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# Indicators for evaluating medication storage locations in Primary Health Care: An integrative review

## *Indicadores para avaliação dos locais de armazenamento de medicamentos na Atenção Primária em Saúde: Uma revisão integrativa*

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**ABSTRACT**

**Objective:** To carry out an integrative review of studies that identified indicators of structure, process and results in medication storage locations in Primary Health Care in Brazil. **Methods:** This is an integrative review carried out based on research in the ME DLINE/PubMed, LILACS, SciELO, Theses and Dissertations Catalog CAPES and Google Scholar databases, of national studies and without temporal limitations. **Results:** Nine teen studies were included, in eighteen (95%) the structure indicator was addressed, in fourteen (74%) the results indicator and in twelve (63%) the process indicator. Structure indicators were addressed in relation to adequacy to good storage practices, human resources and the presence of other structural parameters. The study approach to process indicators was related to stock control and the medication inspection procedure upon receipt. The results indicators addressed the availability of medicines, presence of expired medicines and technical-sanitary documentation. Two studies (10%) addressed exclusively the Pharmaceutical Supply Center (CAF) and the others were conducted simultaneously in pharmacies in Basic Health Units. **Conclusion:** The work describes the criteria related to structure, process and results indicators frequently used to evaluate CAFs and medication storage locations, with structural indicators being more recurrent. The data presented contribute to the creation of specific assessment instruments for CAF, given the lack of information on storage conditions in these locations.

**Keywords:** Pharmaceutical Services; Drug Storage; Surveys and Questionnaires; Primary Health Care

**RESUMO**

**Objetivo:** Realizar uma revisão integrativa sobre estudos que identificaram indicadores de estrutura, processo e resultados, nos locais de armazenamento de medicamentos na Atenção Primária à Saúde no Brasil. **Método:** Trata-se de uma revisão integrativa realizada a partir de pesquisa nas bases de dados MEDLINE/PubMed, LILACS, SciELO, Catálogo de Teses e Dissertações da CAPES e Google Acadêmico, de estudos nacionais e sem limitação temporal. **Resultado**: Foram incluídos 19 estudos sendo que em dezoito (95%) o indicador estrutura foi abordado, em quatorze (74%) o indicador resultado e em doze (63%) o indicador processo. Os indicadores de estrutura foram abordados em relação à adequação às boas práticas de armazenamento, aos recursos humanos e a presença de outros parâmetros estruturais. A abordagem dos estudos para os indicadores de processo foram relacionadas ao controle de estoque e ao procedimento de inspeção do medicamento no recebimento. Os indicadores de resultados abordaram a disponibilidade de medicamentos, presença de medicamentos vencidos e a documentação técnico-sanitária. Dois estudos (10%) abordaram exclusivamente a Central de Abastecimento Farmacêutico (CAF) e os demais foram conduzidos simultaneamente nas farmácias das Unidades Básicas de Saúde. **Conclusão:** O trabalho descreve os critérios relacionados aos indicadores de estrutura, processo e resultados frequentemente utilizados para avaliar as CAFs e os locais de armazenamento de medicamentos, sendo mais recorrente os indicadores de estrutura. Os dados apresentados colaboram para criação de instrumentos de avaliação específicos para a CAF, visto a carência de informações sobre as condições de armazenamento nesses locais.

**Palavras-chave:** Assistência Farmacêutica; Armazenamento de Medicamentos; Inquéritos e Questionários; Atenção Primária em Saúde.

## Introduction

The use of health indicators aims to support decision-making, assisting in processes such as evaluation, research, monitoring, accountability, measuring disparities, managing systems, and improving the quality of care.[1]

In order to assess the scenario of Pharmaceutical Assistance (AF) in Brazil, the Ministry of Health and the Pan American Health Organization developed an extensive project in 2005 using a survey of health indicators as a tool, which were approached based on the structure, process, and outcome criteria proposed by Donabedian.[2] Structure indicators refer to the fixed characteristics of the system, encompassing the quality of material and human resources.[2] Process indicators address the organizational structure and evaluate the functioning of these systems through the accuracy of operations and their adequacy to what was established.[3] Outcome indicators demonstrate the data obtained from the verification of the achievement of the objectives defined for the structure and process criteria.[4] Thus, it is assumed that an adequate health structure increases the likelihood that the processes developed are correct, and both increase the probability of achieving good health outcomes.[2]

