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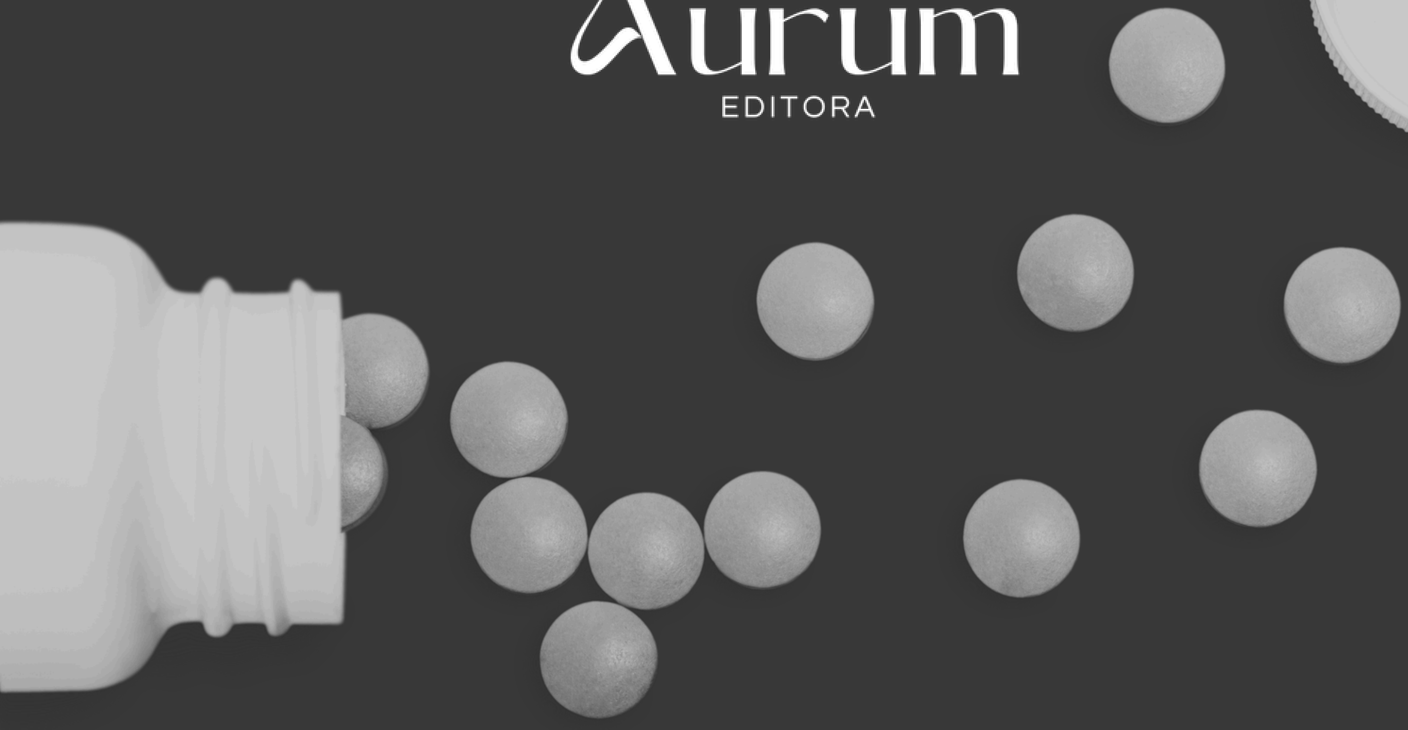

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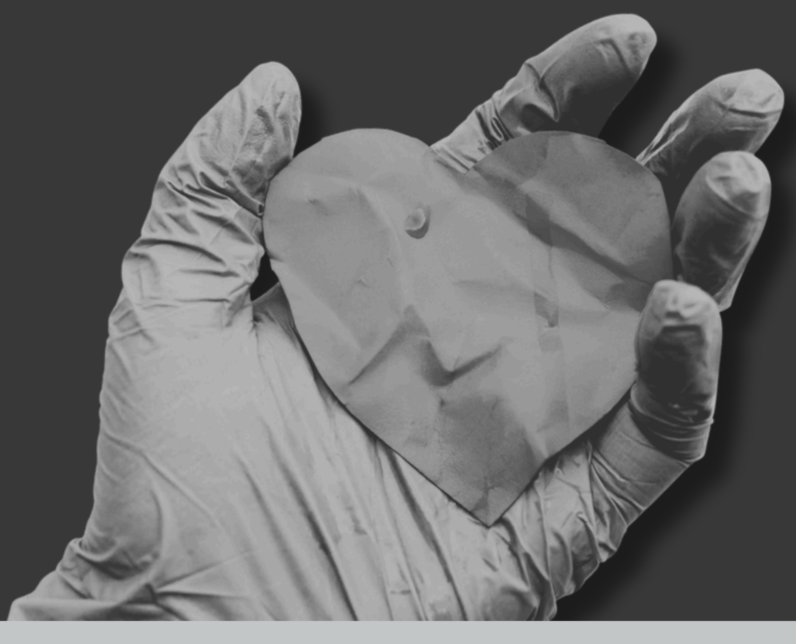

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SUMMARY

FAST-TRACK AND ERAS IN ONCOLOGIC SURGERY: OPTIMIZATION OF OUTCOMES AND ACCELERATED RECOVERY

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Abstract

Enhanced recovery strategies in oncologic surgery have been widely discussed as effective approaches to reduce surgical stress and optimize clinical outcomes. This integrative review analyzed recent evidence regarding Fast-Track and Enhanced Recovery After Surgery (ERAS) protocols, highlighting their similarities and differences. Both models are based on a multimodal approach emphasizing optimized analgesia, early mobilization, reduced preoperative fasting, and multidisciplinary collaboration. The findings consistently demonstrate reduced length of hospital stay, lower postoperative complication rates, and faster functional recovery. However, ERAS presents a higher level of standardization, supported by evidence-based guidelines, continuous auditing, and systematic monitoring of performance indicators, which enhances reproducibility and institutional sustainability. Studies indicate that its implementation does not compromise oncologic safety, preserving survival and recurrence rates while enabling earlier initiation of adjuvant therapy. Emerging evidence also suggests a potential positive impact on long-term outcomes. In contrast, the Fast-Track model is characterized by greater operational flexibility, facilitating its initial adoption, particularly in resource-limited settings. Nevertheless, the absence of a fully structured protocol and systematic auditing may lead to variability in implementation and clinical results. In conclusion, although both models effectively improve perioperative care in oncologic surgery, ERAS demonstrates greater methodological robustness and stronger potential for consolidation as an institutional policy aimed at enhancing quality, safety, and sustainability of cancer surgical care.

Keywords: Adjuvant therapy, Enhanced Recovery After Surgery, Fast-Track, Oncologic surgery, Perioperative care.

INTRODUCTION

Oncologic surgery represents one of the therapeutic pillars in the treatment of solid neoplasms and is frequently associated with major procedures, an exacerbated systemic inflammatory response, intense pain, and a significant risk of postoperative complications. In this context, the search for strategies capable of reducing surgical morbidity, optimizing functional recovery, and ensuring better oncologic outcomes has driven the incorporation of evidence-based care protocols. Among these strategies, Fast-Track and Enhanced Recovery After Surgery (ERAS) programs stand out, as they propose a multimodal, interdisciplinary, and patient-centered approach focused on reducing surgical stress and accelerating recovery (Ripollés-Melchor et al., 2022).

The concept of Fast-Track surgery emerged with the aim of minimizing the physiological impact of operative trauma through the combination of preoperative, intraoperative, and postoperative interventions, such as nutritional optimization, multimodal analgesia, early mobilization, and reduced fasting time. Subsequently, this model evolved into ERAS protocols, structured in systematized guidelines and widely disseminated by international scientific societies, including specific recommendations for gynecologic oncology (Nelson et al., 2023). These guidelines emphasize the standardization of evidence-based practices, multiprofessional integration, and continuous monitoring of care indicators.

In colorectal oncology, the implementation of ERAS protocols has demonstrated a significant reduction in hospital length of stay, a lower incidence of postoperative complications, and maintenance of oncologic safety. Comparative studies show that patients undergoing colorectal surgery under ERAS protocols experience faster recovery of gastrointestinal function and lower hospital readmission rates, in both open and laparoscopic approaches (Mangone et al., 2024). Systematic reviews reinforce that early hospital discharge, including within 24 hours in selected cases, can be achieved without an increase in adverse events, provided that there is appropriate patient selection and monitoring (Sier et al., 2024). In addition, retrospective analyses indicate that the application of enhanced recovery pathways in stages II and III colorectal cancer does not compromise the timely initiation of adjuvant therapy, thereby favoring continuity of oncologic treatment (Wang et al., 2021).

In the context of esophageal surgery and upper gastrointestinal cancer, ERAS protocols have also shown promising results. Evidence points to a positive impact not only on immediate perioperative outcomes but also on long-term survival, suggesting that optimized recovery may influence the overall oncologic trajectory (Chen et al., 2025).

The incorporation of Fast-Track care in laparoscopic rectal surgery demonstrated a reduction in complications and improvement in functional recovery, without an increase in morbidity (Meillat et al., 2022). Furthermore, systematic reviews indicate that oncologic outcomes and long-term safety remain preserved when ERAS protocols are properly implemented in different types of oncologic surgery (Pang et al., 2021).

In gynecologic oncology, randomized clinical trials show that patients managed under ERAS protocols experience less postoperative pain, shorter hospital stay, and greater satisfaction with the care received (Bourazani et al., 2025). Additional studies confirm the effectiveness of these strategies in reducing complications and improving the perioperative experience (Saleh et al., 2025). Updates to international guidelines reinforce the importance of strict adherence to protocol components, highlighting challenges related to implementation, team training, and monitoring of quality indicators (Nelson et al., 2023).

In head and neck surgery, including complex procedures with free flap reconstruction, ERAS programs have been associated with reduced hospital stay, lower complication rates, and earlier return to adjuvant oncologic therapy (Kiong et al., 2022). Similar results were observed in microsurgical reconstructions, with significant improvement in clinical and functional outcomes (Nieminen et al., 2023; Raj et al., 2025). These findings are particularly relevant, considering that delays in complementary treatment may negatively affect oncologic prognosis.

In urologic surgeries, such as radical prostatectomy, the adoption of care pathways guided by the Fast-Track concept has demonstrated improvement in perioperative rehabilitation indices and reduction in complications (Chen et al., 2024). In pancreatic and hepatopancreatic surgery, ERAS protocols and Fast-Track anesthesia strategies are associated with reduced postoperative morbidity and faster recovery, without an increase in mortality (Harsa et al., 2025; Mercadante et al., 2024). Similar results have been described in surgeries for peritoneal surface malignancies undergoing cytoreduction with or without HIPEC, reinforcing the applicability of these programs even in highly complex procedures (Robella et al., 2023).

In breast cancer, the application of the Fast-Track concept during the perioperative period of breast-conserving surgery showed a positive impact on quality of care and reduction of complications (Li; Cao, 2025). In patients with colorectal cancer, structured nursing interventions under the Fast-Track model contributed to better clinical recovery in both open and laparoscopic surgeries (He et al., 2022). Meta-analyses demonstrate that nursing practice is determinant for the success of the protocols, directly influencing indicators such as pain, early mobilization, and length of stay (Jia et al., 2023)

In addition to objective clinical outcomes, qualitative investigations reveal that patients undergoing Fast-Track surgery report a greater sense of safety, autonomy, and understanding of the therapeutic process, evidencing the positive subjective impact of this approach (Zou et al., 2024).

Despite the advances evidenced in the international literature, challenges still exist related to heterogeneity in the application of protocols, structural differences among health services, and the need for adaptation to local realities. Recent studies emphasize that the effectiveness of ERAS depends not only on the isolated adoption of specific measures, but on the integrated and consistent implementation of all its components (Scala et al., 2024; Privalov et al., 2025). In this regard, in-depth analyses of the applicability and impacts of Fast-Track and ERAS programs in oncologic surgery are justified, considering the epidemiological relevance of cancer, the care-related costs involved, and the need to promote safe, efficient, and patient-centered care.

Given this context, the present study aims to analyze the scientific evidence regarding the application of Fast-Track and ERAS protocols in oncologic surgery, highlighting their effects on clinical outcomes, postoperative complications, length of stay, resumption of adjuvant therapy, and survival, as well as discussing the challenges and perspectives for their implementation in different care settings.

METHODOLOGY

This is an integrative literature review, a method that enables the comprehensive synthesis of studies with different designs, allowing an understanding of the current state of knowledge regarding Fast-Track and Enhanced Recovery After Surgery (ERAS) protocols in oncologic surgery. The review was conducted according to the stages proposed for integrative reviews: identification of the problem, establishment of eligibility criteria, definition of search strategies, extraction and categorization of data, critical analysis of the included studies, and synthesis of the knowledge produced.

The guiding question was structured based on the PICo strategy (Population, Interest, and Context), and was defined as follows: What are the impacts of Fast-Track and ERAS protocols on the clinical and oncologic outcomes of patients undergoing oncologic surgery? The population of interest comprised adult patients undergoing oncologic surgeries; the phenomenon of interest corresponded to the application of Fast-Track or ERAS protocols; and the context encompassed the perioperative period and clinical and oncologic outcomes.

The search was carried out in the PubMed/MEDLINE, Scopus, Web of Science, Embase, and Virtual Health Library (VHL) databases, covering the period from 2021 to 2026. The temporal delimitation was established with the objective of gathering contemporary evidence, considering recent updates to international guidelines and the expansion of ERAS protocol implementation in surgical oncology.

Controlled and uncontrolled descriptors were used, combined with Boolean operators (AND and OR), according to the DeCS (Health Sciences Descriptors) and MeSH (Medical Subject Headings) vocabularies. The main descriptors used were: “Enhanced Recovery After Surgery,” “Fast-Track Surgery,” “Surgical Oncology,” “Neoplasms,” “Perioperative Care,” “Postoperative Complications,” “Length of Stay,” “Oncologic Outcomes,” and “Recovery of Function.” The search strategies were adapted to the specificities of each database, ensuring greater sensitivity and comprehensiveness of the results.

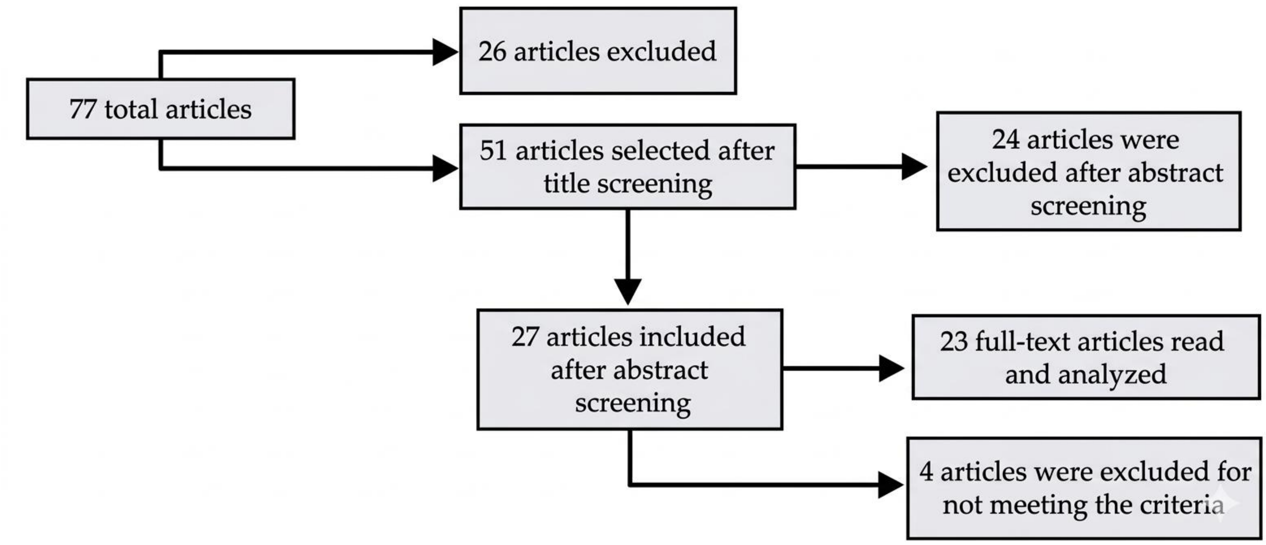
The inclusion criteria comprised: (1) original studies published between 2021 and 2026; (2) articles available in full text; (3) publications in English, Portuguese, or Spanish; (4) research addressing the application of Fast-Track or ERAS protocols in oncologic surgeries; (5) studies presenting clinical, perioperative, or oncologic outcomes, such as length of stay, postoperative complications, resumption of adjuvant therapy, survival, or quality of life. Different methodological designs were considered, including randomized clinical trials, cohort studies, retrospective studies, systematic reviews, and meta-analyses.

The exclusion criteria adopted were: (1) studies published before 2021; (2) duplicate articles in the databases; (3) case reports, letters to the editor, editorials, study protocols, and narrative reviews without explicit methodology; (4) research not specifically addressing oncologic patients; (5) studies dealing exclusively with non-oncologic surgeries; and (6) publications without a clear description of the outcomes evaluated.

The study selection process occurred in three stages: reading of titles, analysis of abstracts, and full-text reading of potentially eligible articles. Screening was conducted carefully, with documentation of the reasons for exclusion at each stage. After the final selection, data extraction was performed using a previously prepared instrument containing information on authors, year of publication, country, type of study, investigated population, type of oncologic surgery, components of the ERAS or Fast-Track protocol used, and the main outcomes evaluated.

Figure 1

Flowchart of study selection



Source: Authors (2026)

Data analysis was conducted in a descriptive and thematic manner, allowing the identification of categories related to the impact of protocols on immediate clinical outcomes (morbidity, pain, length of stay), functional outcomes (early mobilization, gastrointestinal recovery), and oncologic outcomes (initiation of adjuvant therapy, survival, and continuity of treatment). The synthesis of findings was presented narratively, highlighting convergences, divergences, and gaps in the recent literature.

As this was an integrative literature review based on secondary publicly accessible data, submission to a Research Ethics Committee was not required. Nevertheless, ethical principles related to the reliability of information, proper citation of sources, and scientific integrity in the analysis and interpretation of results were respected.

RESULTS AND DISCUSSION

The analysis of studies published between 2021 and 2026 shows that Fast-Track and Enhanced Recovery After Surgery (ERAS) protocols share common foundations such as reduction of surgical stress, multimodal analgesia, early mobilization, and early feeding, but differ in terms of the degree of systematization, standardization, and monitoring of indicators. In general, Fast-Track presents itself as a conceptual model centered on accelerating recovery, whereas ERAS is configured as a structured program based on formal guidelines and continuous auditing of results

GENERAL OVERVIEW OF THE INCLUDED STUDIES

The studies analyzed covered different oncologic specialties, including colorectal, gynecologic, pancreatic, hepatobiliary, esophageal, urologic, breast, and head and neck surgery. Retrospective studies, comparative cohorts, randomized clinical trials, and systematic reviews predominated.

In colorectal oncology, Mangone et al. (2024) demonstrated, in a comparative study conducted in Italy, that implementation of the ERAS protocol significantly reduced length of stay and postoperative complications in both open and laparoscopic surgeries. Similarly, Wang et al. (2021) showed that patients with stage II and III colorectal cancer undergoing enhanced recovery pathways experienced lower morbidity, without delay in the initiation of adjuvant therapy, reinforcing the oncologic safety of the strategy. In a systematic review, Sier et al. (2024) highlighted that hospital discharge within 24 hours after colon cancer surgery is feasible in selected cases included in ERAS protocols, without an increase in readmission rates. Complementing this perspective, Scala et al. (2024) emphasized that full adherence to protocol components is a determining factor for maintaining oncologic safety and obtaining consistent results.

In esophageal surgery, Chen et al. (2025) identified an association between ERAS application and improved three-year survival after esophagectomy, suggesting that optimized recovery may influence long-term oncologic outcomes. In addition, Meillat et al. (2022) observed a significant reduction in complications in laparoscopic rectal surgery conducted under a Fast-Track program, reinforcing the effectiveness of the multimodal approach in minimizing surgical stress and accelerating functional recovery.

In the field of gynecologic oncology, Bourazani et al. (2025), in a randomized clinical trial, demonstrated a reduction in postoperative pain, shorter hospital stay, and greater patient satisfaction among those managed under ERAS, evidencing both clinical and experiential benefits. Updating international recommendations, Nelson et al. (2023) emphasized the challenges related to the practical implementation of protocols, highlighting the need for continuous auditing, monitoring of care indicators, and institutional commitment to ensure full adherence to guidelines.

In head and neck surgery, Kiong et al. (2022) observed that the application of ERAS favored earlier return to planned oncologic therapy, positively impacting continuity of treatment and reducing potentially harmful intervals between therapeutic modalities. Similar results were reported by Nieminen et al. (2023) in free flap reconstructions, in which protocol adoption was associated with reduced length of stay and lower complication rates.

