequalities in the procedures of control of expiration dates and disposal of medicines, which range from the use of the Hórus system to manual methods. Although standardized guidelines may favor the rationalization of the use and disposal of antimicrobials, their effective implementation requires adaptation to the local reality.[7,8] The structuring of a SOP adjusted to the specificities of each unit is strategic to ensure traceability, safe disposal, and alignment with the guidelines of the National Policy on Pharmaceutical Care.

In addition, many health services lack professionals qualified for waste management, transferring responsibilities to municipal managers, who often work without adequate technical support. This situation is aggravated by the lack of supervision and the lack of trained teams for this purpose. Inadequate disposal, especially of expired medicines, poses significant risks to public health and the environment.[9,10]

Despite the existence of regulations aimed at the industrial production of medicines, there are legislative gaps regarding disposal by the final consumer.[11] This requires broad educational actions that clarify the risks and guide the mechanisms available for disposal. The perception that users do not know the correct procedures for disposing of medicines reinforces the need for educational strategies aimed at the population.[12] Authors of a Brazilian study found that 64% of respondents self-medicate, 66% dispose of expired drugs in general waste, and 71.9% have never received guidance on correct disposal.[13] These data illustrate the potential environmental impact of inadequate disposal such as contamination of water resources and favoring microbial resistance.

The analysis of the population's disposal profile is essential to substantiate effective public policies. Knowing variables, such as the reason for disposal, the source of the drug, the existence of medical

prescription, and continuous use, enables more assertive interventions. The reverse logistics promoted by some pharmacies alone is insufficient. It is necessary to invest in health education, aiming both at preventing environmental contamination and promoting the rational use of medicines.[14]

From this perspective, according to the obtained data, guidelines of the one health approach should be included in public policies aimed at the management of pharmaceutical waste. The adoption of this approach can broaden the understanding of the consequences of incorrect disposal of antimicrobials, guiding more effective educational actions, both for health professionals and for the general population. Furthermore, it can promote the dialogue between health, the environment, and health surveillance, promoting strategies to control microbial resistance that exceed the institutional limits of the UBSs and that consider the ecological and social flows characteristic of the Amazon.

Pharmacists, in this context, play a strategic role, working together with the multiprofessional team to promote rational use and provide proper guidance regarding disposal.[8] When integrated into health education actions, this professional can positively influence the conduct of users from acquisition to final disposal of drugs, contributing to the reduction of antimicrobial resistance. The absence of structured programs of continuing education undermines the effectiveness of actions for controlling antimicrobial resistance, an issue acknowledged by the World Health Organization as one of the biggest threats to global public health. This scenario contributes to the accumulation and expiration of medicines, in addition to inadequate use.

Regarding the final destination of antimicrobials, the uncertainty of professionals regarding the methods adopted by third-party companies indicates gaps in transparency and supervision. Strengthening regulatory mechanisms, coupled with the requirement for detailed technical reports, could enhance the confidence of professionals and ensure compliance with environmental standards. The existence of specific protocols and legislation alone does not guarantee the effectiveness of disposal without effective application and strict supervision.[7]

It is necessary that responsible agencies act in an integrated way, supervising the entire disposal cycle. Likewise, health service waste generators should implement and monitor their management plans as recommended by current standards.[6] Although there is the National Solid Waste Policy, there are no specific operational guidelines for health establishments and the population, which makes it difficult to standardize procedures and limits access to information on correct disposal practices.[5]

Among the study limitations, we highlight its descriptive design, which does not allow the establishment of causal relationships, and the use of self-reported questionnaires, subject to memory bias and social desirability. Moreover, the absence of inferential quantitative analysis restricts the generalization of the findings. Conversely, the study significantly contributes to addressing a topic that is still little investigated in the outskirts and riverside contexts of the Amazon, offering practical subsidies relevant to the improvement of health management.

CONCLUSIONS

According to the study findings, there are important weaknesses in the processes of antimicrobials disposal in the UBSs of the metropolitan region of Belém, especially with regard to the absence of a unified SOP and the limited awareness of health professionals and SUS users. Such gaps directly compromise health and environmental safety, while hindering the effectiveness of health surveillance actions and coping with microbial resistance.

In this context, it is essential that municipal managers prioritize the standardization of the protocols for managing and disposing of medicines, through the implementation of a comprehensive SOP adapted to the local reality, as well as the strengthening of the mechanisms for monitoring the destination of such waste. Simultaneously, it is essential that educational institutions and health services promote continuous programs of technical training to qualify professionals involved in the process and increase the population's guidance as to the correct disposal of antimicrobials.

Furthermore, it is necessary that regulatory agencies expand environmental supervision and update the regulations according to which medicines are disposed of within PHC, incorporating guidelines that consider the specificities of the outskirts and riverside territories. The articulation between these fronts — management, professional training, and environmental regulation — is indispensable for advancing toward a more efficient, sustainable health system committed to promoting the rational use of medicines.

By adopting the one health approach, in this study, we show that the inadequate practices of antimicrobial disposal in the UBSs of the metropolitan region of Belém do not only constitute an isolated administrative or technical failure, but reflect a systemic problem that simultaneously compromises human health, environmental integrity, and sustainability of the Amazon territories.

Thus, promoting the proper disposal of antimicrobials is not only a technical measure, but a strategic and ethical action, with direct implications for collective health and for the preservation of the Amazon ecosystem. Overcoming the identified weaknesses requires, therefore, an intersectoral commitment supported by integrated and evidence-based public policies that incorporate the principles of the one health approach.

CONFLICT OF INTERESTS

Nothing to declare.