The actions carried out by Pharmaceutical Assistance (AF) are based on the Pharmaceutical Assistance Cycle, which is a system composed of the stages of selection, programming, acquisition, storage, distribution, and dispensing of medications. The storage stage is critical, as inadequate conditions or processes directly affect the stability and efficacy of medications, which in turn impacts the quality of service provided to the population.[5] In Brazil, the location specifically designated for the storage of medications is referred to as the Central de Abastecimento de Medicamento (CAF), which is responsible for receiving, storing, and distributing medications to health units within municipalities.[6]

Aiming to synthesize scientific knowledge regarding the storage stage of Pharmaceutical Assistance (AF), the objective of the present study was to conduct an integrative review of studies that identified indicators of structure, processes, and outcomes in the locations where medications are stored in Primary Health Care in Brazil.

## Methods

This is an integrative literature review. The development of this review was conducted in six stages[7,8]: 1) formulation of the guiding question; 2) literature search; 3) data collection; 4) analysis of the included studies; 5) discussion of the results; and 6) presentation of the results.

For the construction of the research question, the PICo strategy was employed, defining (P) - Pharmaceutical Supply Centers; (I) - Characteristics related to the storage of medications; and (Co) - Primary Health Care, resulting in the following guiding question: What are the characteristics of medication storage in terms of structure, processes, and outcomes in the locations where medications are stored in Primary Health Care?

As a search strategy, the research was conducted in the following databases: MEDLINE/PubMed (Medical Literature Analysis and Retrieval System Online), LILACS (Latin American and Caribbean Health Sciences Literature), via the Virtual Health Library (BVS), and SciELO (Scientific Electronic Library Online). In addition to the databases, grey literature was explored, highlighting research conducted in dissertations and theses, with searches performed in the CAPES Catalog of Theses and Dissertations and in the Google Scholar search tool. Chart 1 describes the combination of terms used in each database.

Inclusion criteria considered studies conducted in Brazil, published in Portuguese, English, or Spanish, that addressed characteristics related to the storage of medications in Primary Health Care. There were no temporal limitations for the research.

Research that was excluded included those with only the abstract published, without full text available, literature reviews, case studies, letters to the editor, duplicate articles in the databases, and studies conducted in settings outside of Primary Health Care.

The pre-selection of studies was conducted through the reading of titles and abstracts, adhering to the inclusion and exclusion criteria. In this stage, the Rayyan® application was used for the search results from the MEDLINE/PubMed,

LILACS, SciELO, and Google Scholar databases. In the CAPES Catalog of Theses and Dissertations, the pre-selection was performed manually. Two reviewers independently evaluated the studies, and any disagreements were resolved by consensus. In a second stage, a complete reading of the pre-selected articles was conducted, and those that aligned with the research theme were included in the review. The selection stage of studies for the integrative review was carried out until September 30, 2023. The references of the included studies were also evaluated to identify studies not included in the previous stages.

In the collection and analysis stages, the studies were grouped and categorized according to the indicators they addressed[8]: structure, process, and outcome. For the presentation of the data, absolute numbers and percentages were used.

## Results

The search in the databases identified 467 results. After the selection process (Figure 1), a total of 19 studies, all in Portuguese, were selected (Chart 2).

It was observed that the temporal dimension of the studies varied from 2004 to 2023, with 58% (n=11) published in the last five years.

The Brazilian region with the highest number of studies was the Northeast, with seven studies (35%). The South (n=3) and Southeast (n=3) regions together accounted for 31% of the studies. The North region represented 5% of the findings (n=1). No studies addressing this theme were found in the Midwest region. The remaining studies were collected from more than one region.

Upon analyzing Chart 2, it is observed that 52% (n=10) of the studies are academic works, including theses, dissertations, and final course projects, which were not identified from scientific articles in the primary study databases.