In pancreatic surgery, Harsa et al. (2025) reported a significant reduction in postoperative morbidity with the adoption of ERAS protocols, reinforcing their applicability even in highly complex procedures. In parallel, Mercadante et al. (2024) showed that Fast-Track anesthesia contributed to greater intraoperative hemodynamic stability and faster recovery in hepatopancreatic surgeries, highlighting the importance of integrating anesthetic strategies with enhanced recovery protocols.

Table 1

Synthesis of the main clinical outcomes associated with Fast-Track and ERAS

Surgical Specialty	Protocol Evaluated	Main Clinical Outcomes	Impact on Adjuvant Therapy	Main Authors
Colorectal	ERAS	Reduced length of stay; lower complication rate; early gastrointestinal recovery	Timely initiation of chemotherapy	Mangone (2024); Wang (2021); Sier (2024)
Colorectal	Fast-Track	Improved early mobilization; less pain; reduction of mild complications	Limited data	He (2022); Zou (2024)
Gynecologic	ERAS	Reduced postoperative pain; shorter hospital stay; greater satisfaction	Therapeutic continuity preserved	Bourazani (2025); Nelson (2023); Saleh (2025)
Esophageal	ERAS	Lower morbidity; better functional recovery	Association with greater 3-year survival	Chen (2025); Pang (2021)
Head and Neck	ERAS	Reduction of complications; shorter hospital stay	Earlier return to planned therapy	Kiong (2022); Nieminen (2023); Raj (2025)
Pancreatic/Hepatopancreatic	ERAS / Fast-Track	Reduction of morbidity; hemodynamic stability	Oncologic safety maintained	Harsa (2025); Mercadante (2024)
Breast	Fast-Track	Reduction of complications; improvement in quality of care	Not compromised	Li (2025)

Source: Authors (2026)

CONCEPTUAL COMPARISON BETWEEN FAST-TRACK AND ERAS

Although often used synonymously, the terms Fast-Track and ERAS present relevant conceptual distinctions. Fast-Track emerged as a strategy aimed at accelerating postoperative recovery, focusing on isolated or combined interventions, especially those related to analgesia and early mobilization. ERAS, in turn, became consolidated as a structured protocol based on robust scientific evidence and formalized guidelines by international societies.

As argued by Ripollés-Melchor et al. (2022), ERAS represents the systematized evolution of the Fast-Track concept, by incorporating auditing of care indicators, institutional standardization, and an integrated multidisciplinary approach. From this perspective, ERAS is not restricted to accelerating hospital discharge, but is configured as a structured model for reorganizing perioperative care, guided by scientific evidence and continuous monitoring of results. Thus, its proposal goes beyond reducing length of stay, seeking to promote consistent improvement in clinical and oncologic outcomes in a sustainable and reproducible manner across different care contexts.

Table 2

Conceptual and operational differences between Fast-Track and ERAS

Aspect Compared	Fast-Track	ERAS
Conceptual Origin	Initial accelerated recovery model	Structured evolution of Fast-Track
Degree of Standardization	Variable; may be applied partially	High; formal protocol with defined guidelines
Monitoring of Indicators	Not always systematic	Continuous auditing and performance evaluation
Multidisciplinarity	Present, but less structured	Formalized multiprofessional integration
International Guidelines	Absence of consolidated universal guidelines	Updated guidelines by scientific societies
Impact on Oncologic Outcomes	Growing but limited evidence	Robust evidence including survival and resumption of therapy
Institutional Applicability	Gradual and flexible implementation	Requires institutional organization and full adherence

Source: Authors (2026)

IMPACT ON PERIOPERATIVE OUTCOMES

Reduction in length of stay is one of the outcomes most consistently reported in the literature. In colorectal surgery, Mangone et al. (2024) and Sier et al. (2024) showed a significant decrease in hospitalization time with the implementation of ERAS, without a proportional increase in readmission rates. In contrast, studies on Fast-Track, such as that of He et al. (2022), demonstrated improved functional recovery and reduction of complications in patients undergoing colorectal surgery, but with greater variability in the standardization of interventions and in the systematization of the applied components.

In breast cancer, Li et al. (2025) identified a reduction in complications and improvement in quality of care with the application of the Fast-Track concept in the perioperative period. However, unlike ERAS, such interventions were not always embedded in a formally structured protocol with continuous auditing and systematic monitoring of indicators, which may limit the comparability and reproducibility of results across different institutions.

In highly complex surgeries, such as cytoreduction associated with hyperthermic intraperitoneal chemotherapy (HIPEC), Robella et al. (2023) demonstrated that ERAS is applicable and safe even in extensive procedures, reinforcing its methodological robustness and its capacity to adapt to challenging surgical contexts. The broader applicability of ERAS in complex scenarios suggests greater potential for institutional standardization and consolidation of evidence-based practices when compared with the traditional Fast-Track model, whose implementation tends to be more heterogeneous and dependent on local initiatives.

Table 3

Comparison of perioperative impacts between Fast-Track and ERAS by surgical specialty

Specialty	Findings with Fast-Track	Findings with ERAS	Predominant Level of Evidence
Colorectal	Functional improvement; early mobilization	Consistent reduction in length of stay and complications	Cohorts, systematic reviews
Gynecologic	Limited data	Reduction in pain and length of stay; greater satisfaction	Randomized clinical trial
Esophageal	Initial clinical benefits	Association with medium-term survival	Retrospective cohort
Head and Neck	Limited application	Early return to therapy and lower morbidity	Multicenter studies
Pancreatic	Accelerated anesthetic strategies	Reduction of postoperative complications	Retrospective studies
Breast	Improvement in quality of care	Less frequent application	Observational studies

Source: Authors (2026)

IMPACT ON ONCOLOGIC OUTCOMES AND THERAPEUTIC CONTINUITY

One of the most relevant differentials identified in the recent literature concerns the impact on oncologic outcomes. Pang et al. (2021), in a systematic review, highlighted that ERAS implementation does not compromise long-term oncologic outcomes, preserving survival rates and tumor recurrence rates. These findings reinforce the safety of the strategy from an oncologic perspective, dispelling initial concerns that accelerated recovery might negatively interfere with disease control.

In addition, Kiong et al. (2022) observed that patients managed under ERAS in head and neck surgery returned more rapidly to adjuvant oncologic therapy. This evidence is particularly relevant, considering that delays in complementary treatment may negatively affect prognosis and reduce the overall effectiveness of the multimodal therapeutic strategy.

In esophagectomy, Chen et al. (2025) identified an association between ERAS application and improved three-year survival, suggesting that accelerated recovery may influence inflammatory and immunological mechanisms related to tumor progression, in addition to favoring greater clinical stability in the immediate postoperative period. Although studies on Fast-Track also demonstrate consistent clinical benefits, there is a smaller number of investigations evaluating direct impact on survival and on medium- and long-term oncologic outcomes, which highlights a relevant gap in the comparative literature between the two care models.

PATIENT EXPERIENCE AND MULTIPROFESSIONAL PRACTICE

The subjective dimension of recovery has also been explored in recent literature. Zou et al. (2024) identified, in a qualitative study, that patients undergoing surgery under the Fast-Track model reported a greater sense of autonomy, better understanding of the therapeutic process, and an expanded perception of active participation in their own care.

These findings show that accelerated recovery is not limited to objective indicators, such as length of stay or complication rates, but also impacts psychosocial aspects relevant to the experience of the oncologic patient.

However, as highlighted by Nelson et al. (2023), the effectiveness of ERAS is directly conditioned on structured multiprofessional integration, involving anesthesiologists, surgeons, nurses, physiotherapists, nutritionists, and other members of the care team. In this sense, consolidation of the protocol depends not only on the adoption of isolated interventions, but also on institutional coordination, standardization of practices, and continuous monitoring of indicators. Corroborating this perspective, Jia et al. (2023), in a meta-analysis, reinforced the central role of nursing in adherence to protocols and in improving care indicators, highlighting that the systematized performance of these professionals directly influences outcomes such as pain control, early mobilization, and reduction of length of stay.

Table 4

Multiprofessional contributions in Fast-Track and ERAS protocols

Professional Category	Interventions in Fast-Track	Interventions in ERAS	Impact on Outcomes
Surgeon	Minimally invasive technique; reduction of drains	Surgical planning integrated with the protocol	Less surgical trauma
Anesthesiologist	Multimodal analgesia; reduction of opioids	Goal-directed hemodynamic control; prevention of nausea	Reduction of complications and pain
Nursing	Early mobilization; patient education	Systematic monitoring of indicators; protocol adherence	Reduced length of stay; greater satisfaction
Physiotherapy	Encouragement of early ambulation	Structured rehabilitation protocols	Accelerated functional recovery
Nutrition	Early feeding according to tolerance	Evidence-based nutritional strategies; immunonutrition	Evidence-based nutritional strategies; immunonutrition
Hospital Management	Operational support	Auditing, monitoring, and continuous improvement	Sustainability and standardization of care

Source: Authors (2026)

COMPARATIVE SYNTHESIS AND CLINICAL IMPLICATIONS

The comparative analysis between the Fast-Track and ERAS models demonstrates that, although they share similar physiological and care-related foundations, their impacts differ substantially in terms of standardization, consistency of results, and institutional sustainability. Fast-Track is characterized by greater operational flexibility, allowing the progressive adoption of isolated interventions, such as multimodal analgesia, early mobilization, and early feeding. This characteristic favors its initial implementation in services with structural limitations or restricted resources. However, this same flexibility may result in heterogeneity in the application of measures, compromising the uniformity of clinical results. As highlighted by Ripollés-Melchor et al. (2022), the absence of systematic auditing and formally structured protocols may limit the precise measurement of the gains obtained with the Fast-Track model and hinder its consolidation as an institutional policy.

In contrast, ERAS presents itself as a conceptual and operational evolution of Fast-Track, incorporating evidence-based guidelines, clearly defined care goals, and continuous monitoring of performance indicators. This structuring favors greater reproducibility of results and effective integration among the different professional categories involved in perioperative care. According to Nelson et al. (2023), the consolidation of specific guidelines for oncology reinforces the need for strict adherence to protocol components, highlighting that the effectiveness of ERAS depends on the global rather than fragmented implementation of the proposed interventions, otherwise its clinical and organizational benefits may be compromised.

From a clinical standpoint, both models demonstrate a consistent reduction in length of stay and postoperative complications. However, recent studies suggest that ERAS has a more robust impact on continuity of oncologic treatment, especially on the early resumption of adjuvant therapy. Kiong et al. (2022) showed that patients undergoing ERAS protocols returned more rapidly to planned oncologic therapy, a determining factor for prognosis in various types of cancer. Similarly, Wang et al. (2021) observed that the application of enhanced recovery pathways in colorectal cancer did not compromise the timely initiation of adjuvant chemotherapy, reinforcing the oncologic safety of the protocol and its compatibility with multimodal therapeutic strategies.

Moreover, there is emerging evidence of a possible influence of ERAS on long-term outcomes, including survival. Chen et al. (2025) identified an association between protocol application and improved three-year survival after esophagectomy, suggesting that modulation of the inflammatory response and reduction of surgical stress may affect biological mechanisms related to tumor progression. Although studies on Fast-Track also demonstrate relevant clinical benefits, the volume of evidence correlating this model with medium- and long-term oncologic outcomes remains more limited when compared with the body of evidence available for ERAS.

Another distinctive aspect concerns institutional governance and organizational culture. Privalov et al. (2025) emphasize that the effectiveness of accelerated recovery programs is directly related to full adherence to protocols and the standardization of care practices. In this context, ERAS favors the consolidation of a culture of continuous quality improvement by incorporating systematic audits, performance indicators, and periodic evaluation cycles. Fast-Track, although effective and clinically beneficial, tends to depend more on the individual initiative of teams and local experience, and may show greater variability in implementation and, consequently, in the results obtained.

Therefore, the comparative synthesis indicates that Fast-Track remains relevant as a viable and adaptable strategy, especially in contexts of initial implementation of accelerated recovery protocols. However, ERAS demonstrates greater methodological robustness, greater multiprofessional integration, and more consistent impact both on immediate clinical outcomes and on the oncologic therapeutic trajectory. The structured adoption of ERAS, associated with continuous team training and systematic monitoring of results, is configured as a promising strategy for the overall optimization of oncologic surgical care, promoting not only faster recovery, but also greater safety and potential long-term prognostic benefit.

CONCLUSION

The consolidation of strategies aimed at accelerated recovery in the context of oncologic surgery represents a significant advance in the qualification of perioperative care, with a direct impact on the safety, efficiency, and humanization of care. Analysis of the evidence demonstrates that Fast-Track and Enhanced Recovery After Surgery (ERAS) protocols constitute effective approaches to reducing surgical stress, optimizing pain control, and promoting faster functional recovery. By integrating evidence-based interventions and coordinated multiprofessional practice, these models contribute to a safer surgical experience centered on the oncologic patient.

With regard to immediate clinical outcomes, both protocols are associated with reduced length of stay, lower incidence of postoperative complications, and early resumption of functional activities. However, ERAS stands out for its formalized and systematized structure, supported by consolidated guidelines and continuous auditing mechanisms, which favors greater standardization and reproducibility of results. This methodological organization broadens the consistency of the observed benefits and strengthens its applicability across different oncologic surgical specialties.

In the sphere of oncologic outcomes, the evidence indicates that the structured implementation of ERAS does not compromise therapeutic safety, preserving continuity of treatment and favoring the timely initiation of adjuvant therapy. This aspect assumes strategic relevance, since delays in complementary treatment may interfere with prognosis and survival. Although the Fast-Track model also demonstrates expressive benefits in functional recovery and reduction of complications, studies indicate that ERAS presents a greater volume of evidence related to the maintenance of the oncologic therapeutic trajectory and to possible positive impacts in the medium and long term.

Additionally, the effectiveness of these protocols depends on multiprofessional integration and institutional commitment. The articulation among surgeons, anesthesiologists, nurses, physiotherapists, nutritionists, and hospital managers demonstrates that accelerated recovery is not limited to isolated interventions, but represents an organizational restructuring of perioperative care. Nonetheless, challenges persist related to heterogeneity in implementation, structural differences among health services, and the need for adaptation to local realities, especially in contexts with limited resources.

Given this scenario, the development of prospective multicenter studies is recommended to directly compare Fast-Track and ERAS in different types of neoplasms, encompassing not only perioperative outcomes, but also inflammatory markers, time to initiation of adjuvant therapy, quality of life, cost-effectiveness analysis, and overall survival in the medium and long term. Investigations with this design may strengthen the scientific basis for the consolidation of institutional and public policies aimed at the systematized implementation of enhanced recovery protocols in oncologic surgery.

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THE BRAZILIAN UNIFIED HEALTH SYSTEM AS A MODEL OF A UNIVERSAL SYSTEM IN THE GLOBAL HEALTH SCENARIO

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Abstract

The Brazilian Unified Health System (SUS) represents one of the largest public universal health systems in the global health landscape, recognized for its commitment to comprehensive, universal, and equitable access to healthcare. This chapter aims to analyze SUS as a model of a universal health system, highlighting its principles, achievements, and challenges within the international context. The methodology is based on a qualitative bibliographic review, using scientific publications, institutional documents, and reports from international organizations, particularly studies by scholars such as **Paim**, **Giovanella**, **Mendes**, and **Souza**, who have extensively examined Brazilian public health policies. The findings indicate that SUS has significantly expanded access to healthcare services, strengthening primary healthcare, health surveillance, and national immunization programs that have become international references. However, challenges remain regarding financing, management efficiency, and regional inequalities. It is concluded that, despite structural limitations, SUS continues to stand as an important model of a universal health system, contributing to global debates on equity, the right to health, and the organization of public health systems in countries with diverse socioeconomic contexts.

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INTRODUCTION

The right to health is widely recognized as a fundamental human right and constitutes a central element in the promotion of dignity, social equity, and human development. In this context, universal health systems assume a strategic role in guaranteeing equal access to health services, especially in societies marked by social and economic inequalities. In Brazil, the Unified Health System (SUS), established by the Federal Constitution of 1988, represents one of the largest experiences of a universal public system in the world, being grounded in the principles of universality, comprehensiveness, and equity (Paim, 2015). SUS organizes a network of services that ranges from primary care to highly complex procedures, offering free care to the Brazilian population.

In the global health scenario, discussion about universal health systems has intensified, especially in light of challenges such as population aging, health emergencies, and inequalities in access to health services. In this context, SUS has frequently been cited in international studies as a relevant experience in the construction of public policies aimed at guaranteeing the right to health, although it faces structural challenges related to financing, management, and the organization of services (Giovanella et al., 2018).

Given this context, the research problem is defined as understanding how the Unified Health System can be considered a model of a universal system in the global health scenario, taking into account both its advances and the challenges faced in consolidating its principles.

The general objective of this chapter is to analyze the Unified Health System as a model of a universal system in the context of global health. As specific objectives, it seeks to: discuss the principles and foundations that structure SUS; analyze the main advances achieved since its implementation; and reflect on contemporary challenges related to its sustainability, financing, and management.

The relevance of this study is justified by the importance of SUS in guaranteeing the right to health in Brazil and by the need to broaden the academic debate on universal health systems in the international context. Understanding the potentialities and limitations of this system contributes to reflections on public policies aimed at promoting equity and social justice in access to health services.

From a theoretical point of view, this chapter engages with studies on public policies and health systems, especially those that analyze the Brazilian health reform and the organization of SUS. The contributions of authors who discuss the historical trajectory of the system and its contemporary challenges stand out, highlighting the importance of healthcare networks, primary care, and public policies aimed at universalizing access (Mendes, 2011; Paim, 2015; Giovanella et al., 2018). These contributions make it possible to understand SUS not only as a national public policy, but also as a relevant experience in the international debate on universal health systems.

METHODOLOGY

This research is characterized as a qualitative study, with a descriptive and exploratory approach, developed through a bibliographic review. This type of investigation makes it possible to analyze and interpret scientific productions that have already been published, contributing to the theoretical understanding of a given phenomenon or theme. The choice of this approach is justified by the need to understand the Unified Health System (SUS) in the context of global health, considering its conceptual, political, and institutional foundations (Gil, 2019).

The bibliographic review was carried out through consultation of books, scientific articles, institutional documents, and reports from national and international organizations that discuss public health policies, universal systems, and the organization of SUS. Among the main databases used, SciELO, Google Scholar, and the Virtual Health Library (BVS) stand out, in addition to official documents from the Ministry of Health and the World Health Organization. The selection of sources considered criteria of thematic relevance, currency of publications, and academic recognition of the authors in the field of collective health (Marconi; Lakatos, 2021).

RESEARCH TYPE

The study is classified as bibliographic research, since it was developed based on previously published materials, allowing the analysis of different theoretical perspectives on the functioning and importance of SUS in the global health scenario. According to the methodological literature, this type of research enables the researcher to examine existing scientific contributions, promoting a critical synthesis of the available knowledge on a given topic (Gil, 2019).

DATA COLLECTION TECHNIQUES AND INSTRUMENTS

Data collection was carried out through the survey and analysis of academic productions related to the Unified Health System, global health, and universal health systems. Scientific articles, book chapters, official documents, and institutional reports addressing the organization, principles, and challenges of SUS were selected. The information obtained was organized and analyzed thematically, making it possible to identify the main debates present in the literature on the role of the Brazilian system in the international context.

SAMPLE AND SELECTION CRITERIA

The research sample consisted of scientific productions published in journals in the fields of collective health, public policies, and global health, in addition to reference works on SUS. Studies published mainly over the last two decades were considered, a period marked by important discussions on the consolidation and challenges of the Brazilian health system. The selection prioritized works by authors recognized in the field, as well as institutional documents relevant to understanding health policies in Brazil (Paim, 2015; Giovanella et al., 2018).

ANALYSIS PROCEDURES

Data analysis was carried out through critical and interpretive reading of the selected works, seeking to identify concepts, arguments, and evidence that contribute to understanding SUS as a model of a universal system in the global health scenario. The discussion of the results was grounded in theoretical frameworks of collective health and public policies, making it possible to establish relationships between the principles of the Brazilian system and international discussions on universal access to health (Mendes, 2011).

RESULTS AND DISCUSSION

The analysis of the literature showed that the Unified Health System (SUS) has consolidated itself as one of the largest experiences of a universal public system in the world, responsible for guaranteeing free access to health services for millions of Brazilians. Since its creation, the system has significantly expanded healthcare coverage, especially through Primary Health Care, considered the main entry point to the service network. The Family Health Strategy, for example, plays a fundamental role in health promotion, disease prevention, and the continuous monitoring of the population, contributing to the improvement of various health indicators (Paim, 2015).

Another relevant aspect identified in the studies concerns the organizational structure of SUS, based on administrative decentralization and social participation. This model allows health management to be shared among the federal, state, and municipal levels, enabling greater adaptation of public policies to local needs. In addition, the participation of civil society in health councils and conferences strengthens social control and contributes to the construction of more democratic and inclusive policies (Giovanella et al., 2018).

In the global health scenario, SUS also stands out for the implementation of public policies with major population impact, such as the National Immunization Program, epidemiological surveillance actions, and policies for access to medicines for the treatment of chronic and infectious diseases. These initiatives demonstrate the system's capacity to develop nationwide strategies aimed at health promotion and disease prevention, and they are frequently cited as references for other developing countries (Mendes, 2011).