AUTHORS' CONTRIBUTIONS

MEC: Data curation, Formal analysis. TMG: Formal analysis. RNPL: Data curation, Formal analysis. VLB: Formal analysis, Writing – original draft. FGSS: Formal analysis, Writing – original draft. AJVV: Formal analysis, Writing – original draft. AV: Data curation, Formal analysis, Writing – original draft. LS: Formal analysis. LMOH: Conceptualization, Writing – review & editing. RCSO: Conceptualization, Writing – review & editing.

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Appendix 1. Questionnaire.

- Apply the questionnaire to the pharmacist who manages the control of medicines in health centers. Record the role and training of the interviewee;
- Inform what the research is about, its subject and purpose, and present the documents that allow carrying it out;
- In "Other," the interviewer asks: "Would you like to add something to your answer?";
- Respondents can select more than one option.

1. What is the importance of proper disposal of antimicrobials?
a) To avoid pollution of groundwater;
b) To avoid antibiotics resistance;
c) There is no particular importance in the disposal of these drugs with others;
d) Other: _____

2. In your experience, what is the level of instruction of users of the Brazilian Unified Health System (SUS) concerning the disposal/destination of antimicrobials?
a) High, they leave the antimicrobials at the Health Center (UBS) so that we properly dispose of them;
b) High, they properly dispose of antimicrobials themselves;
c) Intermediate, because they are not always instructed by the team to leave the antimicrobials here or how to properly dispose of them;
d) Low, they have likely not been properly instructed on the subject and will dispose of the drugs unevenly;
e) Other: _____

3. What is the standard operating procedure (SOP) for the disposal of medicines at your UBS?
a) There is no SOP formalized at the UBS;
b) There is a SOP formalized by the very UBS;
c) There is a SOP formalized for the whole district;
d) There is a SOP formalized by the State Department of Health;
e) Other: _____

4. How are the expiration dates of the medicines monitored in order to identify expired drugs, those about to expire, and drugs within their shelf life?
a) No formal registration is made;
b) Registration is physically made, on paper;
c) Registration is digitally made;
d) Only expired drugs are registered either physically or digitally.
e) Other: _____

Continue...

Appendix 1. Continuation.

5. What are patients instructed regarding disposal when receiving the drugs?
a) Patients are not instructed;
b) They should bring the drugs to the UBS, and they will be properly disposed of here;
c) They should dispose of the medicines on their own, at home, in a way they deem suitable (general waste, toilet, or sink);
d) They should use the entire drug vial or tablet so that they do not need to discard it;
e) Other: _____

6. How is the spatial segregation of expired drugs, those about to expire, and drugs within their shelf life carried out at the UBS?
a) In a specific fixed area, separating drugs about to expire from expired drugs;
b) In a specific fixed area, with drugs about to expire and expired drugs;
c) They are not separated from other medicines; They are randomly placed with others;
d) Drugs about to expire are placed on the shelf in front of medicines with a longer shelf life, so that they can be used as soon as possible;
e) Other: _____

7. How is the management of drug packaging and its content?
a) Packaging is placed in a disposal bag or an external box, and all its contents (primary packaging, secondary packaging, and drug leaflet) are disposed of together;
b) The drug leaflet, primary packaging, and secondary packaging are separated for different disposal;
c) Other: _____

8. What professionals (position at the UBS) are part of the monitoring, segregation, and delivery steps for collection at your UBS?
a) General services;
b) Pharmacist;
c) Nurses;
d) Technicians;
e) Management;
f) Other: _____

9. Do you feel that everyone involved in the drug disposal steps has adequate training on the principles that involve proper disposal?
a) Most of them;
b) The minority of them;
c) Only the pharmacist;
d) none;
e) Other: _____

Continue...

Appendix 1. Continuation.

10. Do you feel that you have had adequate training in your college education regarding the appropriate disposal of medicines in the UBS/municipal health units (*Unidades Municipais de Saúde* – UMS)?
a) Yes, I learned about the rational disposal of drugs in college;
b) There was no class on rational disposal of drugs in college;
c) I learned it theoretically, on my own, because this is not taught in college;
d) I learned it empirically, by pharmacy practice, although I have heard about it in college;
e) Other: _____

11. How do you register expired drugs targeted for collection?
a) Registration is not made;
b) Registration is physically made, on paper;
c) Registration is digitally made;
d) Other: _____

12. Who collects these drugs for disposal?
a) The urban system of general waste collection, as drugs are disposed of as general waste;
b) The urban system of general waste collection, but medicines are disposed of in a garbage appropriate for the disposal of medications;
c) A specialized third-party company;
d) UBS professionals make the appropriate collection and disposal for UBS/UMS. (Provide examples.)
e) Other: _____

13. How often does the collection take place at your UBS?
a) Weekly;
b) Daily;
c) Monthly;
d) Bimonthly;
e) Other: _____

14. Do you feel that the medicines actually have the appropriate destination proposed by those who make the collection?
a) Yes;
b) No.
Justify: _____

15. Do SUS users fully receive the amount of drugs prescribed in the medical prescription, sufficient for the completion of the treatment?
a) Yes, the exact amount;
b) No, sometimes the amount exceeds what is prescribed in the medical prescription;
c) No, sometimes the amount is less than what is prescribed in the medical prescription;
d) No, there is hardly any in the pharmacy.
e) Other: _____

Continue...

Appendix 1. Continuation.

16. What do you feel is missing for disposal to be improved?
a) Education of the population;
b) Education of SUS professionals;
c) The total disposal network;
d) College education of pharmacists;
e) Means for the proper disposal and segregation of expired drugs and those about to expire;
f) Other: _____

17. What do you feel could be improved for disposal to be safer?
a) The organization of the UBS itself should be more efficient;
b) The waste collection system should be improved more assiduously;
c) The institutionalization of a SOP for all UBSs;
d) The instruction for all those involved in the disposal, including SUS users;
e) Other: _____