Regarding the location of medication storage, two studies (10%) were conducted exclusively at the Pharmaceutical Supply Center. The remaining studies were conducted solely or simultaneously in the pharmacies of Basic Health Units. In all studies, questionnaires were used to obtain data, which were applied to those responsible at the medication storage locations to gather the responses.

The structure indicators were addressed in the majority of the studies (n=18; 95%), followed by outcome indicators (n=14; 74%) and process indicators (n=12; 63%). Nine studies (47%) addressed all three indicators: structure, process, and outcome. Four studies (21%) focused on structure and outcome indicators, two studies (10%) addressed structure and process indicators, and one study (5%) covered process and outcome indicators. The remaining studies (n=3) addressed only structure indicators.

The *structure* indicators were addressed in most studies (n=18; 95%), followed by *outcome* indicators (n=14; 74%) and *process* indicators (n=12; 63%). Nine studies (47%) addressed all three indicators: *structure*, *process*, and *outcome* (15%), four studies (21%) addressed the *structure* and *outcome* indicators, two studies (10%) addressed the structure and process indicators, and one study (5%) addressed the *process* and *outcome* indicators. The remaining studies (n=3) addressed only the *structure* indicators.

The *structure* indicators were addressed in relation to compliance with good storage practices (Chart 3A and Chart 3B), human resources (Chart 4), and other structural parameters (Chart 4).

The approach of the studies for the *process* indicators, presented in Chart 5, highlighted issues related to inventory control and the procedure for inspecting medications upon receipt.

The *outcome* indicators were addressed by the studies in relation to the availability of medications, the presence of expired medications at the storage location, and the presence of technical-sanitary documentation, as outlined in Chart 6.

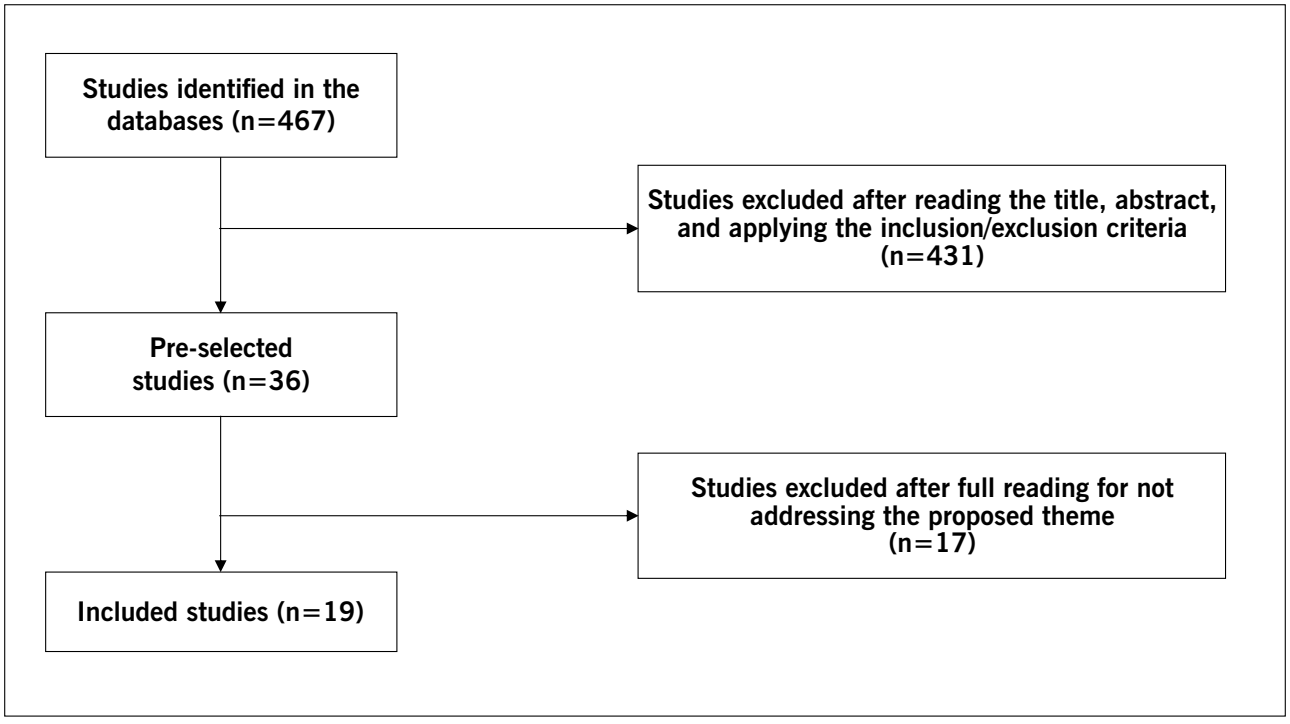
To carry out this classification, the different variables from the questions that addressed the same topic were grouped. For example, the questions "Is the location clean and free of dust and empty boxes?" and "Are the areas clean, without visible dust or dirt?" addressed the same theme and were therefore grouped under the same item called "Clean Environment."