However, the literature also points to important challenges that still need to be overcome for the system's full consolidation. Among these challenges are limitations in public health financing, regional inequalities in the provision of services, and difficulties related to management and the integration of care networks. Such factors may compromise the effectiveness of the principles of universality and equity that guide SUS, highlighting the need for continuous investment and improvement of the system's management policies (Paim, 2015).

Based on the analysis of the main contributions of the literature, Table 1 presents a synthesis of the advances and challenges of the Unified Health System in the context of global health.

Table 1

Main advances and challenges of the Unified Health System in the global health scenario

Analyzed dimension	Main advances identified	Challenges identified in the literature
Access to health services	Expansion of universal and free access to health services; expansion of Primary Health Care through the Family Health Strategy.	Regional inequalities in access and in the distribution of resources and professionals.
Public health policies	Implementation of national immunization programs, epidemiological surveillance, and disease control measures.	Need for greater integration among levels of care.
Organization of the system	Administrative decentralization among the federal government, states, and municipalities; social participation in health councils and health conferences.	Difficulties in the management and coordination of healthcare networks.
Impacts on population health	Reduction in infant mortality, expansion of vaccination campaigns, and improvement of health indicators.	Limitations related to public health financing.
International recognition	SUS recognized as a model of a universal system in developing countries.	Financial sustainability and modernization of management.

Source: Prepared by the author based on Paim (2015), Mendes (2011), and Giovanella et al. (2018).

The analysis of these results demonstrates that, despite structural challenges, SUS represents a relevant experience of public policy aimed at guaranteeing the right to health. The literature highlights that strengthening primary care, adequate financing, and improving management are essential factors for the sustainability of the system. In this way, SUS remains an important object of study in the field of global health, contributing to the international debate on the organization of universal health systems capable of promoting equitable and comprehensive access for the population (Giovanella et al., 2018).

CONCLUSION

This chapter aimed to analyze the Unified Health System (SUS) as a model of a universal system in the context of global health, considering its principles, advances, and challenges throughout its trajectory. Based on the literature review conducted, it was possible to understand that SUS represents one of the largest experiences of a public health system in the world, structured on the principles of universality, comprehensiveness, and equity, guaranteeing free access to health services for the entire Brazilian population.

The results of the study showed that SUS has promoted important advances in access to health services, especially through the expansion of Primary Health Care and the implementation of public policies with broad population reach, such as immunization programs, epidemiological surveillance actions, and strategies aimed at health promotion and prevention. These initiatives contributed to significant improvements in various health indicators, in addition to strengthening the role of the system in the organization of public policies aimed at guaranteeing the right to health.

Despite the advances observed, challenges still persist that affect the consolidation and sustainability of the system. Among these challenges are limitations in public health financing, regional inequalities in the provision of services, and difficulties related to the management and integration of care networks. These factors demonstrate the need to strengthen public health policies and for continuous investment to ensure greater efficiency and quality in the provision of services.

Thus, it is concluded that the Unified Health System constitutes a relevant experience in the international scenario, contributing to the debate on universal health systems and on the importance of public policies aimed at promoting equity and universal access. As a contribution, this study reinforces the importance of SUS for guaranteeing the right to health in Brazil and for building fairer and more inclusive health systems. It is recommended that future research deepen analyses of the system's contemporary challenges and investigate strategies capable of strengthening its management, financing, and capacity to respond to the needs of the population.

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PAIN ASSESSMENT IN PRETERM NEWBORNS IN INTENSIVE CARE SETTINGS: FROM THE PERSPECTIVE OF NURSING AND PHYSICAL THERAPY

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Abstract

Hospitalized premature newborns require specialized care in the Neonatal Intensive Care Unit. During this period, they are daily subjected to several painful procedures inherent to their treatment, carried out by nursing and physical therapy staff. An exploratory, descriptive, and analytical study (Content Analysis) was conducted to identify pain recognition and actions to be taken by fifty healthcare professionals in a NICU in Belém. Based on the analysis of field data, it was observed that there is a need for the nursing and physical therapy staff to know/recognize the types of pain through the use of scales and detailed observation. It was concluded that nurses should train technicians in the use of the NIPS Scale and in the careful observation of preterm newborns; nurses, physical therapists, and other professionals should exchange experiences regarding the application of techniques and medications, promote refresher courses on pain for all professionals dealing with preterm newborns, and foster empathy and affection between the professional and the preterm newborn.

Keywords: Pain, Newborns, NICU, Nursing, Physical Therapy.

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INTRODUCTION

Every year, 30 million low-birth-weight newborns are born worldwide, many as a consequence of preterm birth. This contributes substantially to the high neonatal mortality rates that still exist in various regions, especially in poor and/or developing countries. In Brazil, in 2022, there were 2.54 million births, but the government drew attention to a 3.5% decrease compared with the previous year (WHO, 2018 as cited in Bordino et al., 2023 and Brazil, 2024).

In Brazil, from the 1990s onward, neonatal mortality became the main component of infant mortality, mainly due to the proportional reduction in post-neonatal deaths and the persistence of the early neonatal component (Lansky et al., 2014 and Silva; Reckziegel; Silva, 2018).

Neonatology has undergone profound transformations in recent decades, both from the technological standpoint and in the dissemination of scientific evidence, which have provided significant improvements in the care of the preterm newborn (PTNB) and the family, thanks to intensive care, although many of the necessary procedures are painful (Santos et al., 2012).

The organic survival of PTNBs has increased, allowing neonates with extreme gestational ages or very low birth weight to survive. Despite technological advances and the country's development, prematurity rates unfortunately remain high. In Brazil, a developing country, the prevalence of preterm newborns is approximately 7%. From 2012 to 2022, 31,351,324 births were recorded, and of this total, 3,530,568 were preterm births, with the highest rates in the Northern Region (Santos et al., 2012 and Brazil, 2024).

In view of the above, the following question was posed: What is the importance of the (re)cognition of types of pain in the management, treatment, and care of PTNBs in NICUs by the nursing and physical therapy teams?

NEONATAL PAIN: CONCEPTUALIZATION AND ASSESSMENT

Pain is defined by the International Association for the Study of Pain (IASP) as an unpleasant sensory and emotional experience associated with potential, actual, or described tissue injury. This definition highlights the always subjective nature of pain, which is influenced by emotional, social, cultural, environmental, and cognitive factors, in addition to being tied to the meaning attributed to the situation in previous lived experiences, as well as the individual's ability to understand causes and consequences (Silva; Ribeiro-Filho, 2011 and Martucci, 2021).

A preterm newborn is not able to comprehend and understand pain and its consequences, nor, in some cases, to express pain and its intensity intelligibly/verbally to nurses and physical therapists, thus depending directly on them for the perception of and the way they will deal with another's pain—that is, empathy.

The newborn undergoes countless painful experiences, since he or she is exposed to painful procedures in the NICU and is more sensitive to pain because of having a greater number of nociceptive nerve fibers than adults. In addition, the descending inhibitory fibers to the posterior horn of the spinal cord are still immature, making sensitivity even greater, such that positioning, medication administration, and feeding, among others, may provoke a sensation of pain (Sposito et al., 2017 and Araújo et al., 2021).

Painful experiences during the peri- and postnatal period may cause future effects such as cognitive and motor deficits, which may only be diagnosed at preschool age, school age, or even adolescence. Ultrasound examination may cause discomfort to the baby because of the noise made by the device, the pressure on the mother's skin, among other factors, which the professional could minimize by asking the mother where the baby's head and feet are located, allowing the device to be moved through areas that do not cause discomfort or pain (Alves et al., 2013 and Costa et al., 2017).

Identifying pain is extremely important for effective management. Self-report is considered by health professionals to be one of the best instruments for pain assessment. However, newborns do not verbalize their pain. Thus, it is essential to use other methods known and used by professionals to assess pain, such as validated scales and, especially, precise and in-depth observation of the newborn. It is also important to talk with and exchange information with the team that accompanies development, care, feeding, and medication—that is, especially the nursing technicians and other professionals who support the PTNB (Costa et al., 2017).

Pain recognition in the newborn is based on behavioral factors (simple or complex motor responses, facial expressions, and crying) and physiological factors (increased heart rate, decreased oxygen saturation, increased intracranial pressure, altered cerebral blood flow, sweating, and variability in respiratory rate and transcutaneous PO2 and PCO2 values), since newborns still do not express themselves verbally. However, these factors do not quantify pain (Silva; Silva, 2010).

The growing knowledge regarding pain assessment and intervention in neonates and infants remains underrecognized and undertreated; pain management in the newborn continues to be a challenge for Chinese and American neonatal care professionals because these newborns cannot speak and advocate for themselves when they feel pain.

Thus, for a pain scale to be ideal and useful, it should require minimal financial resources and minimal training by those who use it, be easy to apply and interpret, take little time, allow pain to be quantified both in intensity and duration, and be comparable to others. In addition, it should be appropriate to the PTNB's age, the clinical context, and the type of pain (Silva; Silva, 2010).

Therefore, unidimensional scales appear to be more sensitive tools for identifying individuals in pain when compared with multidimensional scales. In this context, Guinsburg and Cuenca (2010) indicate, for neonatal pain assessment, the use of multiple scales by different health professionals, but recommend that at least one of these instruments be a unidimensional behavioral scale—that is, one that takes into account the various pain behaviors displayed by the newborn. It should be emphasized that in their studies the authors recommend the use of scales in the pain assessment protocol.

There are several scales whose application has already been proven; the most commonly recommended in use are the following: Neonatal Facial Coding System - NFCS, Premature Infant Pain

Profile - PIPP, and Neonatal Infant Pain Scale - NIPS. NFCS is a unidimensional instrument used to assess acute procedural pain. The newborn's facial activity is observed during painful stimuli, and the indicators are open eyes, deepened nasolabial furrow, tightly closed eyes, mouth stretched vertically or horizontally, and tense tongue (Gaspardo et al., 2008).

PIPP is a multidimensional instrument that assesses acute pain through the analysis of seven pain indicators: facial movements (brow bulge, tightly closed eyes, and nasolabial furrow), physiological indicators (heart rate and oxygen saturation), and contextual aspects (gestational age and sleep-wake state) (Stevens et al., 1996).

NIPS, in turn, assesses six indicators of behavioral responses to acute pain: facial expression, crying, breathing pattern, motor activity of arms and legs, and sleep-wake state (Lawrence et al., 1993).

It is understood, therefore, from the description of the aforementioned instruments, that neonatal facial activity in response to painful stimuli constitutes a strong indication of pain, according to Silva and Silva (2010). There is a typification of pain, and we present a summary table below:

Table No. 01

Types of Pain

Painful state	Causes	Characteristics
Acute pain	Fracture, rupture, avulsion, burns	Lasts a few days, mild or severe, known or unknown cause, presumed nociceptive afference
Subacute pain	Postoperative, post-fracture	Duration from a few days to a few months
Recurrent acute pain	Rheumatoid arthritis, osteoarthritis, migraine	Recurrent nociceptive afference from an underlying chronic disease
Persistent acute pain	Uncontrolled neoplastic disease	Continuous nociceptive afference
Chronic pain	Evolves from acute pain (longer duration)	Usually lasts more than 6 months; nociceptive afference is reduced or unknown, but there is still adequate functional adaptation of the patient
Chronic pain syndrome	Evolves from chronic pain—low back pain—or acute pain—whiplash injury	Poor functional adaptation; pain becomes the central focus of the patient's life

Source: Araújo (2020, p. 3) – Table adapted from Creu; Pinsky (1984).

Based on the type of pain, the nurse, physical therapist, among other professionals, may or may not intensify management with the PTNB, making it possible to reduce pain intensity resulting from the treatment being provided. The PTNB expresses pain and its intensity through crying and facial expressions, as well as indicating which movement and/or touch causes pain. It is worth remembering that the table above applies only partially to the theme of this investigation, since the investigation concerns PTNBs who present a condition of low birth weight and intubation and who undergo numerous procedures, including nursing care and physical therapy care.

Health professionals (nurses, nursing technicians, and physical therapists) may use scales to assess the pain the PTNB may be feeling; the most common are: Neonatal Facial Coding System - NFCS, Premature Infant Pain Profile - PIPP, and Neonatal Infant Pain Scale - NIPS. Based on their application, the nurse and physical therapist can organize, plan, and guide their handling/movement actions, administer medication, provide guidance on hygiene and feeding, among other measures, with the aim of causing as little pain as possible and/or minimizing it.

APPLICATIONS OF SCALES IN NEONATAL PAIN ASSESSMENT

Exposure to pain is one of the most harmful extrauterine environmental factors for newborns and may generate serious organic and emotional consequences, compromising growth and development. Thus, the more immature and/or ill the neonate is, and the earlier and more frequent the exposure to these stressful and painful events, the greater the risk of harmful consequences to health (Capellini, 2012).

The immediate effects of neonates' exposure to pain and stress include behavioral and physiological changes. Behavioral changes include facial expressions of pain, body movement, and crying. Physiological changes include increased heart rate, respiratory rate, blood pressure, and intracranial pressure; decreased oxygen saturation; increased levels of cortisol, catecholamines, and glucagon; and decreased insulin. Pain in neonates may also cause feeding difficulties, hyperalgesia—

significant increase in pain—as well as compromise in brain development and behavior (Brazil, 2022 and Moreira; Bomfim, 2004).

The Neonatal Infant Pain Scale - NIPS, created in 1993 by researchers at the Children's Hospital of Eastern Ontario, in Canada, is a multidimensional instrument that analyzes behavioral aspects and one physiological aspect, and aims to indicate the presence of pain in term and preterm newborns who are not under sedation or who do not have neurological impairment (Marins, 2010).

NIPS is considered the most widely used and studied instrument because it is a scale that is easy to interpret and apply and can be used simultaneously with the measurement of vital signs before, during, and after painful procedures. Its score ranges from 0 to 7, and when the score is above 3, the presence of pain is considered. Preventing painful sensation in the neonate is important not only because of the ethical aspects related to the subject. The scale is used in the assessment of acute pain (Marins, 2010 and Motta, 2013).

From the use of the scale, nursing and physical therapy professionals can evaluate their actions in procedures necessary for maintaining the newborn's health. In nursing, the application of the Neonatal Pain, Agitation and Sedation Scale - N-PASS (Table 02) is carried out simultaneously with the monitoring of vital signs, that is, every 1 to 3 hours, according to the patient's severity. Scores > 3 should alert professionals to the need to introduce or adjust the dose of analgesics.

Table No. 02

Neonatal Pain, Agitation and Sedation Scale - N-PASS

Table 1. N-PASS - Neonatal Pain, Agitation and Sedation Scale (Hummel et al., 2009).

	Sedation		Sedation/Pain	Pain/Agitation	
	-2	-1	0/0	1	2
Crying/Irritability	Does not cry with painful stimulus	Grumbles/cries with painful stimulus	No signs of sedation or pain	Irritable or episodes of cry Consolable	High-pitched cry or continuous silent cry Is not consolable
Behavior	Does not awaken with stimulus No spontaneous movement	Wakes briefly with stimulus Rare spontaneous movement	No signs of sedation or pain	Restless, squirms Wakes frequently	Arches body, kicks Wakes constantly or does not wake doesn't move (is not sedated)
Facial Expression	Mouth slack and open No facial expressions	Minimal facial expression with stimulus	No signs of sedation or pain	Any expression of pain intermittent	Any expression of pain continuous
Extremity Tone	No grasp reflex Flaccid	Weak grasp reflex Muscle tone ↓	No signs of sedation or pain	Clenched fists or splayed hands intermittently Relaxed body tone	Clenched fists or splayed hands continuously Tense body tone
Vital Signs: HR, RR and SpO_2	No change (Δ) after stimulus Hypoventilation or apneas	Change (Δ) < 10% with stimulus	No signs of sedation or pain	↑ 10-20% relative to baseline SpO_2 76-85% with stimulus; rapid recovery	↑ 20% relative to baseline SpO_2 < 75% with stimulus; slow recovery Not in sync with ventilator

Sedation: -10 to 0; Deep sedation: -10 to -5; Mild sedation: -5 to -2.
Pain: 0-11 (add 1 point if NB < 30 weeks corrected GA); Pain present if score > 3.

Source: Hummel et al (2009 apud Balda;Guinsburg, 2019,p.44) *(translated and adapted)*

The Neonatal Pain, Agitation and Sedation Scale - N-PASS enables: pain interpretation, pain and agitation analysis, adoption of pharmacological and non-pharmacological measures, adequate sedation (non-opioid analgesics and opioid analgesics), use of topical or local anesthetics, among other procedures (Péret; Péret; Radd, 2022).

The physical therapist is one of the professionals who work with PTNBs within Neonatal Intensive Care Units (NICUs), being one of the important professionals in reducing neonatal morbidity and mortality and especially pain in PTNBs, through techniques and knowledge that facilitate the rehabilitation of these newborns (Santos; Otto, 2019).

It is worth remembering that neonatal physical therapy consists of maintaining airway patency to ensure the maintenance and/or gain of pulmonary volumes, thereby optimizing gas exchange and reducing respiratory effort, thus attenuating the number of aspirations that cause pain; on the other hand, the nursing professional enables newborn containment (venous access puncture, blood collection, dressing changes), among other types of care, especially by knowing how to guide the nursing technicians in the handling/treatment of the PTNB (Caetano et al., 2013).

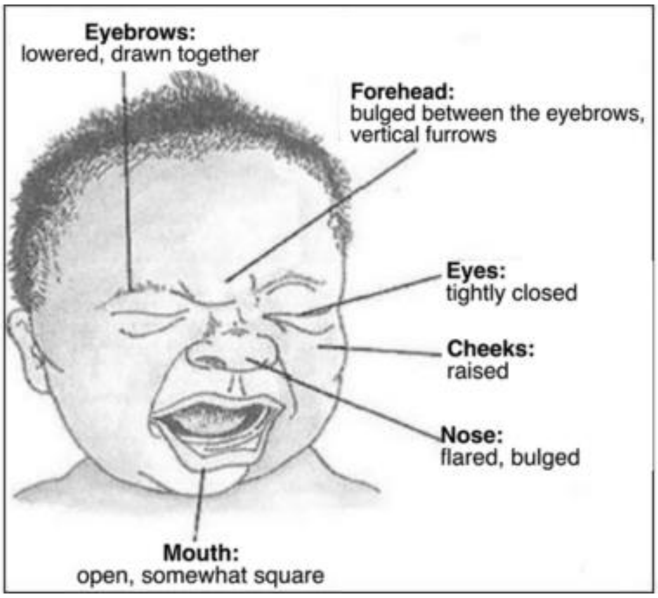
Another factor that draws the attention of nursing and physical therapy professionals concerns the painful impulses frequently suffered by PTNBs, which contribute to sequelae in the development of the neurological system, such as peri-intraventricular hemorrhage, periventricular leukomalacia, difficulty gaining weight, and greater susceptibility to infections, thus affecting recovery of general health status (Amaral et al., 2024 and Lima et al., 2025).

Given the consequences that pain may cause in the newborn, it is important that the physical therapist, together with the nursing professional and other professionals, include pain assessment and treatment during their procedures (aspiration, maneuvers, puncture, personal hygiene, among others). It should be emphasized that untreated pain may make the newborn more susceptible to infections (urinary tract infection, bacterial meningitis, bloodstream infection, wound infections, pneumonia, among others), hypoxia, changes in sleep-wake patterns, metabolic and behavioral changes, among others (Brazil, 2014 and Lima et al., 2025).

Trained observation by the nursing professional and the team, as well as by physical therapists, is important in identifying pain through the PTNB's behavioral expression, as shown in the figure below:

Figure No. 01

Facial expression of an infant under stress and pain



Source: Balda; Guinsburg (2019, p.45)

The PTNB's facial expression conveys the intensity and frequency of the pain felt; nursing professionals, physical therapists, and other professionals can analyze the newborn's expression and identify the pain felt by the PTNB. Professionals can use the NIPS Scale to assess pain in PTNBs and possibly determine the care measures to be taken to minimize or eliminate pain (Crescênio; Zanelato; Leventhal, 2009).

The PTNB's expression, added to the understanding and comprehension of the NIPS Scale by the nursing professional, the team, the physical therapist, and other professionals, can reduce painful states that some activities may cause in PTNBs. However, the fact is that there are attitudes among health professionals that do not fully reflect the knowledge acquired, because the entire team must be in sync regarding PTNB handling and care. Therefore, nursing technicians, who spend the vast majority of the time with PTNBs, must be well trained by the nursing professional to know how to act and report changes in mood, behavior, and expression observed in the PTNB to the entire team (physicians, nurses, physical therapists, and other professionals).

It is not enough merely to sedate the PTNB so that pain is not felt; rather, knowing how to perform the actions necessary for the newborn's well-being and health is a major challenge for all professionals who work with PTNBs in neonatology, especially with regard to the assessment and use of non-pharmacological and pharmacological measures. Therefore, the implementation of protocols for pain management/control is necessary, and records in medical charts may contribute to the systematization of care for PTNBs in pain and/or to avoiding painful situations.

For the implementation of pain protocols in NICUs to occur, the following should be taken into consideration: newborn patient safety regarding medication use; ethical and bioethical aspects of care for the newborn in pain; mediation of teaching processes; identification, assessment, and treatment of pain across shifts so that everyone may appropriate knowledge regarding pain and the procedures to be taken with newborns, as well as in the education of new health professionals, so that they may include such content in their curricula, proposing articulation between theory and practice—praxis (Christoffel et al., 2017).

METHODOLOGY: STEPS AND INSTRUMENTS

The research was carried out in a public hospital that is a reference in PTNB care, approved by the Research Ethics Committee of the Institute of Health Sciences of the Federal University of Pará – ICS (CAAE No. 38096114.6.0000.0018).

The research participants were invited to participate individually and voluntarily in the investigation by signing an Informed Consent Form (ICF), and identification of the participant's name was not mandatory.

TYPE OF APPROACH

Discussing pain in newborns in the ICU from the perspective of nursing professionals, physical therapists, and other professionals led us to choose an exploratory, descriptive, and analytical study focusing on the recognition of and actions to be taken in response to pain.

SETTING AND PARTICIPANTS

The research was conducted in the city of Belém with professionals who work in Neonatal Intensive Care Units (NICUs). The study was carried out with 50 (fifty) professionals who work directly with newborns in NICUs in the city of Belém, such as nurses, physicians, physical therapists, speech therapists, occupational therapists, and nursing technicians, regardless of length of experience in the healthcare field. Professionals who do not work in NICUs were excluded.

INVESTIGATION INSTRUMENTS AND DATA ANALYSIS

The instrument used for data collection was a questionnaire containing open- and closed-ended questions. Aranda (2016) and Fernandez and Camargo (2019) state that the questionnaire aims to verify which procedures professionals perform to assess the pain of the preterm newborn admitted to the NICU.

As it involved the application of a questionnaire, the study presented minimal risks regarding breaches of confidentiality and possible discomfort in answering some questions. However, every possible precaution was taken to ensure the confidentiality of personal data, and participants were informed that there was no obligation to answer all questions. The questionnaires were identified only with the initials of the name, with no identification of the people who participated in this study. This applied both to the questionnaire and to the Informed Consent Form (ICF).

Descriptive statistical techniques were used for the quantitative data. Most responses were presented in tables with the frequency of each one. Responses to the open-ended questions were analyzed through Content Analysis (Bardin, 2011).

In Content Analysis (CA), Bardin (2011) presents three distinct phases: pre-analysis, which is the period in which the material on which the researcher will systematize the initial ideas about the object of investigation is organized, a moment of "intuitions," separating material pertinent and not pertinent to the research and conducting a floating reading.

In pre-analysis, the researcher's actions are divided into four distinct moments: floating reading; choice of documents—which is subdivided into rules of exhaustiveness, representativeness, homogeneity, and pertinence; formulation and/or reformulation of objectives and hypotheses; and formulation of indicators that will support preparation for exploration of the material.

In the material exploration phase, the researcher codes the researched material, that is, transforms raw data into texts, knowledge, and information pertinent to the investigation in question, presenting new concepts and knowledge transformed into categories of analysis.

In the final phase, the researcher must process the results and interpret them based on the constitutive elements of the classical communication mechanism; it is the construction of the research text/report by analyzing and interpreting the collected data (Valle; Ferreira, 2025).

RESULTS: ANALYSIS AND DISCUSSION

Although the investigation data come from multiple professionals who work directly with PTNBs in NICUs, we focused on the role of the nurse and the physical therapist in pain assessment, management, and relief. It is known that during most of the hospitalization period, the closest follow-up is the responsibility of the nursing technicians' team, and any change is reported to the immediate supervisor (nurse), followed by the physical therapist, pediatric physician, and other involved professionals. Pain assessment in newborns can be complex, requiring observation of signs and symptoms such as facial expression, crying, and body movement, in addition to the use of the NIPS Scale, among others.

Table No. 01

Distribution of the professionals interviewed according to knowledge of any instrument/scale for assessing the baby's pain

KNOWLEDGE OF INSTRUMENT FOR ASSESSING THE BABY'S PAIN	PROFESSIONALS	
	Nº	%
Has no knowledge	11	22
NIPS	14	18
Knows one, but did not specify which	25	50
Total	50	100

Source: Field Research, 2019

According to the data in Table No. 01, it can be seen that 50% of the professionals know some instrument/scale for assessing the baby's pain but did not specify which ones; 22% reported having no knowledge, and 18% use NIPS. Since the newborn does not verbalize pain, the use of other methods, such as validated scales, is essential (Costa et al., 2017). Careful observation of changes in behavior and facial expressions is therefore necessary, and for this the nursing technician's observation must be trained.

For Anand et al. (2006), pain assessment in newborns occurs through specific instruments that allow the professional to obtain evaluation scores and plan treatment.

NIPS, the scale identified by participants in this study, is considered the most widely used instrument because it is easy to interpret and apply and can be used simultaneously with the measurement of vital signs before, during, and after painful procedures (Motta, 2013). In a study carried out by Caetano et al. (2013), it was found that 4.2% of nursing personnel used scales to assess pain.

Table No. 02

Distribution of the professionals interviewed according to the habit of evaluating daily the pain of babies hospitalized in the NICU, or not

DAILY ASSESSMENT HABIT OF THE BABY'S PAIN	PROFESSIONALS	
	Nº	%
Yes	44	88
No	6	12
Total	50	100

Source: Field Research, 2019

The data in Table No. 02 show that most of the professionals interviewed (88%) have the habit of assessing daily the pain of babies hospitalized in the NICU, while 12% do not. Silva and Silva (2010) emphasize that prevention of pain in newborns should be the goal of all health professionals, especially nurses, since repeated painful exposures have the potential for deleterious consequences. In this context, it is recommended that neonatal pain be routinely assessed before and after procedures by means of multidimensional tools chosen to guide the provision of effective pain-relief care.

Bottega et al. (2014) mention that the nursing team must recognize the need to approach pain in the newborn based on the newborn's singularity, since the repercussions that pain may cause may occur in the short and long term in health development, which confirms the care of most participants in performing pain assessment daily.

Physical therapists promote welcoming, control, and reduction strategies for states of pain in the newborn, because pain alters the newborn's entire system, removes comfort, hinders treatment, increases length of hospitalization, interferes with the response to treatment, and may cause intracranial bleeding, among other consequences. Pain control reduces deleterious effects in the newborn (Gimenez et al., 2020).

Table No. 03

Distribution of the professionals interviewed according to the method used to assess the baby's pain

METHOD USED FOR ASSESSMENT OF THE BABY'S PAIN	PROFESSIONALS	
	Nº	%
Crying	25	50
Change in behavior	19	38
Assessment scales	17	34
Verbal report of pain	16	32
Physical examination	16	32

Source: Field research, 2019

From the data in Table No. 03, it is observed that half (50%) of the interviewees assess the baby's pain through crying, 38% through changes in behavior, 34% through assessment scales, 32% through verbal report of pain, and 32% through physical examination. Half of the professionals interviewed in this study referred to identification of the type of crying as one of the characteristics most often observed in relation to pain assessment in the newborn, which may be explained by Balda and Guinsburg (2019) and Santana et al. (2023) when they report that during painful stimuli there may be subtle changes in normal crying patterns, such as prolongation of the expiratory phase, higher pitch, loss of melodic pattern, and increased duration, which help detect pain.

Changes in behavior, physical examination, and the scales used by some of the participants are supported by Silva and Silva (2010), who state that recognition of babies' pain is based on behavioral and physiological factors and on the use of scales. Some interviewees mentioned that they evaluate pain through verbal report of pain, which is inconsistent, since the newborn cannot yet use this behavior (Costa et al., 2017 and Silva; Silva, 2010).

For pain control to occur in the newborn in a NICU, the nursing team must be well trained and in sync with the physical therapy team so that the newborn may be monitored and welcomed while strategies are created to reduce pain.

Table No. 04

Distribution of the professionals interviewed according to whether pain is recorded in the medical chart, or not

PAIN RECORD IN THE MEDICAL CHART	PROFESSIONALS	
	Nº	%
Does not record	0	-
Records only pain	22	44
Records pain and location	16	32
Records pain, location, and intensity	10	20
Yes, but did not specify how	2	4
Total	50	100

Source: Field Research, 2019

Table No. 04 presents the following data: all participants record pain in the medical chart, with 44% recording only pain, 32% recording pain and location, 20% recording pain, location, and intensity, and 4% reporting that they record it but did not specify how. In addition to the need for neonatal pain control, recording these actions is essential and, according to COFEN Resolution No. 429 of February 15, 2012, it is the responsibility and duty of the nursing team to record in the patient's medical chart the care activities performed, linked to the care process and work management, thereby guaranteeing the quality and continuity of nursing care (Otoni; Grave, 2014).

Many professionals may not recognize the baby's signs of discomfort; therefore, if these signs are identified and recorded in the medical chart, they will be alerted to perform a quality intervention (Fiorenzano et al., 2019 and Garate et al., 2024).

Table No. 05

Distribution of the professionals interviewed according to the physiological signs considered most appropriate for identifying the baby's pain

PHYSIOLOGICAL SIGNS	PROFESSIONALS	
	Nº	%
Tachycardia	40	80
Tachypnea	36	72
Decreased O2 saturation	32	64
Dyspnea	13	26
Increased O2 saturation	7	14
Apnea	4	8
Bradycardia	2	4

Source: Field Research, 2019

In Table No. 05, the physiological signs considered by the professionals interviewed to be most appropriate for identifying the baby's pain are presented. The data in Table 5 show that 80% referred to tachycardia, 72% to tachypnea, 64% to decreased O2 saturation, 26% to dyspnea, 14% to increased O2 saturation, 8% to apnea, and 4% to bradycardia.

Balda and Guinsburg (2019) state that, currently, it is known that during hospitalization pain contributes to respiratory, cardiovascular, and metabolic changes in the health of the PTNB, increasing neonatal morbidity and mortality rates. As the literature states, recognition of babies' pain may be based on physiological measures (Silva; Silva, 2010; Amaral et al., 2014; and Bottega et al., 2014). In a study conducted by Caetano et al. (2013), it was found that 9% of nursing staff assessed pain through physiological parameters.

Table No. 06

Distribution of the professionals interviewed according to the behavioral signs used to identify pain in the baby

PHYSIOLOGICAL SIGNS	PROFESSIONALS	
	Nº	%
Crying	50	100
Leg movement	33	66
Arm movement	32	64
Tightly closed eyes	26	52
Chin tremor	25	50
Bulging forehead	14	28
Narrowed palpebral fissure	12	24
Tense tongue	10	20
Open mouth	10	20
Tongue protrusion	7	14
Stretched mouth	7	14
Deepened nasolabial furrow	5	10

Source: Field Research, 2019

The data in Table No. 06 show that 100% of the interviewees used crying to identify pain in the baby, 66% used leg movements, 64% used arm movements, 52% observed tightly closed eyes, 50% chin tremor, 28% bulging forehead, 24% narrowed palpebral fissure, 40% tense tongue and open mouth, 28% tongue protrusion and stretched mouth, and 10% deepened nasolabial furrow.

Recognition of pain occurs through simple or complex motor responses, facial expressions, and crying. It is worth emphasizing that recognition of babies' pain may be based on behavioral factors (Silva; Silva, 2010; Caetano et al., 2013; Amaral et al., 2014; Bottega et al., 2014). In their investigation, it was observed that 88% of the nursing staff assessed pain through behavioral changes.

FINAL CONSIDERATIONS

The procedures performed with PTNBs in the NICU may cause pain—or rather, most of them do—and this affects prolonged hospitalization. From the literature reviewed together with the field data, it is evident that the empathy established between the health professional (nurse, nursing technician, and physical therapist) makes a difference in maintaining the PTNB's well-being.

It is worth remembering that pain results from both physiological and behavioral changes, which should be observed by the health professional; in this case, the focus is on the nurse (and nursing technicians) and the physical therapist, who, when properly trained, are able to assess the intensity and frequency of pain and subsequently intervene assertively with the PTNB.

Regarding the field data, it was affirmed that the vast majority of professionals interviewed in this study have the habit of assessing daily the pain of babies hospitalized in the NICU, using behavioral methods, physiological methods, and scales. However, another piece of information that emerged concerned the need to listen to nursing technicians regarding changes in the PTNB that presents behavioral alterations and is possibly in pain, but the higher-level professional does not listen, believing that only his or her own assessment is accurate when faced with pain in PTNB patients.

The main behavioral sign these professionals use is crying, but they also observe leg movements, arm movements, tightly closed eyes, bulging forehead, narrowed palpebral fissure, tense tongue and open mouth, tongue protrusion and stretched mouth, and deepened nasolabial furrow.

With regard to physiological signs, the interviewed professionals referred to tachycardia, tachypnea, decreased O2 saturation, dyspnea, increased O2 saturation, apnea, and bradycardia. Half of the professionals were unable to indicate which scale they knew, and those who could identified the Neonatal Infant Pain Scale (NIPS), endorsed by the literature.

Recording these actions in the medical chart is essential to ensure the quality and continuity of the intervention with the baby. The effective participation of all professionals in neonatal pain assessment in this study suggests that this is a type of care that can involve interdisciplinary action, which would greatly improve quality of life during hospitalization in the NICU. PTNBs are susceptible to pain, and the cited literature showed that when pain is not treated the newborn may present long-term physical and psychological sequelae.

Pain should be approached in a multidimensional way, as has already been stated, and physical therapists and nurses should have knowledge of the procedures that cause pain so that effective resources may be provided to minimize the pain of these patients. However, for this to occur, the nursing technicians' team must be trained in the perception, analysis, and description of pain, in chart recording, and in the use of the NIPS Scale, among others.

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HUMANIZED OBSTETRIC CARE AS A STRATEGY TO REDUCE UNNECESSARY INTERVENTIONS AND IMPROVE MATERNAL AND NEONATAL OUTCOMES

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Abstract

Humanized obstetric care has emerged as an essential strategy to improve the quality of care for women during pregnancy, childbirth, and the postpartum period, contributing to the reduction of unnecessary interventions and better maternal and neonatal outcomes. This study aims to analyze the importance of humanization in obstetric care and its impacts on clinical practice. This is an integrative literature review with a qualitative approach, based on scientific databases and publications by authors such as Michel Odent, Robbie Davis-Floyd, as well as recommendations from the World Health Organization. The results indicate that humanized practices, including respect for women's autonomy, the judicious use of interventions, and the encouragement of physiological childbirth, are associated with a reduction in unnecessary cesarean sections, fewer complications, and higher maternal satisfaction. Furthermore, improvements in neonatal indicators were observed, such as reduced prematurity rates and fewer invasive

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procedures in newborns. It is concluded that the adoption of humanized care models is fundamental to promoting safe, ethical, and woman-centered care, highlighting the need for continuous professional training and the implementation of public policies that strengthen this approach.

Keywords: Obstetric care, Humanized childbirth, Unnecessary interventions, Maternal health, Neonatal health.

INTRODUCTION

Humanized obstetric care has stood out as a fundamental approach for improving the quality of care provided to women during the pregnancy-puerperal cycle, prioritizing respect for the physiology of childbirth, female autonomy, and the reduction of unnecessary interventions. This model stands in opposition to the technocratic paradigm, historically centered on the medicalization of childbirth, marked by the excessive use of procedures such as cesarean sections, episiotomies, and inductions without clinical indication, which may pose risks to maternal and neonatal health (Odent, 2003; World Health Organization, 2018).

In view of this context, the following research problem is defined: in what way does humanized obstetric care contribute to the reduction of unnecessary interventions and to the improvement of maternal and neonatal outcomes? The relevance of this issue is evidenced by the high rates of obstetric interventions in Brazil, especially cesarean sections, frequently performed without clinical indication, contrary to recommendations based on scientific evidence (Leal et al., 2014).

The general objective of this study is to analyze humanized obstetric care as a strategy to reduce unnecessary interventions and improve maternal and neonatal outcomes. The specific objectives include: understanding the principles of childbirth humanization; identifying unnecessary obstetric interventions; and evaluating the impacts of this approach on the health of women and newborns.

The justification for this study is based on the need to promote safer, more ethical, and woman-centered care practices, aligned with scientific evidence and public health guidelines. In Brazil, policies such as Rede Cegonha reinforce the importance of humanizing childbirth and birth care, with the aim of improving the quality of maternal and child care (Brazil, 2011).

In the theoretical field, the humanization of obstetric care involves valuing childbirth as a physiological event and integrating the technical and emotional aspects of care. According to Davis-Floyd (2001), models of childbirth care can be understood within different paradigms, with the humanistic model being the one that balances technology and woman-centered care. For Odent (2003), the environment and care practices directly influence labor, making it essential to ensure conditions that favor its natural progression. Furthermore, the World Health Organization (2018) recommends evidence-based practices, with emphasis on women's protagonism and on reducing routine interventions without clinical indication.

METHODOLOGY

TYPE OF STUDY

This is a qualitative study, with a descriptive and exploratory approach, developed through an integrative literature review. This type of research allows for the synthesis of previously produced knowledge, making possible a broader understanding of humanized obstetric care and its impacts on reducing unnecessary interventions and improving maternal and neonatal outcomes (Souza; Silva; Carvalho, 2010).

SEARCH STRATEGY AND STUDY SELECTION

Data collection was carried out through a bibliographic survey in scientific databases, such as the Virtual Health Library (VHL), Scientific Electronic Library Online (SciELO), and PubMed. Controlled and uncontrolled descriptors were used, such as: "obstetric care," "humanization of childbirth," "obstetric interventions," and "maternal and child health," combined using Boolean operators (AND, OR).

As inclusion criteria, articles published between 2013 and 2023, available in full text, in Portuguese, English, and Spanish, and directly addressing the proposed theme were considered. Duplicate studies, abstracts, editorials, and papers not relevant to the objective of the research were excluded.

DATA ANALYSIS PROCEDURES

Data analysis was conducted through the critical and systematic reading of the selected studies, followed by thematic categorization of the information. This stage made it possible to identify patterns, convergences, and divergences among the findings, organizing them into thematic axes related to the humanization of care, obstetric interventions, and maternal and neonatal outcomes.

The integrative review, as proposed by Mendes, Silveira, and Galvão (2008), involves stages such as problem definition, literature search, study evaluation, data analysis, and presentation of results, ensuring methodological rigor and reliability in the synthesis of evidence.

ETHICAL ASPECTS

As this is a study based on secondary public-domain data, submission to a Research Ethics Committee was not necessary. However, ethical principles related to scientific integrity were respected, with due citation of the authors and sources used, in accordance with ABNT standards.

METHODOLOGICAL FOUNDATION

The choice of the integrative review as a method is justified by its ability to gather and synthesize the results of relevant research, contributing to evidence-based practice in the health field. According to Mendes, Silveira, and Galvão (2008), this method makes it possible to incorporate different research designs, broadening the understanding of the phenomenon under study.

In addition, studies indicate that the use of scientific evidence in obstetric care is essential for reducing unnecessary practices and promoting safer and more humanized care (World Health Organization, 2018), reinforcing the importance of rigorous methodologies in knowledge production.

RESULTS AND DISCUSSION

The analysis of the selected studies showed that humanized obstetric care has been widely associated with improved quality of care and the reduction of unnecessary interventions in the context of labor and childbirth. There was a predominance of research published in the last decade, with different methodological designs, which allowed for a comprehensive understanding of the topic. The findings indicate that the adoption of woman-centered practices contributes significantly to reducing the medicalization of childbirth, favoring physiology and respecting women's protagonism (Leal et al., 2014; World Health Organization, 2018).

With regard to obstetric interventions, the studies demonstrate a significant reduction in the performance of cesarean sections without clinical indication, routine episiotomies, and the indiscriminate use of oxytocin in contexts where the humanization of care is prioritized. These results reinforce the importance of the judicious use of health technologies, in line with international recommendations, which guide the adoption of evidence-based practices centered on women's individual needs (World Health Organization, 2018).

Table 1 presents a synthesis of the main findings related to the reduction of unnecessary obstetric interventions identified in the analyzed studies.

Table 1

Reduction of obstetric interventions in humanized care models

Obstetric intervention	Traditional model	Humanized model
Cesarean section without indication	High frequency	Significant reduction
Routine episiotomy	Frequent	Restricted use
Use of oxytocin	Indiscriminate	Judicious use
Restriction of mobility	Common	Encouragement of free movement

Source: Prepared by the author, based on Leal et al. (2014) and World Health Organization (2018).

In addition to the reduction of interventions, a positive impact on maternal and neonatal outcomes was found. The evidence points to a lower incidence of complications during childbirth, a reduction in infections, a lower rate of prematurity, and better conditions for newborn adaptation. The adoption of practices such as immediate skin-to-skin contact and the encouragement of early breastfeeding directly contribute to these results, in addition to strengthening the bond between mother and baby (Brazil, 2011).

Table 2 synthesizes the main maternal and neonatal outcomes associated with humanized obstetric care.