**Chart 1.** Descriptors used for research in different databases.

| DATABASE | TERMS |
|---|---|
| MEDLINE/PubMed | (Drug Storage) AND (Primary Health Care) |
| LILACS | Drug Storage AND Primary Health Care |
| SciELO | Drug Storage AND Primary Health Care |
| CAPES Theses and Dissertations Catalog | Pharmaceutical Supply Center |
| | Drug Storage AND Primary Health Care |
| | Pharmaceutical Supply Center AND Primary Health Care |
| Google Scholar | Drug Storage AND Primary Health Care |
| | Pharmaceutical Supply Center AND Primary Health Care |

Legend: MEDLINE/Pubmed - Medical Literature Analysis and Retrieval System Online; LILACS - Latin American and Caribbean Health Sciences Literature; SciELO - Scientific Electronic Library Online; CAPES - Coordination for the Improvement of Higher Education Personnel.
Source: Prepared by the author (2023).

**Figure 1.** Study selection process.




Source: Prepared by author (2023).

**Chart 2.** Studies included in the Integrative Review (n=19).

| Authors | Medication Storage Location | Type of Indicator Addressed | State of the Study Location | Study Type |
|---|---|---|---|---|
| Pilger (2004)[9] | UBS | Structure Process | Multicenter | Dissertation |
| Feltrin de Oliveira (2007)[10] | UBS | Structure Process Outcome | Bahia | Dissertation |
| Freitas *et al. (2011)*[11] | UBS CAF | Structure Process Outcome | Ceará | Article |
| Silva Junior *et al*. (2012)[12] | UBS | Structure Process | Pernambuco | Article |
| Conceição de Oliveira *et al. (2014)*[13] | UBS | Structure | Minas Gerais | Article |
| Alves Costa *et al. (2017)*[14] | UBS | Structure Outcome | Multicenter | Article |
| Nascimento *et al. (2017)*[15] | UBS | Structure Outcome | Multicenter | Article |
| Leite *et al. (2017)*[16] | UBS | Structure | Multicenter | Article |
| Bernardino (2018) [17] | UBS CAF | Structure Process Outcome | Rio Grande do Norte | TCR |
| Maschietto (2018)[4] | UBS CAF | Structure Process Outcome | São Paulo | Dissertation |
| Nievola (2018)[18] | UBS | Process Outcome | Paraná | TCC (Final Course Work for *Lato Sensu* Specialization) |
| da Silva Costa *et al. (2020)*[19] | UBS | Structure Outcome | Pernambuco | Article |
| Guimarães (2020)[20] | UBS CAF | Structure Process Outcome | Piauí | Thesis |
| Santos (2021)[21] | CAF | Structure Process Outcome | Rio de Janeiro | Dissertation |
| Wessler (2022)[22] | UBS | Structure | Santa Catarina | Dissertation |
| Pereira *et al (2022)*[23] | UBS | Structure Process Outcome | Multicenter | Article |
| Sampaio Costa (2023)[24] | UBS | Structure Outcome | Ceará | Dissertation |
| Rossoni *et al (2023)*[25] | CAF | Structure Process Outcome | Rio Grande do Sul | Article |
| Gomes (2023)[26] | UBS CAF | Structure Process Outcome | Pará | Dissertation |

Legend: CAF - Pharmaceutical Supply Center; TCC - Final Course Work; TCR - Residency Completion Work; UBS - Basic Health Unit; Multicenter - studies conducted simultaneously in various locations.
Source: Prepared by the author (2023).