Table 2

Main outcomes associated with humanized obstetric care

Outcomes	Observed impact
Maternal complications	Reduction
Puerperal infections	Reduction
Prematurity	Decrease
Interventions in the newborn	Lower occurrence
Maternal satisfaction	Increase

Source: Prepared by the author, based on Brazil (2011) and Davis-Floyd (2001).

Another relevant aspect concerns women's experience during childbirth. The analyzed studies indicate greater maternal satisfaction when care is based on humanized principles, including respect for autonomy, the presence of a companion, and a welcoming environment. These factors contribute to a more positive childbirth experience and to better emotional and psychological outcomes (Davis-Floyd, 2001; Odent, 2003).

The discussion of the findings shows that humanized obstetric care is in line with current recommendations in the scientific literature, which emphasize the need to reorient the model of childbirth care. Despite advances, challenges still persist regarding the implementation of these practices, especially in relation to institutional culture and the training of health professionals. Thus, the consolidation of a humanized model requires investment in continuing education, organizational changes, and the strengthening of public policies focused on maternal and child health (Brazil, 2011; World Health Organization, 2018).

CONCLUSION

The present study aimed to analyze humanized obstetric care as a strategy for reducing unnecessary interventions and improving maternal and neonatal outcomes. Based on the integrative literature review, it was possible to understand that the adoption of practices grounded in the humanization of care contributes significantly to improving the quality of assistance during labor and childbirth.

The main results showed that humanized care models are associated with a decrease in obstetric interventions without clinical indication, such as elective cesarean sections, routine episiotomies, and the indiscriminate use of oxytocin. In addition, a positive impact on maternal and neonatal outcomes was observed, including a reduction in complications, a lower incidence of infections, decreased prematurity, and increased maternal satisfaction. These findings reinforce the importance of practices that respect the physiology of childbirth, women’s protagonism, and the judicious use of health technologies.

As a contribution, this study highlights the relevance of humanized obstetric care as an effective strategy for promoting safer, more ethical, and woman-centered care, in addition to supporting professional practice based on scientific evidence. Furthermore, it reinforces the need to strengthen public policies and invest in the training of health professionals, with a view to consolidating this model of care.

Finally, it is suggested that future research deepen the analysis of the challenges involved in implementing humanization in different health contexts, as well as investigate strategies that favor the adherence of professionals and institutions to evidence-based practices. The conduct of longitudinal studies that assess the long-term impacts of humanized care on maternal and child health indicators is also recommended.

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IMPACT OF LATE ASD DIAGNOSIS ON FUNCTIONAL DEVELOPMENT IN LOW - AND MIDDLE-INCOME COUNTRIES

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Abstract

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by difficulties in communication, social interaction, and restricted behavioral patterns. This study aims to analyze the impact of late diagnosis of ASD on the functional development of individuals in low- and middle-income countries. This is an integrative literature review with a qualitative approach, based on scientific articles published in national and international databases. The results indicate that late diagnosis is associated with significant impairments in cognitive, social, and adaptive domains, as well as increased family burden and reduced access to early interventions. It was also observed that factors such as limitations in healthcare systems, lack of professional training, and socioeconomic barriers contribute to delayed diagnosis. It is concluded that early identification of ASD is essential for implementing effective therapeutic strategies, highlighting the need for public policies, professional training, and expanded access to healthcare services to reduce negative impacts on functional development.

Keywords: Autism spectrum disorder, Developing countries, Functional development, Late diagnosis, Social vulnerability.

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INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by persistent deficits in communication and social interaction, associated with restricted and repetitive patterns of behavior, interests, or activities (American Psychiatric Association, 2014). In recent decades, a significant increase in the prevalence of ASD has been observed globally, which has driven advances in clinical recognition, diagnostic criteria, and intervention strategies. Despite these advances, important inequalities in access to diagnosis and care persist, especially in low- and middle-income countries, where structural and socioeconomic limitations hinder the early identification of cases (Elsabbagh et al., 2012).

Early detection of ASD is considered a determining factor for better outcomes in functional development, since it allows the implementation of therapeutic interventions during critical periods of brain development, marked by greater neural plasticity (Dawson et al., 2010). However, in contexts of greater social vulnerability, diagnosis often occurs late, which can significantly impair the cognitive, social, and adaptive development of affected individuals (Lord et al., 2020). This scenario highlights an important gap between the available scientific knowledge and its practical application in healthcare systems with limited resources.

Given this context, the following research question is defined: in what way does late ASD diagnosis impact the functional development of individuals in low- and middle-income countries? This issue involves multiple factors, including the scarcity of trained professionals, the low availability of specialized services, the social stigma associated with neurodevelopmental disorders, and cultural barriers that hinder the early recognition of ASD signs (WHO, 2013).

The general objective of this study is to analyze the impact of late ASD diagnosis on functional development in low- and middle-income countries. The specific objectives are: to identify the main factors associated with diagnostic delay; to analyze the functional impairments resulting from this delay in different areas of development; and to discuss strategies that may favor early detection and broaden access to effective interventions in these contexts.

The relevance of this study is justified by the need to expand understanding of the effects of late ASD diagnosis, especially in vulnerable populations, where inequalities in access to healthcare are more evident. Late identification may result in greater functional impairment, increased family burden, and reduced opportunities for social and educational inclusion (Zeydanli; Fagundes; Silva, 2019). Thus, investigating this phenomenon contributes to the strengthening of more equitable and effective public policies and care practices.

From a theoretical perspective, the literature shows that early interventions, especially those based on behavioral and developmental approaches, are effective in promoting social, communicative, and adaptive skills in children with ASD (Rogers; Dawson, 2010). In addition, studies emphasize that the absence of timely diagnosis and intervention may intensify functional deficits throughout life, affecting individuals' autonomy and quality of life (Lord et al., 2020). Therefore, understanding the impacts of late diagnosis becomes essential for guiding more accessible and effective care strategies, particularly in low- and middle-income countries, where the challenges are even more complex.

METHODOLOGY

TYPE OF RESEARCH

This study is characterized as basic research, with a qualitative approach and an exploratory and descriptive nature, conducted through an integrative literature review. The choice of this method is justified by the possibility of synthesizing and critically analyzing the knowledge already produced on the impact of late diagnosis of autism spectrum disorder (ASD) on functional development in low- and middle-income countries, as pointed out by authors such as Whittemore and Knafl (2005).

SEARCH STRATEGY AND STUDY SELECTION

The search was conducted in national and international scientific databases, such as PubMed, SciELO, LILACS, and Google Scholar, using controlled and uncontrolled descriptors related to the topic, such as: “autism spectrum disorder,” “late diagnosis,” “functional development,” and “developing countries.” Articles published between 2010 and 2024, in Portuguese, English, and Spanish, that directly addressed the proposed topic were included. Duplicate studies, articles without access to the full text, and those not directly related to the research objective were excluded.

INCLUSION AND EXCLUSION CRITERIA

Original studies, systematic reviews, meta-analyses, and clinical guidelines addressing ASD diagnosis and its implications for functional development were included. Opinion articles, editorials, isolated case reports, and publications that did not present adequate methodological rigor were excluded. The selection followed the principles of the PRISMA method, aiming to ensure transparency and reproducibility in the study selection process (Moher et al., 2009).

DATA ANALYSIS

Data analysis was carried out through critical reading and narrative synthesis of the selected studies, allowing the identification of patterns, convergences, and divergences among the findings. The data were organized into thematic categories, considering aspects such as the cognitive, social, and adaptive impact of late diagnosis, as well as factors associated with barriers to access to diagnosis. This approach allows for a broad and in-depth understanding of the phenomenon studied, as suggested by Souza, Silva, and Carvalho (2010).

EVIDENCE-BASED DISCUSSION

The analysis of the studies shows that late ASD diagnosis is directly related to worse outcomes in functional development, especially in low- and middle-income contexts. According to Dawson et al. (2010), early intervention is essential to take advantage of critical periods of brain development, promoting significant gains in social and cognitive skills. However, the absence of timely diagnosis limits access to these interventions, increasing difficulties throughout life.

In addition, structural factors, such as the insufficiency of specialized services and the limited training of healthcare professionals, contribute to diagnostic delay, as highlighted by Elsabbagh et al. (2012). The World Health Organization (WHO, 2013) reinforces that healthcare systems in low- and middle-income countries face significant challenges in meeting demands related to neurodevelopmental disorders.

Another relevant aspect is the impact of late diagnosis on the family, which often faces a greater emotional burden and difficulties in managing the individual with ASD without adequate support (Zeydanli; Fagundes; Silva, 2019). Thus, it is observed that the issue involves not only the individual, but also their social and family context, requiring multidisciplinary approaches and effective public policies.

Thus, the methodology adopted makes it possible to comprehensively understand the impact of late ASD diagnosis, highlighting the need for strategies that promote early diagnosis and broaden access to healthcare services, especially in more vulnerable regions.

RESULTS AND DISCUSSION

The findings of this integrative review show that late diagnosis of autism spectrum disorder (ASD) in low- and middle-income countries is associated with significant impairments in functional development, especially in the cognitive, social, and adaptive areas. It is observed that most diagnoses occur after early childhood, a period considered critical for neuropsychomotor development and for the effectiveness of early interventions (Dawson et al., 2010).

In addition, the studies analyzed indicate that children diagnosed late show greater difficulties in language acquisition, lower capacity for social interaction, and greater dependence in activities of daily living. These findings corroborate the literature indicating that diagnostic delay reduces opportunities for evidence-based intervention, negatively impacting functional prognosis (Lord et al., 2020).

Table 1

Main Impacts of Late ASD Diagnosis

Development Dimension	Observed Impacts	Reference Authors
Cognitive	Language delay, learning difficulties	Dawson et al. (2010)
Social	Interaction and social communication deficits	American Psychiatric Association (2014)
Adaptive	Reduced autonomy and greater dependence	Lord et al. (2020)
Family	Emotional burden and management difficulties	Zeydanli; Fagundes; Silva (2019)

The analysis also reveals that structural factors play a central role in diagnostic delay, such as limited access to healthcare services, the scarcity of trained professionals, and the lack of public policies aimed at early ASD screening (Elsabbagh et al., 2012). In low- and middle-income countries, these limitations are even more evident, resulting in inequalities in access to diagnosis and treatment.

According to the World Health Organization (WHO, 2013), healthcare systems with low coverage and limited resources face difficulties in implementing screening and early diagnosis programs, which contributes to the late identification of neurodevelopmental disorders. This scenario reinforces the need for strategies aimed at training primary care professionals and expanding access to specialized services.

Another relevant point identified in the studies is the impact of late diagnosis on the quality of life of individuals with ASD and their families. The absence of early interventions is associated with higher levels of family stress, educational difficulties, and lower social inclusion (Zeydanli; Fagundes; Silva, 2019). Such evidence reinforces the importance of multidisciplinary approaches and integration among health, education, and social assistance sectors.

The literature also highlights that evidence-based early interventions, such as those described by Rogers and Dawson (2010), are capable of promoting significant gains in the development of social and communicative skills. However, limited access to these interventions in low- and middle-income contexts constitutes an important challenge for improving clinical outcomes.

Thus, the results obtained in this review indicate that late ASD diagnosis represents a critical factor that compromises functional development, making it necessary to strengthen public policies, expand the care network, and implement early detection strategies. Overcoming these barriers may significantly contribute to improving the quality of life of individuals with ASD and their families, especially in contexts of greater social vulnerability.

CONCLUSION

The present study aimed to analyze the impact of late diagnosis of autism spectrum disorder (ASD) on functional development in low- and middle-income countries, seeking to understand the main factors associated with this delay and its consequences in the different dimensions of human development.

The results showed that late diagnosis is directly related to significant impairments in cognitive, social, and adaptive development, in addition to implying greater burden for families and reduced opportunities for early intervention. It was also observed that factors such as structural limitations of healthcare systems, scarcity of trained professionals, and socioeconomic inequalities contribute significantly to delays in the identification of ASD.

The contributions of this research consist in reinforcing the importance of early diagnosis as an essential strategy for improving the functional prognosis of individuals with ASD, especially in contexts of greater social vulnerability. In addition, the study highlights the need to strengthen public policies aimed at training healthcare professionals, expanding access to specialized services, and implementing early screening programs.

In view of the findings, it is suggested that future research delves deeper into the analysis of low-cost intervention strategies adapted to the reality of low- and middle-income countries, as well as studies that evaluate the effectiveness of public policies aimed at early ASD diagnosis. It is also important to develop longitudinal studies that allow the impact of late diagnosis to be followed throughout the life cycle.

Thus, it is concluded that early ASD diagnosis is fundamental for better outcomes in functional development, making it essential to adopt measures that reduce barriers to diagnosis and expand access to appropriate interventions, promoting greater equity and quality of life for individuals with ASD and their families.

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THE IMPACT OF EXCESSIVE SCREEN USE ON MENTAL HEALTH AND SLEEP QUALITY IN YOUNG PEOPLE AND ADULTS

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Abstract

This study aims to analyze the impact of excessive screen use on mental health and sleep quality in young people and adults. It is an integrative literature review with a qualitative approach, based on scientific articles published in national and international databases, including recent studies on digital behavior, mental health, and sleep disorders. The results indicate that prolonged use of electronic devices, especially at night, is associated with increased symptoms of anxiety, depression, and stress, as well as significant impairments in sleep quality, such as insomnia, reduced sleep duration, and sleep fragmentation. Exposure to blue light and cognitive overstimulation are identified as key contributing factors. It is concluded that excessive screen use represents an important risk factor for mental health and sleep quality, highlighting the need for health education strategies, promotion of sleep hygiene, and conscious use of technology to improve overall quality of life.

Keywords: Anxiety, Digital technologies, Mental health, Screen use, Sleep quality.

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INTRODUCTION

The use of digital technologies and electronic devices has become an integral part of everyday life, especially among young people and adults. Smartphones, computers, and tablets are widely used for academic, professional, and entertainment purposes, contributing to connectivity and rapid access to information. However, the excessive use of these technologies, particularly during nighttime hours, has raised concerns regarding their effects on mental health and sleep quality.

In this context, the following research question is defined: in what way does excessive screen use influence mental health and sleep quality in young people and adults? Based on this issue, the general objective of this study is to analyze the impacts of prolonged use of electronic devices on these two aspects of health. The specific objectives are: to identify the main effects of excessive screen use on mental health; to assess the changes in sleep quality associated with this behavior; and to discuss prevention strategies and the promotion of healthy habits related to the use of technology.

The rationale for this study is grounded in the growing incidence of sleep disorders and mental disorders, such as anxiety and depression, especially in populations intensely exposed to digital technologies. Understanding this relationship is essential to support health education actions and to guide more balanced practices in the use of electronic devices.

From a theoretical perspective, studies indicate that prolonged exposure to screens, especially to the blue light emitted by these devices, interferes with the production of melatonin, the hormone responsible for sleep regulation, thereby hindering the onset and maintenance of rest. In addition, excessive use is associated with cognitive overstimulation, increased social comparison on digital networks, and information overload, factors that contribute to the development of symptoms such as stress, anxiety, and mental fatigue. Thus, the need to deepen the understanding of the impacts of screen use on health becomes evident, considering its individual and collective implications.

METHODOLOGY

TYPE OF RESEARCH

This is a qualitative study designed as an integrative literature review, a method widely used in the health field because it allows for the synthesis of knowledge and the incorporation of scientific evidence into practice. This type of study makes it possible to gather and analyze research findings with different methodological approaches, favoring a comprehensive understanding of the impact of excessive screen use on mental health and sleep quality in young people and adults. In addition, the integrative review contributes to the identification of gaps in knowledge, thereby guiding future investigations.

SEARCH STRATEGY AND STUDY SELECTION

The search for studies was carried out systematically in recognized scientific databases, including the Virtual Health Library (VHL), Scientific Electronic Library Online (SciELO), and PubMed. Controlled and uncontrolled descriptors were used, extracted from the Health Sciences Descriptors (DeCS) and the Medical Subject Headings (MeSH), such as: “screen use,” “screen time,” “mental health,” “sleep quality,” “electronic devices,” and “blue light.” These terms were combined using the Boolean operators AND and OR in order to broaden and refine the search results.

As inclusion criteria, articles published between 2015 and 2025 were selected, available in full text, in Portuguese, English, and Spanish, and directly addressing the relationship between screen use, mental health, and sleep in young and adult populations. Duplicate studies, non-systematized reviews, editorials, letters to the editor, incomplete works, and research that did not align with the proposed objective were excluded.

The selection process occurred in stages: initially, the titles and abstracts were read in order to screen potentially relevant studies. Subsequently, the selected articles were read in full, with the inclusion and exclusion criteria being applied. At the end, the eligible studies comprised the review sample.

INSTRUMENTS AND DATA ORGANIZATION

For the extraction and organization of information, an instrument was developed containing variables such as: author(s), year of publication, country of origin, study objective, type of methodological design, main results, and conclusions. This process enabled the systematization of the data and facilitated comparison among the included studies. The data were organized into tables and thematic categories, favoring the critical analysis and interpretation of the findings.

DATA ANALYSIS PROCEDURES

Data analysis was performed using a descriptive and interpretive approach, based on the thematic analysis technique. Initially, the studies were read in depth, seeking to identify common and divergent elements. Subsequently, the findings were grouped into analytical categories, such as: psychological impacts of excessive screen use, physiological changes related to sleep, and behavioral factors associated with nighttime use of electronic devices.

This stage allowed for the construction of a critical synthesis of the available knowledge, highlighting recurring patterns, causal relationships, and possible explanatory mechanisms for the observed effects. In addition, it made it possible to identify moderating factors, such as age, exposure time, type of content consumed, and social context.

ETHICAL ASPECTS

As this was an integrative literature review, the study did not directly involve human subjects, and therefore submission to a Research Ethics Committee was not necessary. Nevertheless, the ethical principles of scientific research were strictly respected, including fidelity in data presentation, respect for authorship, and the correct citation of the sources used, thereby avoiding any form of plagiarism.

METHODOLOGICAL RIGOR AND STUDY LIMITATIONS

In order to ensure methodological rigor, clear criteria for the selection and analysis of studies were adopted, as well as the use of recognized databases and standardized descriptors. The systematic organization of the stages contributed to the transparency and reproducibility of the research.

However, some limitations must be considered. Dependence on the methodological quality of the included studies may influence the consistency of the results presented. In addition, the temporal and linguistic restriction may have excluded relevant studies published outside the established criteria. Another point concerns the heterogeneity of the designs of the studies analyzed, which may make it difficult to generalize the findings.

METHODOLOGICAL DISCUSSION

The choice of the integrative review proved appropriate to the objective of the study, since it enabled a broad analysis of a contemporary and multifactorial phenomenon. The growing use of digital technologies and their impacts on health require approaches that integrate different scientific perspectives, including biological, psychological, and social aspects.

In this sense, the adopted methodology allowed not only the synthesis of existing knowledge, but also critical reflection on the challenges associated with excessive screen use. The results obtained reinforce the need for new research, especially longitudinal and experimental studies, which may deepen the understanding of causal relationships and contribute to the development of effective interventions aimed at promoting mental health and sleep quality.

RESULTS AND DISCUSSION

The results of this integrative review show a consistent association between excessive screen use and significant harm to mental health and sleep quality in young people and adults. The analysis of the selected studies demonstrated that prolonged exposure to electronic devices, especially during nighttime hours, is directly related to an increase in symptoms such as anxiety, depression, stress, and irritability.

With regard to mental health, several studies indicate that intensive use of social media and other digital platforms favors social comparison, technological dependence, and information overload, factors that contribute to psychological distress. In addition, the constant need for connection and updating may generate a sense of urgency and difficulty relaxing, negatively affecting emotional well-being.

Regarding sleep quality, the findings indicate that exposure to the blue light emitted by screens interferes with the production of melatonin, an essential hormone for the regulation of the sleep-wake cycle. As a consequence, delayed sleep onset, reduction in total sleep duration, and greater fragmentation are observed, resulting in non-restorative sleep. Studies also highlight that the use of electronic devices before bedtime is associated with insomnia and daytime fatigue.

The literature analyzed reinforces that these impacts are intensified by factors such as duration of use, type of content accessed, and individual context. Young people tend to be more vulnerable due to greater exposure to social media, while adults may present greater impairment related to the continuous professional use of technology.

In a complementary manner, some studies suggest that the adoption of sleep hygiene strategies, such as reducing screen use before bedtime, controlling exposure time, and using blue light filters, may contribute to minimizing the negative effects observed.

A synthesis of the main findings identified in the literature is presented below:

Aspect Analyzed	Main Results Observed
Mental health	Increase in anxiety, depression, and stress
Sleep quality	Insomnia, reduced duration, and fragmented sleep
Associated factors	Nighttime use, blue light, social media
Preventive strategies	Sleep hygiene, reduced screen time

The interpretation of the results shows consistency with the current scientific literature, which recognizes excessive screen use as an emerging risk factor for health. Although digital technologies bring undeniable benefits, their dysregulated use may lead to significant impacts, reinforcing the need for awareness and interventions aimed at promoting healthier habits.

Finally, it is emphasized that the complexity of the topic requires multidisciplinary approaches involving professionals from health, education, and technology in order to promote balance between the use of digital tools and the preservation of mental health and sleep.