**Chart 3A.** Distribution of the theme addressed in the studies regarding the structure indicator (n=18)

| AUTHORS | STRUCTURE | | | | |
|---|---|---|---|---|---|
| | Good Storage Practices | | | | |
| | Monitoring temperature and ambient humidity | Medications stored away from the floor/wall/ ceiling | Medications stored on pallets/ shelves | Medications protected from direct sunlight | Refrigerator temperature monitoring |
| Pilger (2004)[9] | X | X | X | X | |
| Feltrin de Oliveira (2007)[10] | X | X | X | X | X |
| Freitas *et al*. (2011)[11] | X | | X | | X |
| Silva Junior *et al*. (2012)[12] | X | | X | X | X |
| Conceição de Oliveira *et al.* (2014)[13] | | | | | X |
| Alves Costa *et al.* (2017)[14] | X | X | X | X | X |
| Nascimento *et al*. (2017)[15] | | | | | X |
| Leite *et al.* (2017)[16] | X | | | | X |
| Bernardino (2018)[17] | X | | | X | X |
| Maschietto (2018)[4] | | X | | | X |
| da Silva Costa et al. (2020)[19] | | | | | X |
| Guimarães (2020)[20] | X | X | | X | X |
| Santos (2021)[21] | X | X | X | X | X |
| Wessler (2022)[22] | X | X | | | X |
| Pereira *et al.* (2022)[23] | X | X | X | X | X |
| Sampaio Costa (2023)[24] | X | | | | X |
| Rossoni *et al.* (2023)[25] | X | X | X | X | X |
| Gomes (2023)[26] | X | | X | X | X |

Source: Prepared by the author (2023)

**Chart 3B.** Distribution of the theme addressed in the studies regarding the structure indicator (n=18).

| AUTHORS | STRUCTURE | | | |
|---|---|---|---|---|
| | Good Storage Practices | | | |
| | Absence of mold/ infiltration | Clean environment | Medications in a locked cabinet | Facilities smooth and without cracks |
| Pilger (2004)[9] | X | | | |
| Feltrin de Oliveira (2007)[10] | X | X | | X |
| Freitas *et al*. (2011)[11] | X | | X | |
| Silva Junior *et al*. (2012)[12] | X | X | | |
| Conceição de Oliveira *et al.* (2014)[13] | | | | |
| Alves Costa *et al.* (2017)[14] | X | | X | |
| Nascimento *et al*. (2017)[15] | | | X | |
| Leite *et al.* (2017)[16] | | | | |
| Bernardino (2018)[17] | | X | | X |
| Maschietto (2018)[4] | | | X | |
| da Silva Costa et al. (2020)[19] | | | | |
| Guimarães (2020)[20] | X | X | | X |
| Santos (2021)[21] | X | X | X | X |
| Wessler (2022)[22] | X | X | X | |
| Pereira *et al.* (2022)[23] | X | | X | |
| Sampaio Costa (2023)[24] | | | X | |
| Rossoni *et al.* (2023)[25] | X | | X | |
| Gomes (2023)[26] | | | X | |

Source: Prepared by the author (2023).

**Chart 4.** Distribution of the theme addressed in the studies regarding the structure indicator (n=15).

| AUTHORS | STRUCTURE | | | | | |
|---|---|---|---|---|---|---|
| | Human Resources | | Presence of other structural parameters | | | |
| | Presence of a pharmaceutical professional | Conducting training/continuing education | Computer and/or internet access | Fire extinguisher | Windows with protective screens | Secondary source of electrical power |
| Pilger (2004)[9] | | | | | X | |
| Feltrin de Oliveira (2007)[10] | | | | X | | |
| Freitas *et al*. (2011)[11] | X | X | | | | |
| Alves Costa *et al.* (2017)[14] | X | | | X | X | X |
| Nascimento *et al.* (2017)[15] | X | | | | | |
| Leite *et al.* (2017)[16] | | | | | | X |
| Bernardino (2018)[17] | X | X | X | X | X | |
| Maschietto (2018)[4] | X | X | | | | |
| da Silva Costa *et al. (2020)*[19] | X | X | | | | |
| Guimarães (2020)[20] | X | | | | X | |
| Santos (2021)[21] | | | X | X | X | X |
| Wessler (2022)[22] | X | X | X | | | |
| Pereira *et al.* (2022)[23] | X | | | X | X | X |
| Sampaio Costa (2023)[24] | X | X | | | | |
| Rossoni *et al.* (2023)[25] | | | | | | X |

Source: Prepared by the author (2023).

**Chart 5.** Distribution of the theme addressed in the studies regarding the process indicator (n=12).

| AUTHORS | PROCESS | | | | | |
|---|---|---|---|---|---|---|
| | Stock control | | | | | Inspection of medication upon receipt |
| | Stock monitoring | Purchase scheduling | Control of medication expiration dates | Systematic organization of medications | Medication counting | |
| Pilger (2004)[9] | X | | X | X | X | |
| Feltrin de Oliveira (2007)[10] | X | | X | X | | X |
| Freitas *et al*. (2011)[11] | X | X | X | X | | |
| Silva Júnior (2012)[12] | X | X | X | X | | |
| Bernardino (2018)[17] | X | X | X | X | | X |
| Maschietto (2018)[4] | X | | | X | | |
| Nievola (2018)[18] | X | X | | | X | X |
| Guimarães (2020)[20] | X | | X | X | | |
| Santos (2021)[21] | X | X | X | X | X | X |
| Pereira *et al.* (2022)[23] | X | | | | | |
| Rossoni *et al.* (2023)[25] | X | | X | X | X | X |
| Gomes (2023)[26] | X | X | X | | | |

Source: Prepared by the author (2023).

**Chart 6.** Distribution of the theme addressed in the studies regarding the outcome indicator (n=14).

| AUTHORS | OUTCOME | | |
|---|---|---|---|
| | Drug shortages | Expired medications in the storage location | Technical-sanitary documentation |
| Feltrin de Oliveira (2007)[10] | X | X | |
| Freitas *et al*. (2011)[11] | X | X | |
| Alves Costa *et al.* (2017)[14] | | | X |
| Nascimento *et al.* (2017)[15] | X | | |
| Bernardino (2018)[17] | | X | X |
| Maschietto (2018)[4] | X | X | |
| Nievola (2018)[18] | X | X | |
| da Silva Costa *et al. (2020)*[19] | X | | |
| Guimarães (2020)[20] | X | X | X |
| Santos (2021)[21] | X | X | X |
| Pereira *et al.* (2022)[23] | | X | X |
| Sampaio Costa (2023)[24] | X | X | X |
| Rossoni *et al.* (2023)[25] | X | X | X |
| Gomes (2023)[26] | X | X | X |

Source: Prepared by the author (2023).

## Discussion

The presented data demonstrated that the use of *structure*, *process*, and *outcome* indicators remains relevant in the evaluation of health services. This finding indicates the timeless applicability of this approach.

The obtained data highlighted the frequent approach to *structure* indicators in medication storage locations. These findings demonstrated that *structure* indicators were addressed, either individually or in combination, in 95% of the studies. It is known that ensuring adequate storage conditions is fundamental for maintaining the stability of medications.[5] Therefore, it is assumed that the possibility of *structural* nonconformities will directly impact the effectiveness of the medications, which will affect the quality of the services provided to the population.[27]

It is noted that the most addressed theme in the studies related to good storage practices. Among the items presented, all studies discussed the need to monitor the temperature/humidity of the environment and/or the temperature of the refrigerator. This data reaffirms the importance of this action for ensuring the stability and consequently the effectiveness of the medication.

A clean environment, free from the presence of mold and/or infiltration, that allows for the monitoring of the temperature/humidity of the environment and the temperature of the refrigerator; that stores medications on pallets, elevated from the floor/walls/ceiling and protected from direct sunlight; and that features an installation with smooth surfaces and without cracks were the most frequently cited items in the studies for a storage location to be considered adequate for medications.