CONCLUSION

The present study aimed to analyze the impacts of excessive screen use on mental health and sleep quality in young people and adults. Based on the integrative literature review, it was possible to understand comprehensively the main implications of this behavior for individuals' biopsychosocial well-being.

The results showed that prolonged use of electronic devices, especially during nighttime hours, is associated with increased symptoms of anxiety, stress, and depression, in addition to significant impairments in sleep quality, such as insomnia, reduced duration, and sleep fragmentation. Exposure to blue light and cognitive overstimulation were identified as central factors in this process, contributing to changes in the sleep-wake cycle and emotional balance.

As a contribution, this study reinforces the importance of raising awareness about the conscious use of digital technologies, highlighting the need for health promotion strategies, such as the adoption of sleep hygiene practices and the limitation of screen exposure time. In addition, the findings may support health and education professionals in the development of interventions aimed at preventing health problems related to the excessive use of electronic devices.

Finally, future research with longitudinal and experimental designs is suggested in order to deepen the understanding of the causal relationships between screen use and impacts on mental health and sleep. The importance of investigations that consider different age groups, sociocultural contexts, and types of technology use is also highlighted, contributing to the development of more effective and targeted strategies.

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SELF-MEDICATION WITH SEMAGLUTIDE FOR WEIGHT LOSS IN BRAZIL

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Abstract

Self-medication has emerged as a public health problem in Brazil, especially in light of the increase in the use of semaglutide for aesthetic purposes and rapid weight loss. Originally indicated for the treatment of type 2 diabetes and clinical obesity, the substance began to be consumed indiscriminately, influenced by factors such as aesthetic pressure and the dissemination of information on social media. This scenario has raised concern regarding the risks arising from this practice, which range from gastrointestinal effects to serious complications, such as retinopathy and the risk of neoplasms. The present study aimed to analyze the risks of self-medication with semaglutide, highlighting its clinical, social, and ethical impacts. This is a qualitative and descriptive literature review, carried out through the analysis of scientific publications between 2018 and 2025, selected from national and international databases. The results demonstrated that self-medication increased the risks of adverse effects, reduced the appreciation of professional practice, and strengthened unsafe consumption practices. Furthermore, it was observed that broad media dissemination contributed to the trivialization of the medication and to the increase in its off-label use. It is concluded that self-medication with semaglutide requires greater regulatory attention, as well as

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strategies to raise public awareness and to enhance the value of professional guidance, in order to promote the rational use of medicines and prevent harm to collective health.

Keywords: Self-medication, Social media, Public health, Pharmacotherapy, Patient safety.

INTRODUCTION

Obesity has become one of the main public health challenges in Brazil and worldwide, being responsible for significant impacts on quality of life and for increasing the incidence of chronic diseases. This condition, characterized by the excessive accumulation of body fat, involves biological, genetic, psychological, and social factors, going beyond the simple relationship between caloric intake and energy expenditure (Lima; Rinald; Andrade, 2024). In this context, the search for rapid solutions for weight loss intensified, leading to the growing consumption of medications with potential slimming effects. Among them, semaglutide stood out, initially developed for the treatment of type 2 diabetes, but used indiscriminately for aesthetic purposes due to its proven effect on reducing body weight (Trabulsi et al., 2023).

The wide dissemination of information through social media contributed to popularizing the use of semaglutide, encouraging self-medication. Studies demonstrated that media exposure, combined with the valorization of aesthetic standards, drove increased demand for weight-loss medications without proper professional guidance (Freitas; Baiense; Andrade, 2024). This phenomenon became even more concerning in light of the social pressure to value an ideal body, which historically has already led to the use of harmful weight-loss practices and which, in contemporary times, found in semaglutide an apparently effective alternative, yet one surrounded by risks (Santos; Deuner, 2024).

The practice of self-medication with semaglutide raised questions about its clinical, social, and ethical implications. Use outside approved indications (off-label) brought to light concerns about the limits of patient autonomy, the devaluation of health professionals, and possible harms related to consumption without a prescription. Evidence indicated that this behavior may provoke anything from gastrointestinal reactions to more serious complications, such as retinopathy and the risk of thyroid cancer, when used over a prolonged period (Dias et al., 2023). Thus, the need emerged to investigate in depth the risks associated with the inappropriate use of the substance, especially in individuals without a clinical diagnosis of obesity or diabetes.

This research problem led to the formulation of the following guiding question: what are the main risks of self-medication with semaglutide for the health of the Brazilian population? This question proved relevant in light of the significant increase in the consumption of this drug and the evidence that its use in individuals outside the target population may intensify adverse effects, compromising patient safety (Andrade et al., 2023). The answer to this question became essential not only for the academic field, but also for health practice, since it made it possible to broaden the discussion on the conscious use of medicines and the need for professional follow-up.

In this way, the general objective of this research was to present the risks of self-medication with semaglutide in Brazil. As specific objectives, it sought to highlight the main harms to individual health resulting from inappropriate use and to identify the disseminating agents responsible for amplifying improper consumption. The relevance of the study was justified by the growth of self-medication with this drug, by the social and public health impact of its adverse effects, and by the need to raise public awareness regarding the rational use of medicines (Campos et al., 2024).

DEVELOPMENT

METHODOLOGY

The present research was characterized as a qualitative and descriptive literature review, developed from the analysis of scientific publications addressing the use of semaglutide, its effects related to weight loss, and the risks of self-medication. The time frame considered covered the period between 2018 and 2025, in order to include recent productions that reflected the advancement of discussions on the subject.

The inclusion criteria adopted were scientific articles, dissertations, theses, technical manuals, and institutional documents available in Portuguese and English that dealt directly with semaglutide, obesity, weight loss, off-label use, and possible adverse effects of the drug. Materials consisting only of abstracts, initial impressions, or opinion texts without a scientific basis were excluded.

Data collection was carried out in recognized scientific databases, such as Google Scholar, PubMed, SciELO, the Virtual Health Library (BVS), and the CAPES Journal Portal, in addition to official documents made available by regulatory bodies such as the Brazilian Health Regulatory Agency (Anvisa) and the World Health Organization (WHO). These sources were selected for their relevance and credibility, enabling a well-founded analysis of the object of study.

For the search, descriptors combined with Boolean operators (AND and OR) were used, among which the following stood out: “semaglutide,” “weight loss,” “obesity,” “self-medication,” “adverse effects,” and “off-label use.” The final selection of the works was made according to their relevance to the central objective of this research, ensuring consistency and methodological adequacy for the investigation.

RESULTS AND DISCUSSION

Obesity was characterized as a complex and multifactorial condition, marked by the excessive accumulation of body fat. The reviewed studies highlighted that this disease could not be explained solely by high food consumption, but was related to genetic, biological, behavioral, and social factors. In addition, it was associated with an increased risk of type 2 diabetes, cardiovascular diseases, and functional difficulties, which reinforces its seriousness as a public health challenge (Lima; Rinald; Andrade, 2024).

Although it is widely recognized as a collective health problem, obesity has often been interpreted as an individual failure, associated with a lack of dietary discipline or the absence of regular physical activity. This reductionist view neglected determining factors and worsened the stigmatization of people with excess weight. The need to revise this paradigm is reinforced, showing that the management of obesity requires public policies and integrated care strategies (Martins, 2018).

In the current context, aesthetic pressure has become a highly relevant factor in the adoption of rapid and, in many cases, unsafe weight-loss behaviors. The social standard that values thinness fostered the use of pharmacological alternatives without professional follow-up, such as semaglutide. Thus, it was observed that the search for the ideal body went beyond genuine concerns with health and well-being, favoring the growth of self-medication practices (Santos; Deuner, 2024).

It has been pointed out that social media played a central role in the popularization of semaglutide for aesthetic purposes. The dissemination of personal experiences, reports of accelerated weight loss, and the promotion of the medication as a quick solution were factors that encouraged its use without medical support (Mailhac et al., 2024). This process contributed to the spread of off-label consumption and to the increase in indiscriminate access to the substance, expanding the risks associated with self-medication (Freitas; Baiense; Andrade, 2024).

According to Freitas, Baiense, and Andrade (2024), the manipulative power of social media drives the pursuit of aesthetic standards and the indiscriminate use of weight-loss drugs. Although these medications may be effective, self-medication is dangerous due to the inherent adverse reactions. Therefore, medical follow-up is necessary for a rigorous risk-benefit assessment and for the prescription of appropriate treatment, thus ensuring the individual’s safety.

The off-label use of this pharmacological agent, exacerbated by media influence and aesthetic demand, imposes an urgent regulatory challenge. Such a scenario increases the risk of self-medication and the omission of medical follow-up, potentially generating significant iatrogenic consequences. It is crucial that its administration be strictly mediated by a multidisciplinary team, ensuring rigorous supervision of treatment in order to optimize the safety-efficacy relationship within a context of appropriate and non-indiscriminate therapeutic indication (Campos et al., 2024).

From a pharmacological point of view, semaglutide belongs to the class of GLP-1 analogues, acting in glucose regulation, appetite reduction, and the control of caloric intake. These mechanisms explained its efficacy in weight loss and justified the growing demand for the medication. However, the same studies warned that the substance presented relevant adverse effects, especially when used without an appropriate clinical indication (Trabulsi et al., 2023).

The drug under analysis, semaglutide, demonstrates a significant satiating and anorexigenic effect, being effective in reducing appetite and promoting satiety, which supports its use in controlling excess weight in association with a lifestyle-modification program. Nevertheless, clinical evaluation must weigh the costs and the incidence of transient gastrointestinal adverse events, such as nausea and diarrhea (Andrade et al., 2023).

Also according to Andrade et al. (2023), it is further emphasized that, despite its efficacy, the assessment of long-term safety in obese nondiabetic individuals still requires further study, since the compound was initially approved for the treatment of Type 2 Diabetes Mellitus. Thus, its prescription requires a rigorous analysis of the individual risk-benefit profile. Continuous pharmacovigilance monitoring is imperative in order to optimize clinical outcomes.

Overweight and obesity, exacerbated by social and media-driven standards, motivate the search for pharmacological solutions for weight reduction. However, the indiscriminate use of Ozempic, originally intended for Type 2 Diabetes, may lead to serious complications, including gastrointestinal dysfunctions, pancreatitis, and the risk of hypoglycemia and neoplasms (Dias et al., 2023).

Among the observed effects, gastrointestinal symptoms such as nausea, diarrhea, and vomiting stood out, in addition to headaches and constipation (Dias et al., 2023). In more severe cases, prolonged use was associated with the risk of diabetic retinopathy and even neoplasms, such as thyroid cancer, which demonstrated the danger of the uncontrolled use of the drug (Silva; Simões; Ishiuchi, 2024). These findings reinforced the importance of professional follow-up in order to minimize risks and monitor patients.

Another point concerns the use of semaglutide by individuals with a low body mass index. Research showed that, in such situations, the risks of adverse effects were potentially more severe, since the safety of the medication had not been robustly studied in this population. This finding highlighted the inadequacy of self-medication and the dangers of consumption motivated solely by aesthetic concerns (Andrade et al., 2023).

In addition, it was observed that the indiscriminate use of semaglutide could mask the real need for lifestyle changes, such as adopting balanced eating habits and engaging in regular physical activity. In this way, although the medication is effective, it did not replace long-term health-promotion strategies, which are fundamental for weight control and for improving quality of life (Naressi; Paludo, 2024).

The social and ethical aspects of self-medication include the devaluation of the role of health professionals and the absence of adequate follow-up (Linhares et al., 2024). Without the guidance of physicians and pharmacists, the risks of drug interactions, improper storage, and inappropriate dosage use increased significantly. In this scenario, the presence of the pharmacist was identified as essential for guidance and the safe use of medications (Nascimento, 2021).

The analysis of the studies showed that self-medication with semaglutide has become an expanding public health problem in Brazil. The phenomenon was driven by aesthetic pressure, by facilitated access to information on social media, and by the trivialization of the drug's risks. Thus, the review pointed to the urgent need for stricter regulation, associated with educational strategies, in order to ensure the rational and safe use of semaglutide, reducing the negative impacts of this practice on collective health (Campos et al., 2024).

CONCLUSION

The present research made it possible to identify that self-medication with semaglutide in Brazil has become a growing and concerning phenomenon, driven by social, cultural, and media-related factors. The search for rapid weight loss, combined with the valorization of aesthetic standards, led to the inappropriate use of the medication without proper professional follow-up. This scenario highlighted the seriousness of the practice and reinforced the need to raise public awareness about the risks involved.

The review demonstrated that, although semaglutide has proven efficacy in the treatment of type 2 diabetes and clinical obesity, its use outside these indications resulted in numerous health problems. The studies analyzed showed adverse effects ranging from gastrointestinal symptoms to serious complications, such as retinopathy and cancer risk, which reinforces the seriousness of self-medication without scientific support or specialized follow-up.

Another important point revealed by the review was the impact of social media on the dissemination of information about the medication. Some of the studies consulted highlighted that this digital environment has promoted a trivialization of risks, encouraging unsafe behaviors and strengthening the idea of quick solutions for weight loss. This finding brought to light the role of health communication and the need for strategies to combat misinformation.

It is important to emphasize, however, that this study presented limitations inherent to the literature review method. The analysis was restricted to secondary data, making direct clinical evaluation of patients who used semaglutide inappropriately impossible. Despite this, the reviewed literature proved sufficient to demonstrate the magnitude of the problem and to reinforce the relevance of the debate on self-medication in the national context.

It is recommended that future research advance in monitoring the use of semaglutide in different population contexts, analyzing not only adverse effects, but also the social, psychological, and ethical impacts of this practice. In addition, the development of awareness programs is suggested in order to provide guidance on the rational use of medicines and to enhance the role of health professionals. In this way, it will be possible to minimize the risks associated with indiscriminate consumption and to promote greater safety in the use of pharmacological therapies.

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PHARMACEUTICAL INTERVENTION IN THE TREATMENT OF ELDERLY DIABETIC PATIENTS: CONTRIBUTIONS TO EDUCATION AND SELF-CARE

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Abstract

This article addresses pharmaceutical intervention in the treatment of elderly diabetic patients, highlighting its importance for treatment adherence and self-care. Diabetes mellitus is a chronic disease with high prevalence among older adults, who face challenges such as polypharmacy and inappropriate medication use. The general objective of the research is to analyze how the pharmacist's professional guidance influences adherence to drug therapy. The methodology used involves a bibliographic review and qualitative analysis of pharmaceutical practices. The expected results indicate that pharmaceutical interventions can significantly improve treatment adherence and patients' quality of life, while also promoting self-care habits. The final considerations emphasize the need for continuous training of pharmacy professionals to deal with the complexities of caring for elderly diabetic patients, in addition to suggesting the implementation of educational strategies aimed at overcoming barriers to treatment adherence. This study contributes to the development of a more patient-centered approach, resulting in benefits for public health and the quality of life of the elderly population.

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Keywords: Diabetes mellitus, Older adults, Pharmaceutical intervention, Self-care, Treatment adherence.

INTRODUCTION

Diabetes mellitus is one of the most relevant chronic non-communicable diseases today, presenting high prevalence and a significant impact on morbidity and mortality, especially among the elderly population. This condition is characterized by alterations in the production or action of insulin, resulting in hyperglycemia and increasing the risk of cardiovascular, renal, and infectious complications (Prado; Francisco; Barros, 2016).

In Brazil, there has been a continuous increase in the number of older adults diagnosed with diabetes, a phenomenon associated with rising life expectancy and demographic changes. Although aging does not, in itself, represent illness, it is related to greater vulnerability to the development of chronic diseases, such as diabetes mellitus, which requires constant monitoring and multiprofessional interventions (Prado; Francisco; Barros, 2016).

The complexity of therapy in this population involves both the use of medications and self-care practices. However, polypharmacy, cognitive limitations, and drug interactions make adherence to treatment more difficult, which may compromise clinical outcomes. In light of this, the research problem arises: in what way can pharmaceutical intervention favor glycemic control in elderly diabetic patients and reduce associated complications (De Melo et al., 2019).

The justification for this study is based on the importance of pharmaceutical practice within the healthcare team. Through clinical follow-up, the pharmacist can identify risks, provide guidance on the correct use of medications, and encourage self-care practices, such as a balanced diet and glycemic monitoring. This performance contributes to treatment adherence and the prevention of complications (Camacho; De Carvalho; Marini, 2023).

The general objective of this article is to analyze the relevance of pharmaceutical intervention in the treatment of older adults with diabetes mellitus. As specific objectives, it seeks to understand the main challenges faced by this population, highlight the pharmacist's contribution to the prevention of complications, and discuss self-care strategies that promote quality of life.

Thus, it is expected that this study will contribute to highlighting the importance of the pharmacist in the care of elderly patients with diabetes. The proposal is to show that this professional's role goes beyond the dispensing of medications, encompassing health education, therapeutic monitoring, and the promotion of patient autonomy in managing their chronic condition.

DEVELOPMENT

METHODOLOGY

This research is characterized as a bibliographic review of a qualitative and descriptive nature, with the objective of analyzing the importance of pharmaceutical intervention in the treatment of elderly diabetic patients, highlighting the impact of professional guidance on self-care and adherence to drug therapy. This method does not involve hypotheses and is not exploratory, systematic, experimental, quantitative, or a case study, being limited to the critical analysis of the existing literature.

The search for relevant materials will be conducted in the Google Scholar and SciELO databases, encompassing publications from the last ten years. Articles and books published in Portuguese and English that specifically address the role of the pharmacist in the context of diabetes mellitus in elderly patients, as well as the relationship between pharmaceutical intervention, self-care, and treatment adherence, will be considered for inclusion. On the other hand, review articles, abstracts, editorials, first impressions, and works that do not present empirical data or are not directly related to the proposed theme will be excluded.

The keywords used in the search will be: "pharmaceutical intervention," "diabetes mellitus," "older adults," "self-care," "treatment adherence," and "professional guidance." The literature review will make it possible to consolidate the existing knowledge regarding the pharmacist's role in improving therapeutic adherence and self-care among elderly diabetic patients, contributing to the theoretical foundation of this work.

RESULTS AND DISCUSSION

Population aging has significantly transformed the health profile in Brazil and around the world, requiring adjustments in the organization of services and in the planning of public policies focused on elderly care. According to the Brazilian Institute of Geography and Statistics (IBGE, 2022), it is estimated that, by 2030, the elderly population will outnumber children and adolescents, reflecting the ongoing demographic and epidemiological transition. This phenomenon leads to an increase in the incidence of chronic non-communicable diseases (CNCDs), among which type 2 diabetes mellitus (T2DM) stands out due to its impact on morbidity and mortality and on healthcare costs (Rodrigues et al., 2020). Data from the World Health Organization (WHO, 2021) indicate that T2DM already affects more than 460 million people worldwide, approximately 20% of whom are over 65 years of age, making the disease a public health priority.

The physiological changes inherent to aging directly influence the pharmacokinetics and pharmacodynamics of medications, altering the processes of absorption, distribution, metabolism, and excretion. This increases the vulnerability of older adults to adverse events and heightens the risks associated with the inappropriate use of pharmacotherapy. In addition, the frequent presence of comorbidities in this age group leads to the phenomenon of polypharmacy, characterized by the simultaneous use of five or more medications. This situation, common among elderly diabetic patients with hypertension, dyslipidemia, and cardiovascular diseases, may compromise treatment adherence, increase the risk of drug interactions, and contribute to preventable hospitalizations (Costa et al., 2020). The literature shows that approximately 40% of older adults using polypharmacy present at least one drug-related problem (DRP), highlighting the need for closer clinical follow-up.

In the context of T2DM, the challenges to maintaining adequate glycemic control are broad and multifactorial. The prevalence of the disease increases with age and is aggravated by behavioral and socioeconomic factors, such as physical inactivity, inadequate diet, low educational attainment, and difficulties in accessing health services (Brazilian Diabetes Society, 2022). Another concerning factor is late diagnosis, which favors the onset of microvascular complications (retinopathy, nephropathy, and neuropathy) and macrovascular complications (coronary artery disease, stroke, and peripheral vascular disease), compromising quality of life and increasing the need for specialized follow-up (Oliveira et al., 2019). In Brazil, it is estimated that nearly half of older adults with T2DM are unaware of their diagnosis, which contributes to the high rate of associated complications.

In addition to clinical aspects, functional and cognitive aspects also affect diabetes management in older adults. Motor and visual limitations make the correct administration of medications and the measurement of capillary blood glucose more difficult, compromising treatment monitoring. Likewise, cognitive deficits, depression, and a limited perception of the seriousness of the disease may reduce therapeutic adherence and engagement in self-care measures (Gonçalves & Sachett, 2019). It is common for older adults to confuse medication schedules, omit insulin doses, or make inappropriate use of oral hypoglycemic agents, which reinforces the need for continuous follow-up by healthcare professionals.

In light of this scenario, health education emerges as a central tool for overcoming barriers related to diabetes management. The promotion of educational actions enables greater understanding of the pathology, encourages the adoption of healthier lifestyle habits, and fosters the patient’s active participation in the care process. Diabetes education programs involving lectures, practical workshops, and home follow-up have shown a positive impact on adherence and on the reduction of complications (Tanqueiro, 2015). The use of methodologies adapted to the cognitive and sensory limitations of older adults, such as illustrated booklets, accessible language, and audiovisual resources, enhances the effectiveness of educational actions.

Pharmaceutical intervention, in this context, stands out due to its role in clinical follow-up and in the optimization of pharmacotherapy. Personalized guidance regarding dosage, administration schedules, correct insulin application techniques, recognition of signs of hypoglycemia and hyperglycemia, in addition to explanations about possible adverse effects, has proven effective in reducing medication-related errors (Bonifácio, 2013). Ferreira Júnior and Batista (2018) emphasize that the pharmacist's presence alongside the elderly patient broadens the perception of safety and strengthens the relationship of trust, promoting greater engagement in treatment. Moreover, the pharmacist may assist in organizing the therapeutic regimen by suggesting the use of medication organizers or simplified schedules that facilitate adherence.

Another relevant aspect is the management of polypharmacy. In many cases, elderly diabetic patients use medications for hypertension, dyslipidemia, and other concomitant chronic conditions, increasing the risk of therapeutic duplication and harmful drug interactions. Periodic review of prescriptions by the pharmacist makes it possible to detect and correct flaws, in addition to simplifying complex therapeutic regimens, thereby favoring adherence and preventing hospitalizations related to adverse events (Costa et al., 2020). This preventive action is essential to avoid severe outcomes such as falls, mental confusion, and severe hypoglycemia, which are frequent causes of hospital admission among older adults.

Despite the benefits evidenced in the literature, significant obstacles remain. Low educational and socioeconomic levels limit the understanding of technical guidance, while difficulty in regular access to health services restricts continued follow-up. Resistance to changing lifestyle habits, especially among older adults with a long history of unhealthy behaviors, represents another important barrier (Souza et al., 2023). In this sense, the participation of family members and caregivers is indispensable, since they are often directly responsible for medication administration and for encouraging self-care practices.

Paiva (2020) highlights that the inclusion of the pharmacist in continuing education programs has a positive impact, as it enables greater adherence to prescriptions, improves understanding of the disease, and increases patient autonomy in self-care. When such interventions are developed in a multiprofessional manner, with the participation of physicians, nurses, nutritionists, and physical therapists, the possibilities for a comprehensive approach are expanded, also strengthening the family's role in supporting treatment. This integrated approach is recommended by the National Primary Care Policy (PNAB) and is supported by programs such as the Family Health Strategy (FHS), which seeks to promote care close to the community and centered on the needs of the elderly patient.

In summary, the analysis of the literature shows that population aging associated with the growing prevalence of T2DM requires comprehensive, interdisciplinary, and continuous care. The clinical pharmacist stands out as a strategic actor in promoting adherence, the rational use of medications, and the strengthening of self-care. Health education programs adapted to the needs of older adults, combined with pharmaceutical follow-up, constitute effective strategies for overcoming barriers and improving therapeutic outcomes, contributing not only to patients' quality of life, but also to the sustainability of the healthcare system.

CONCLUSION

This review made it possible to broadly understand the relevance of pharmaceutical intervention in the treatment of elderly diabetic patients. It was verified that the pharmacist's role, through continuous guidance and health education, significantly contributes to therapeutic adherence and the strengthening of self-care. Thus, the objective proposed in this work was achieved, since it was possible to highlight the importance of this professional in improving the quality of life of this population.

The research problem was also answered, demonstrating that pharmaceutical guidance has a direct and positive impact on disease control and on the prevention of complications, especially in a context marked by the frailties inherent to aging, such as polypharmacy and cognitive difficulties. However, it should be noted that some limitations were present, such as the restriction of the search to publications from certain databases and the defined time frame, which may have excluded other relevant contributions.

It is recommended that new studies be conducted using diversified methodologies and in different practice settings, in order to broaden understanding of the most effective intervention strategies. In addition, the development of interdisciplinary programs that strengthen the pharmacist's role alongside other healthcare professionals is suggested. Thus, this work not only reinforces the importance of pharmaceutical intervention in the care of the elderly diabetic patient, but also points to paths for future research and for the consolidation of sustainable and replicable practices in different contexts.

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IMMUNOBIOLOGICAL THERAPY FOR RHEUMATOID ARTHRITIS: EFFICACY, RISKS, AND IMPACT ON TREATMENT

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Abstract

Rheumatoid arthritis is a chronic inflammatory and autoimmune disease that primarily affects women between 30 and 50 years of age, leading to progressive joint destruction and functional impairment. Given the limitations of conventional treatments, immunobiologicals emerge as an innovative therapeutic alternative because they act selectively on specific molecular targets, providing better symptom control and improved quality of life for patients. Despite their efficacy, these medications present challenges such as high cost, adverse effects, and the need for rigorous monitoring. This study was developed through a bibliographic review with a qualitative and descriptive approach, using scientific sources from the SciELO and Google Scholar databases published between 2015 and 2024. The objective was to evaluate the impacts of the use of immunobiologicals in the treatment of rheumatoid arthritis, considering their efficacy, associated risks, and implications within the context of the health system. The analysis showed that immunobiologicals contribute significantly to disease remission, reduction of physical disabilities, improvement of psychological well-being, and social reintegration of patients. However, their use requires public policies that ensure equitable access, the sustainability of the SUS, and the qualification of

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health services. It is concluded that the adoption of this therapy requires an integrated approach involving innovation, clinical safety, and economic viability.

Keywords: Biotechnology, Pharmacotherapy, Medications, Treatment, Inflammation.

INTRODUCTION

Rheumatoid arthritis is a chronic autoimmune disease that causes inflammation in the joints, intense pain, and even loss of function. For patients who have not been successful with conventional therapies, immunobiological drugs are an innovative and hopeful alternative, as their mechanism of action includes TNF, IL-6, IL-17, and JAK inhibitors in treatment (Santos et al., 2024).

According to Finotti (n.d.), immunobiological drugs may be vaccines or antibodies administered subcutaneously, intramuscularly, or intravenously, weekly or even semiannually. They are produced from a living cell and have a complex molecular structure.

However, like any other medication, there are risks, undesirable effects, and other issues such as high cost that must be evaluated before implementing this treatment, mainly due to the various immunological processes in which immunobiologicals act (Mota, 2015).

The use of immunobiological drugs for rheumatoid arthritis has been satisfactory for users because they act more specifically, focusing on molecules that play a crucial role in inflammation, providing a more targeted treatment. There is a significant number of patients with autoimmune diseases in the population, specifically rheumatoid arthritis, and appropriate treatment is crucial to control symptoms and prevent long-term complications (Mota, 2015).

This study is relevant to the population because this disease causes a major deterioration in patients' quality of life, and it is common for conventional treatments not to work. Immunobiological drugs have had a major impact and yielded excellent results for these types of patients, making broader dissemination of information on the topic necessary.

Immunobiological drugs, although relatively recent in the pharmaceutical market and of more restricted use, still raise doubts regarding their efficacy, safety, and impact on patients' lives. In view of this, this study aims to answer the following research question: What are the impacts of the use of immunobiologicals in the control of rheumatoid arthritis, considering treatment efficacy, adverse effects, and patients' quality of life?

The general objective of this study is to evaluate the efficacy of treatment with immunobiological drugs in combating rheumatoid arthritis. To achieve this purpose, it specifically seeks to identify the main adverse effects reported by patients using these drugs, analyze the differences between the use of immunobiologicals and conventional drugs in the treatment of rheumatoid arthritis, as well as evaluate the efficacy of immunobiologicals in reducing disease symptoms and improving patients' quality of life.

DEVELOPMENT

METHODOLOGY

This research is a bibliographic review, with a qualitative and descriptive approach, on the use of immunobiologicals in the treatment of rheumatoid arthritis. The search for materials was carried out in the Google Scholar and SciELO databases, recognized in the health field for providing a broad scientific collection. Articles, dissertations, and theses published in the last ten years, between 2015 and 2024, were selected. The inclusion criteria adopted were: publications available in Portuguese and English, with full text, that directly addressed the topic of immunobiologicals applied to rheumatoid arthritis. As exclusion criteria, opinion articles, systematic reviews, abstracts without access to the full text, case reports, and non-scientific documents were disregarded. The keywords used in the searches were: "immunobiologicals," "rheumatoid arthritis," "efficacy," and "adverse effects," in addition to other descriptors that proved relevant during the course of the research.

RESULTS AND DISCUSSION

Rheumatoid arthritis (RA) is a chronic, inflammatory, autoimmune disease that affects the synovial joints and may progress with the progressive destruction of cartilage and underlying bone. Over time, this inflammation can lead to significant functional loss, directly impacting patients' mobility and quality of life. In addition, RA has the potential to cause joint deformities and permanent disabilities, making it one of the leading causes of disability in young adults. It is a disease that affects about 1% of the world population, with a higher prevalence among women, especially in the 30 to 50 age group, although it may occur at any age. Early identification and appropriate management are essential to control disease progression, minimize joint damage, and improve patients' functionality and quality of life (SBR, 2015).

Its etiopathogenesis involves genetic, environmental, and immunological factors, which contribute to abnormal activation of the immune system, which then begins to attack the body's own structures. Historically, the treatment of RA was based on symptomatic medications such as nonsteroidal anti-inflammatory drugs (NSAIDs) and corticosteroids. Later, with the introduction of disease-modifying antirheumatic drugs (DMARDs), such as methotrexate, greater symptom control and delayed disease progression were observed. However, many patients show inadequate responses or develop adverse effects with the prolonged use of these drugs (Ferreira et al., 2023).

Over the last 20 years, the emergence of immunobiologicals has represented a revolution in the treatment of rheumatoid arthritis (RA). These medications are obtained through genetic engineering, using living organisms to produce specific proteins that modulate the inflammatory response. Among these medications, monoclonal antibodies and soluble receptors stand out, whose main advantage is their highly selective action on specific molecular targets.

Among these targets, the most relevant include tumor necrosis factor alpha (TNF-α), interleukin-6 (IL-6), and B cells, all of which are involved in the pathogenesis of RA. By blocking these molecules and cells, immunobiologicals are able to significantly reduce inflammation, control symptoms, and prevent progressive joint damage. In addition, their use has shown benefits not only in relieving pain and stiffness, but also in improving joint function and patients' quality of life, contributing to a more effective and individualized management of the disease (Andrade et al., 2020).

According to a study published by Andrade et al. (2020), medications such as infliximab, adalimumab, and etanercept demonstrated significant clinical efficacy in patients who did not respond to methotrexate, improving not only inflammatory markers but also functional scores such as DAS28 (Disease Activity Score), which is a measure widely used to assess disease activity in rheumatic diseases such as rheumatoid arthritis. The reduction of these scores is directly related to a decrease in symptoms of pain, stiffness, and swelling in the joints, leading to a substantial improvement in patients' functional capacity. In addition, there was an improvement in the quality of life perceived by patients, an aspect increasingly valued in modern therapeutic approaches, which seek not only to control clinical symptoms but also to improve overall well-being and the patient's ability to carry out daily activities. These findings reinforce the importance of personalized therapies that take into account the specific needs of each patient, especially in cases of resistance to conventional treatment.

The positive impact of immunobiologicals, however, is not without challenges. One of the main risks associated with their use is the increased incidence of opportunistic infections such as tuberculosis and hepatitis B, due to suppression of the immune system. In addition, the prolonged use of these medications can affect the patient's immune response, making them more vulnerable to severe infections and hindering the early detection of infectious diseases. This risk of infection can be even more pronounced in patients with comorbidities or in concomitant treatments that also suppress immune function. As a result, a careful approach and constant monitoring are required to ensure the safety of patients undergoing treatment with immunobiologicals, in order to minimize complications and optimize therapeutic benefits (Silva, 2019).

Thus, clinical protocols and Ministry of Health guidelines recommend prior testing for latent infections before the start of treatment, in addition to continuous follow-up during administration.

Another sensitive point is the high cost of these medications, which directly impacts population access, especially in countries with income inequality such as Brazil. Moura's study (2018), from FGV, highlights that public health policy has adopted strategies such as Productive Development Partnerships (PDPs) in order to enable the national production of immunobiologicals, such as those manufactured by the Butantan Institute, reducing dependence on imports and public health expenditures.

Access through the Unified Health System (SUS) has also been progressively expanded. Since 2013, the Ministry of Health has incorporated several immunobiologicals into the Specialized Component of Pharmaceutical Assistance (CEAF), enabling the free provision of these drugs to patients with proven clinical indication. According to the clinical protocol and therapeutic guidelines for rheumatoid arthritis of the National Committee for the Incorporation of Technologies in the SUS, the selection of the immunobiological should consider the patient's clinical history, disease severity, and prior response to conventional therapies (CONITEC, 2021).

Souza (2017) emphasizes that, despite advances in technological incorporation, logistical and bureaucratic barriers still exist that hinder the regular dispensing of these medications in the public system. Among them are the requirement for complex reports, periodic efficacy assessments, and the scarcity of specialized centers in remote areas.

On the other hand, the positive impact on patients' quality of life is widely documented. Patients treated with immunobiologicals report pain reduction, improved mobility, greater autonomy in daily activities, and return to the labor market. These effects not only alleviate personal suffering but also reduce the indirect costs associated with the disease, such as early retirement, frequent sick leave, and intensive use of health services (Nascimento et al., 2023).

In addition to the physical and functional benefits, there is also a considerable improvement in psychological well-being. Many patients experience a reduction in depressive symptoms and greater social engagement after beginning treatment with immunobiologicals, especially when there is integrated multiprofessional follow-up, as recommended by current rheumatology guidelines (Andrade et al., 2020).

In the long term, studies indicate that the continuous and appropriate use of immunobiologicals contributes to sustained disease remission, although constant monitoring is necessary for dose adjustments and substitutions with biosimilars when needed. Biosimilars, moreover, emerge as a promising alternative to reduce costs without compromising therapeutic efficacy, provided that there is adequate regulation and oversight by health agencies (Moura, 2018).

Thus, the theoretical foundation of the present study shows that immunobiologicals represent an essential advance in the treatment of RA, with positive impacts on therapeutic efficacy, quality of life, and reduction of disease sequelae. However, their adoption requires a balanced approach between technological innovation, clinical safety, economic sustainability, and equity in access.

In addition to clinical and therapeutic issues, it is essential to consider the economic and organizational aspects involving the use of immunobiologicals in the context of public health. According to Oliveira et al. (2019), in a study published in Value in Health Regional Issues, the incorporation of these medications should be accompanied by cost-effectiveness analyses that evaluate not only the direct price of treatment but also the positive impacts on productivity, reduced hospitalizations, and the lesser need for invasive procedures. Such data reinforce that, although the initial investment is high, the long-term benefits justify their adoption, especially in cases of refractory rheumatoid arthritis.

Another relevant point is the role of biosimilars, which have gained prominence as a strategy to expand access to treatment without compromising therapeutic quality. According to Mattos et al. (2017), in a study presented at SINGEP, biosimilars represent a concrete opportunity for sustainability for the SUS, provided that they are subject to rigorous regulatory processes and accompanied by active pharmacovigilance. Confidence in these products depends both on proof of clinical equivalence and on the perception of safety by health professionals and patients, which requires clarification campaigns and continuous training.

It is understood that the implementation of advanced therapies such as immunobiologicals demands a prepared health structure and multidisciplinary teams acting in an integrated manner. The article by Reche and Santos (2021), published in the journal of Santa Cecília University, highlights that factors such as difficulties in geographic access, failures in scheduling infusions, and lack of knowledge about the disease still compromise the continuity of treatment in various services. This reinforces the need for management policies that prioritize not only the acquisition of medications but also the qualification of services and the humanization of care.

CONCLUSION

The present study achieved the general objective of evaluating the efficacy of immunobiological medications in the treatment of rheumatoid arthritis. It was possible to identify that these medications promote significant improvement in symptom reduction and in patients' quality of life, in addition to presenting a specific profile of adverse effects that requires clinical attention. The comparison between immunobiologicals and conventional treatments also showed important advantages in terms of disease control, reinforcing the relevance of these drugs as a fundamental therapeutic option for patients who do not respond adequately to traditional therapies.

However, the research encountered limitations related to the relative novelty of the topic, which is reflected in a smaller number of in-depth and available studies, as well as in the constant evolution of biological therapies. This limitation hinders an even more detailed and comprehensive analysis, especially with regard to long-term data and economic impacts in different health contexts. Moreover, barriers to access and the high costs of immunobiologicals also represent challenges that may interfere with the generalization of the observed results.

For future investigations, it is recommended that longitudinal studies be carried out to monitor the effects of immunobiologicals over longer periods, as well as research evaluating strategies to expand access to these medications, including the use of biosimilars. It would also be important to explore the integration of multidisciplinary approaches in patient follow-up, considering not only clinical aspects but also psychosocial ones. In this way, it will be possible to further consolidate knowledge about the role of immunobiologicals in the management of rheumatoid arthritis and contribute to the continuous improvement of patient care.

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IMPLICATIONS OF SELF-MEDICATION WITH LEVONORGESTREL IN ADOLESCENTS

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Abstract

Self-medication with levonorgestrel among adolescents has become an increasingly frequent and concerning practice, marked by dilemmas that go beyond physical health. The use of the so-called "morning-after pill," often without professional guidance, emerges as a rapid response to risk situations, yet reveals impacts that extend beyond the immediate. Although effective as an emergency contraceptive, when used indiscriminately, the medication may cause hormonal alterations, side effects, and even compromise the emotional stability of young individuals. In this context, self-medication is not merely an individual choice but reflects gaps in the healthcare system, sexual education, and social relationships. The ease of access to the medication brings a duality: while it promotes autonomy, it also opens space for misuse, sustained by illusions of safety. This behavior may generate feelings of fear, guilt, anxiety, and isolation, as many adolescents resort to the pill in silence, without family dialogue or specialized support. Thus, understanding this practice requires a comprehensive analysis that considers the biological, psychological, and social aspects involved. This study seeks to foster critical reflection and propose pathways to promote more conscious, safe, and responsible use.

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Keywords: Self-medication, Levonorgestrel, Adolescence, Reproductive Health, Sexual Education.

INTRODUCTION

Adolescence, a phase so unique and full of nuances, can be seen as fertile ground where doubts, discoveries, and, of course, contradictions arise. It is within this scenario—resembling a stage in constant transformation—that many young individuals find themselves facing choices that, at first glance, seem trivial but carry echoes that reverberate far beyond the immediate. Among such choices, self-medication stands out: an age-old practice that, like a weed, continues to flourish in the gaps left by the healthcare system and insufficient education, foreshadowing challenges that extend beyond the individual sphere and affect society as a whole (Silva; Ferreira, 2020).

In Brazil, it is no surprise that this practice finds fertile ground in the well-known “Brazilian way,” a nearly theatrical ability to improvise quick solutions. Who has never heard, “take this little medicine and it will pass”? Often, a headache or minor discomfort is treated with the same naturalness as changing a shirt. Thus, the pharmacy counter becomes an improvised consulting room, where the pharmacist suddenly assumes the symbolic role of physician and advisor. However, when this narrative shifts to the universe of adolescents, especially regarding the use of levonorgestrel, the well-known “morning-after pill,” what seemed like a practical solution reveals itself as a delicate trap, where autonomy may be confused with risk (Souza; Lima, 2019).

Levonorgestrel, widely recognized as effective as an emergency contraceptive, functions like a race against time: each minute after unprotected sexual intercourse is like sand slipping through an invisible hourglass. If, on one hand, this effectiveness can be celebrated as a triumph of science, on the other, when trivialized and consumed indiscriminately, the medication becomes a double-edged sword. From a protective shield, it transforms into a silent threat, capable of affecting not only the body but also the emotional stability of adolescents (Brasil, 2017).

It is curious, and even unsettling, to note how easy access to the pill has been interpreted by many young people as a symbol of freedom. However, this autonomy, which should represent empowerment, often becomes an invisible crutch, supporting thoughtless decisions. The repetitive use of levonorgestrel, almost ritualistic, reveals not only a lack of knowledge but also the absence of critical reflection. As commonly stated: freedom without awareness may become a disguised prison. It is at this intersection that the urgency of educational policies becomes evident—policies that do not merely inform but truly foster awareness (Costa et al., 2021).

Side effects are not mere footnotes in a package insert. Changes in the menstrual cycle, nausea, headaches, and hormonal imbalances emerge as persistent shadows, reminding us that every shortcut has a cost. The body, in its silent wisdom, attempts to signal; however, the mind, overwhelmed by doubts and taboos, hesitates to listen. Without proper guidance, the adolescent may fall into a vicious cycle of fear and insecurity, where each symptom appears as an indecipherable enigma (Oliveira; Pereira, 2020).

It is not only about biology but also about emotions. Each pill ingested may carry an invisible burden: fear of pregnancy, anxiety about judgment, and the silence of secrecy. It is as if the medication, personified, holds within it untold stories—secrets locked away—born from the absence of family dialogue and the lack of effective public policies. Levonorgestrel thus ceases to be merely a pill and becomes a metaphor for isolation and hidden choices (Martins; Gomes, 2020).