These recommendations are in accordance with the provisions of RDC 430/2020 from ANVISA[28], which establishes the rules that must be followed regarding good practices for the distribution, storage, and transportation of medications. This resolution revoked Ordinance No. 802/1998 from the Ministry of Health[29] and RDC 304/2019 from ANVISA[30], serving as the most current and applicable reference for medication storage locations. It is noteworthy that during this transition of legislation, these indicators

remained present, showing little variation over the years, which was also observed in the studies.

Another theme addressed by the studies encompasses the storage of medications subject to special control, emphasizing that they must be stored in a secure location with restricted access. This recommendation reaffirms the obligation to comply with Ordinance 344/1998 from ANVISA[31], which outlines the technical regulations for these medications.

Stock control is mentioned by all studies that addressed *process* indicators. It is known that stock control assists in the programming and acquisition stages of medications by maintaining sufficient levels of items to meet specific demand.[27] This technical-administrative activity aims to prevent shortages and avoid unnecessary accumulation of medications. Such control can be performed through a manual system, using shelf cards, or through a computerized system, such as Hórus, which is a free software developed by the Department of Pharmaceutical Assistance and Strategic Inputs of the Ministry of Health – DAF/MS.[5]

To ensure efficient stock control, the studies identified several strategies for storage locations, such as: conducting validity checks on medications, systematic organization of medications, and regular counting of medications in stock.

Regarding *outcome* indicators, the studies addressed: shortages of medications, the presence of expired medications, and the availability of technical-sanitary documentation. Measuring the availability of medications is important to assess the quality of the programming and acquisition stages in the Pharmaceutical Assistance cycle, as well as to detect occurrences of medication shortages, which directly compromise the assistance provided to the population. According to Feltrin de Oliveira (2007)[10], medication shortages in primary health care are caused by issues related to financing, scarcity of human resources, and deficiencies in physical infrastructure.

The presence of expired medications may indicate failures in stock control, as the tracking of these items has not been adequately performed. It is recommended that expired or soon-to-expire medications be removed from stock or stored in a designated area, separated from other medications.[27] The existence of expired medications can pose a risk to the population, as these medications may be dispensed and administered.

Regarding *outcome* indicators, the technical-sanitary documents cited by the studies included: location permit, sanitary permit, fire safety permit, and technical regularity certificate. For the Pharmaceutical Supply Center, it is mandatory to have at least the technical regularity certificate from the Regional Pharmacy Council and the sanitary permit from the Health Surveillance.

It is important to highlight that despite the growing interest in medication storage demonstrated by the increase in studies in recent years, this topic is still underexplored in Pharmaceutical Supply Centers (CAF). Most of the research conducted does not specifically address CAF, but rather the storage locations of medications within pharmacies in Basic Health Units. It is known that due to the necessary structure and organization, few municipalities have CAF, which may justify this finding. However, this data reveals a gap in knowledge regarding the storage conditions of medications in these locations, highlighting the need for the development of specific studies in CAF.

Among the limitations of this research, there is the possibility that relevant studies were not included if their publication occurred in databases different from those used in the research or due to the use of other combinations of descriptors in the databases.

## Conclusion

This work describes the characteristics most frequently assessed regarding the *structure*, *process*, and *outcome* indicators of Pharmaceutical Supply Centers (CAFs) and medication storage locations in Primary Health Care. The results presented demonstrated that the use of these indicators is applicable for evaluating these locations, with *structure* indicators being the most commonly utilized.

Finally, the data obtained from this integrative review are relevant for the creation of specific evaluation tools for the Pharmaceutical Supply Center, given the need for knowledge about the storage conditions of medications in these locations and the importance of this service.

**Contributions of the authors**
LPK was responsible for the conception and design, data analysis and interpretation, drafting of the article, or critical revision of relevant intellectual content, and accountability for all aspects of the text, ensuring the accuracy and integrity of any part of the work; DP was responsible for reviewing the manuscript and final approval of the version to be published.

**Conflicts of interest**
The authors declare that there are no conflicts of interest regarding this article.

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