The greatest risk lies in the illusion of safety. Using levonorgestrel as a regular method is like trying to hold back the sea with one's hands: an impossible task, destined to fail. This false sense of security opens gaps not only for unplanned pregnancies but also for the risk of sexually transmitted infections. In this dangerous dynamic, what should be the exception often becomes the rule, and the consequences inevitably surface (Almeida et al., 2018).

Indeed, the ease of access to the medication is a double-edged sword. While over-the-counter availability represents progress in terms of female autonomy, it also exposes the door to careless and repetitive use. This paradox illustrates the complexity of the issue: how to balance individual rights with collective responsibility? This is a question that, more than ever, requires answers that combine science, ethics, and sensitivity (Brito; Santos, 2021).

Thus, this Course Completion Paper stands as an invitation to reflection. More than discussing data and statistics, it aims to give voice to hidden stories, revealing the nuances of this complex phenomenon. May this study serve as a bridge, connecting theory and practice, science and society, reason and emotion, for caring for adolescent health is, ultimately, planting the seeds of a more conscious, responsible, and humane future.

DEVELOPMENT

METHODOLOGY

The methodology of this study is a systematized bibliographic review aimed at understanding the effects of self-medication with levonorgestrel in adolescents, encompassing physical, psychological, and social effects, as well as the impact of the absence of professional guidance. To ensure that the information is up to date, articles published between 2007 and 2025 were selected. It was decided to include articles written in Portuguese, excluding review-type publications, preliminary impressions, abstracts, and works that did not provide complete data or lacked sufficient scientific relevance.

The bibliographic research was conducted using reputable academic platforms and databases, including Google Scholar, SciELO, and CAPES Journals. To identify relevant articles on the topic, descriptors and keywords such as “self-medication,” “levonorgestrel,” “morning-after pill,” “adolescents,” “sexual health,” “professional health guidance,” and “sexual education” were used, enabling a broad and focused search.

The 22 selected articles were thoroughly analyzed, focusing on the negative physical effects of continuous use of levonorgestrel in adolescents, the emotional impacts involving anxiety, fear, and guilt, and the social and cultural influences surrounding self-medication. The impact of the lack of professional guidance and the absence of public policies in sexual education—factors that contribute to the continued misuse of the morning-after pill—was also examined.

Based on the integration of the collected data, reflections and suggestions for educational strategies were developed to encourage responsible and conscious use of contraceptive methods among young people. Grounded in recent and diverse scientific evidence, this methodology allows for a comprehensive understanding of the phenomenon under analysis, aiding in the development of recommendations that promote overall health and well-being in this group.

RESULTS AND DISCUSSION

Self-medication with levonorgestrel is widely practiced among adolescents, often without proper professional guidance, revealing a significant discrepancy between theoretical knowledge and lived practice (Almeida et al., 2018; Brasil, Ministry of Health, 2017). This practice stems from easy access to the medication and the lack of reliable information, leading to the use of the morning-after pill as an emergency solution to prevent pregnancy, but without full understanding of its risks and implications (Souza; Lima, 2019; Brito; Santos, 2021).

Physically, the most frequently reported adverse effects include changes in the menstrual cycle, nausea, and headaches—clear indicators of the limitations of repeated use of this medication (Bottoli et al., 2023; Oliveira, 2020). Psychologically, feelings such as guilt, fear, and anxiety are common, resulting in considerable negative emotional impact (Martins; Gomes, 2020; Rodrigues et al., 2020).

Table 1

Adverse Effects of Levonorgestrel in Adolescents

Physical Effects	Frequency	Main References
Changes in the menstrual cycle	Frequent	Bottoli et al., 2023; Oliveira, 2020
Nausea	Frequent	Bottoli et al., 2023; Oliveira, 2020
Headaches/Cephalgias	Common	Bottoli et al., 2023
Vomiting	Less frequent	Ministry of Health, 2018

Source: Adapted from Bottoli et al. (2023), Oliveira (2020), and Ministry of Health (2018)

The social context has a strong influence, especially the absence of open dialogue within family relationships and peer pressure, which promote self-medication as a response to social and cultural norms (Nunes, 2022; Souza, 2020). Health education proves essential, as adolescents who participate in educational programs demonstrate greater knowledge and responsibility in the use of levonorgestrel (Fernandes; Moura, 2019; Santos, 2021).

Additionally, a limited perception of risk is observed, where the morning-after pill is mistakenly viewed as a substitute for regular contraceptive methods, a situation that increases the physical and emotional vulnerability of young individuals (Costa et al., 2021; Pêgo et al., 2021). The media and social networks contribute to the construction of narratives that emphasize immediate autonomy regarding the medication, minimizing risks and distorting notions of safety (Pereira, 2007; Trebien et al., 2021).

Socially, repeated self-medication is associated with isolation and stigma, hindering communication between adolescents and their families and friends, which intensifies emotional distress and silence surrounding the issue (Silva; Ferreira, 2020; Silva, 2024). In this context, the role of healthcare professionals is crucial, as proper guidance and monitoring promote correct use, fostering responsible autonomy and safer choices, as well as facilitating reflective dialogue with adolescents (Cruz et al., 2022; Brasil, Ministry of Health, 2018).

Public policies and educational programs emerge as indispensable instruments for preventing misuse and the negative effects of self-medication with levonorgestrel, strengthening structured information, professional support, and awareness of associated risks (Brasil, Ministry of Health, 2018; Trebien et al., 2021).

Table 2

Comparison of Educational Methods and Their Impacts

Educational Method	Impact on Self-Medication	Main References
School programs	Reduction in impulsive use	Santos, 2021; Mendes, 2021
Professional guidance	Conscious and responsible use of levonorgestrel	Pêgo et al., 2021; Pereira, 2019
Media campaigns	Can reinforce autonomy, but with risks	Trebien et al., 2021

Source: (Adapted) From Santos (2021), Mendes (2021), Pêgo et al. (2021), Pereira (2019), and Trebien et al. (2021).

In summary, the data reinforce that self-medication is a complex phenomenon, shaped by physical, emotional, social, and cultural factors, and that effective interventions require a multidisciplinary approach integrating education, professional guidance, and public policies focused on the comprehensive health of adolescents.

CONCLUSION

The present study achieved its objective of examining the phenomenon of self-medication with levonorgestrel among adolescents, highlighting the complexity of this behavior across physical, psychological, social, and cultural dimensions. It was possible to demonstrate that, although the morning-after pill is widely used, technical understanding of its risks and consequences remains insufficient. This underscores the importance of providing greater professional guidance and health education for this group. Thus, the research confirmed that indiscriminate use is not solely the result of easy access to the medication but also of the lack of reliable information and a social context characterized by taboos and absence of dialogue.

However, some limitations were identified, such as the lack of more comprehensive quantitative data and the challenge of obtaining direct reports from adolescents in certain sociocultural contexts. Furthermore, the study focused on theoretical and qualitative aspects, without implementing practical educational interventions to assess their real effects on self-medication behavior. It is recommended that future research adopt mixed methods, expand sample sizes, and implement intervention strategies involving schools, families, and healthcare professionals, with the aim of increasing awareness and promoting responsible use of levonorgestrel.

In summary, it is emphasized that self-medication is a phenomenon with multiple causes and requires integrated responses, such as effective public policies, continuing education programs, and qualified professional support. Therefore, it is recommended that future research investigate the creation and evaluation of educational programs adapted to the cultural realities of adolescents. Additionally, it is important to monitor the physical and emotional effects of this use over time, consolidating an approach that promotes comprehensive health and conscious empowerment among young individuals.

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DRUG–FOOD INTERACTION: IMPACTS AND CLINICAL CONSIDERATIONS

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Abstract

The interaction between medications and foods is a relevant and complex topic that may compromise treatment efficacy and patient safety. The present study is a review article whose general objective is to analyze the main interactions between medications and foods and their impacts on treatment efficacy. The specific objectives include classifying the most common types of interactions, identifying the medications most prone to interacting with foods, and suggesting strategies to minimize risks. The methodology consisted of a literature review, with the selection of scientific articles published between 2015 and 2024 in the PubMed, SciELO, LILACS, and Google Scholar databases. Descriptors such as "drug-nutrient interaction," "drug interaction with foods," "alcohol x medication," and "drug interactions" were used, encompassing publications in Portuguese and English. The data were analyzed qualitatively. The results show that factors such as type of food, timing of intake, and drug characteristics can directly influence the absorption, metabolism, and excretion of medications. Medications such as antihypertensives, antibiotics, and supplements are more likely to undergo food interactions, which may reduce efficacy or cause adverse effects. It is concluded that knowledge about these interactions is essential for promoting the

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rational use of medicines, and that follow-up by health professionals and proper guidance for patients are indispensable.

Keywords: Medication, Interaction, Food, Treatment, Efficacy.

INTRODUCTION

Over time, medications have continuously evolved with the objective of promoting a constant increase in benefits for patients, which requires health professionals to remain continually updated through studies and practical experience in order to keep pace with such advances and ensure greater safety and efficacy in the treatment of patients with various therapeutic modalities (Horta; Coelho, 2022). Among the challenges faced, the interaction between medication and food stands out, as it may compromise therapeutic effects.

However, unfortunately, medications do not bring exclusively beneficial effects to health. Depending on their use and the way they are handled, they may cause adverse and harmful effects on health. This may occur from administration itself as well as from interaction with other components, compromising the therapeutic effect and, in some cases, significantly worsening the initial problem (Horta; Coelho, 2022).

When it comes to drug interaction, the interaction between medications and foods is a case that must be analyzed with caution, as it is complex and difficult to recognize. This situation should be investigated quickly in order to avoid compromising the patient's condition (Souza et al., 2017).

When a medication and a food are consumed simultaneously, several changes may occur in pharmacokinetics, affecting aspects such as absorption, metabolism, release, and elimination of the medication, which may significantly alter the expected effect of the drug and bring unexpected consequences to the patient (Koziolek et al., 2019).

Such nutrients may influence drug absorption by altering the pH of the intestinal contents, the rate of gastric emptying, intestinal peristaltic activity, and several other factors that influence the proper functioning of the medication (Dos Santos; De Lima; Silva, 2021).

The interaction between medications and foods is a topic of great relevance to public health, as it may affect treatment efficacy and patient safety. Many people are unaware of or do not understand the importance of proper medication administration and often use medicines inappropriately. In addition, there is a lack of knowledge about how certain foods may potentiate or reduce therapeutic effects.

The relevance of this study lies in the need to expand knowledge about these interactions, both for health professionals and for the general population. Understanding this information and its real importance may contribute to the rational use of medicines and reduce their harmful effects.

Therefore, this study is relevant because it expands knowledge on the subject, emphasizes that inappropriate use may lead to serious health problems and compromise treatment efficacy, and aims to guide the general population regarding the importance of adopting safer practices in medication use.

The administration of medications frequently occurs together with food intake, a practice that may generate critical interactions. Given this scenario, the problem guiding this research is: what is the impact of the main interactions between medications and foods on the efficacy of pharmacological treatments?

The present study has the general objective of analyzing the main interactions between medications and foods and their impacts on treatment efficacy. To this end, the following specific objectives are established: to classify the most common types of interactions in order to elucidate their mechanisms; to identify the medications most susceptible to such interactions, allowing targeted pharmacological surveillance; and to suggest strategies to minimize risks and improve therapeutic adherence among patients.

DEVELOPMENT

METHODOLOGY

The present study is a bibliographic review, a qualitative and descriptive investigation aimed at gathering and analyzing publications on the interaction between drugs and nutrients. For the preparation of this study, scientific articles published between 2015 and 2024 were selected. The sources consulted were databases such as PubMed, SciELO, LILACS, and Google Scholar, using the keywords “drug-nutrient interaction,” “drug interaction with foods,” “alcohol x medication,” and “drug interactions.”

Articles in Portuguese and English were selected in order to enhance understanding and coverage of the topic.

RESULTS AND DISCUSSION

A healthy diet is fundamental to ensuring a well-nourished body, functioning properly and preserving its structural integrity. In addition, it plays a crucial role in strengthening the immune system (Dutra et al., 2020). Furthermore, physical and mental condition improves considerably, which enhances learning, concentration, and disposition (Alves; Cunha, 2020).

According to ANVISA, a medication is a pharmaceutical product, produced or prepared technically, with a preventive, therapeutic, palliative, or diagnostic purpose (2020). It is essential to select the appropriate medication for each need and to monitor its use in order to avoid risks involving drug treatment (Silveira, 2021).

The inappropriate use of medications is one of the main factors leading to so-called irrational use. This practice, often characterized by self-medication without the necessary technical knowledge or the supervision of a qualified health professional, such as a pharmacist, significantly increases the likelihood of harmful interactions. Such interactions not only compromise treatment efficacy but may also precipitate serious adverse events, including cases of drug intoxication (Ferreira; Júnior, 2018).

The patient should be informed in advance by the healthcare team about the types of reactions that may occur when taking medication together with meals. This is justified by the fact that this combination may bring benefits to the patient, such as accelerating the desired therapeutic effect, or may cause harm, such as increasing the risk of toxicity (Almeida, 2018).

When a medication is ingested together with a food, changes are likely to occur in the pharmacodynamics and pharmacokinetics of the drug or nutrient, which may affect medication efficacy and its therapeutic effect, resulting in a drug-nutrient interaction (Almeida, 2018). This reduction in treatment efficacy occurs through decreased drug bioavailability and may lead to toxicity (Kose et al., 2021).

Drug-nutrient interaction occurs when there is a therapeutic alteration or when the patient's nutritional status is compromised. In addition, changes occur in the absorption, metabolism, distribution, and elimination of a drug or nutrient. Another important clinical effect of these interactions is linked to the modification of the physiological action of the drug or nutrient (Leal; Junior, 2018). This interaction directly affects the pharmacokinetics and pharmacodynamics of medications, reducing absorption and/or increasing the excretion of nutrients, which may lead to deficiencies with serious consequences such as weakness and dizziness (Souza et al., 2017).

Drugs administered orally share with foods and nutrients the same absorption process in the gastrointestinal tract, making this the primary site for the occurrence of interactions. The presence of food content in the stomach and intestines can significantly alter the dynamics of drug absorption, influencing critical variables such as gastric emptying time and the duration of the substance's stay in the digestive system. Such changes may result in either an increase or a reduction in the bioavailability of the drug, directly affecting the onset and intensity of its therapeutic action (Santos et al., 2022).

The presence of high-fat foods delays the gastric emptying process, which may result in an increased residence time of certain medications in the stomach. However, this change in absorption time generally does not cause negative effects for these drugs, provided that it does not interfere with the amount absorbed. On the other hand, a reduction in the absorption rate of medications such as analgesics and antibiotics may cause significant clinical interference (Santos et al., 2022).

Among the various medications that most interact with foods, the following stand out: analgesics, anesthetics, antibiotics, medications for diabetes, antihypertensives (Captopril, Furosemide), supplements, and a variety of other drugs (Kose et al., 2021). In addition, vitamins and minerals are the nutrients most affected by this interaction. When interaction between drugs and nutrients occurs, it may result in malnutrition and pose risks to therapeutic treatment (Dantas, 2015).

The most common antihypertensives in pharmacotherapy present substantial drug-nutrient interaction, and since hypertension is a chronic disease, daily use of medication is required. Therefore, it is essential that the patient undergo strict monitoring so that no interaction occurs (Santos et al., 2020).

Prednisone may affect calcium transport, resulting in difficulty in absorption. In addition, it may increase urinary elimination of zinc and vitamin C, interfere with the renal process of vitamin D metabolism, and cause deficiencies (Silva et al., 2020).

Recommendations from health organizations warn about the consumption of amlodipine and grapefruit. Patients using amlodipine should avoid consuming large quantities of grapefruit or its juice, as grapefruit may increase amlodipine levels in the body, which may intensify side effects; however, no warning about this interaction was identified in other organizations (Stouras et al., 2022).

In addition to a variety of foods with high potential for drug interaction, alcohol stands out as one of the main interaction factors, modifying the entire bioavailability and pharmacokinetics. The population often ends up neglecting or failing to perceive its importance in this context (Neto, 2018).

The pharmacotherapeutic management of arterial hypertension requires special caution due to the high prevalence of interactions between antihypertensive agents and various nutrients. This susceptibility makes strict monitoring of the time interval between food intake and medication administration imperative. The adoption of this strategy is primarily aimed at optimizing drug absorption and minimizing side effects, thus ensuring treatment efficacy and patient safety (Freitas, 2022).

Thus, drug-nutrient interaction involves both physiological and pathophysiological aspects. It became evident that certain foods/nutrients may interfere with the absorption, bioavailability, and concentration of medications, which is a matter of concern, since it may cause treatment failure (Pereira, 2018).

Therefore, for the successful completion of pharmacological treatment without the occurrence of complications, it becomes essential to establish clear and continuous communication between the patient and the healthcare team. In this context, the pharmacist emerges as a fundamental professional, being responsible for precise and individualized guidance regarding potential interactions between drugs and nutrients. This specialized pharmacotherapeutic follow-up is a decisive strategy for the prevention of complications, ensuring greater safety and therapeutic efficacy (Barbosa; Medeiros, 2019).

CONCLUSION

This study succeeded in fulfilling its main objective of mapping the most important interactions between medications and foods. It was possible to list some medications that have significant interactions with foods, such as analgesics, anesthetics, and antibiotics. The analysis showed that the genesis of most related problems does not lie in an intrinsically negligent attitude on the part of patients, but rather in the lack of accessible information and clear professional guidance. In this way, the results obtained corroborate the premise that the knowledge gap constitutes a significant risk factor for health, underscoring the importance of educational strategies in the context of the safe use of medications.

It is important to mention that the research had its limitations. Since we basically depended on already published articles and reports, it was not possible to collect recent data on the proposed topic, as a large portion of the collected articles had been published more than 15 years ago. Another point is that the field of medications is constantly evolving, with frequent new discoveries, which makes it difficult to cover absolutely all possible interactions. Therefore, it would be interesting for new studies to conduct field research in health centers or with community groups in order to gather this information.

Finally, this study makes it even more evident how relevant this topic is and how crucial it is for health professionals to discuss it more with their patients and for it to be present in leaflets and warnings. To continue this work, I suggest that future studies create easy-to-understand materials, organize lectures in communities, and focus on populations that require more attention, such as older adults who take several medications. In this way, research moves off the page and becomes something that truly helps people use medications more safely.

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DRUG INTERACTIONS AND SELF-MEDICATION: RISKS OF THE INDISCRIMINATE USE OF MEDICATIONS WITHOUT PROFESSIONAL GUIDANCE

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Abstract

The present study aims to analyze, through a rigorous review of the scientific literature, the dangers inherent in the practice of self-medication, with an emphasis on potential and hazardous drug interactions. This approach is crucial, as self-medication has become established as a serious public health problem, driven by easy access to medications, the search for immediate symptom relief, and, often, the influence of unverified information. The methodology employed consisted of an in-depth analysis of scientific articles, systematic reviews, and epidemiological studies that address the consequences of the irrational use of drugs without proper guidance from a qualified healthcare professional. The main findings demonstrate an alarming scenario: self-medication not only increases the risk of adverse reactions and intoxications, but also significantly compromises the therapeutic effectiveness of treatments. The simultaneous or sequential intake of different medications, without knowledge of pharmacokinetic and pharmacodynamic interactions, may result in toxic effects, nullify the expected therapeutic action, or mask the diagnosis of underlying diseases. Additionally, an impact of extreme relevance to public health is the increase in antimicrobial resistance, frequently associated with the inappropriate and indiscriminate

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use of antibiotics without prescription. This irresponsible practice directly contributes to the emergence of so-called “superbugs,” limiting treatment options for future infections and increasing global morbidity and mortality. In conclusion, minimizing these complex and multifaceted risks is imperative. Investment in robust public policies that promote continuous public education on the rational use of medications is essential, highlighting the fundamental role of the pharmacist in counseling and pharmaceutical care. Professional guidance and the strengthening of access to medical consultations are essential pillars to ensure the safe and effective use of drugs, protecting individual and collective health against the silent dangers of self-medication.

Keywords: Adverse reactions, Patient safety, Public health, Polypharmacy.

INTRODUCTION

Self-medication is a recurring practice across different social classes, favored by easy access to medicines and the mistaken perception that certain drugs are harmless. However, the indiscriminate use of medicines without proper professional guidance can result in significant health consequences, such as adverse reactions, resistance to active principles, tolerance, and drug interactions. This behavior compromises therapeutic efficacy, may aggravate preexisting diseases, and constitutes a relevant public health problem (Mota; Santos; Andrade, 2024).

Drug interactions, in turn, occur when two or more drugs administered simultaneously modify their effects in the body, potentially enhancing or reducing therapeutic action, in addition to increasing the risk of toxicity. This phenomenon may also involve foods and natural substances, which increases its complexity. The lack of knowledge about these interactions, combined with indiscriminate medicine use, considerably raises health risks, especially among polymedicated patients, older adults, and children (Pinto et al., 2020; Castro; Lacerda; Marquez, 2024).

In this context, it becomes imperative to promote public awareness regarding the dangers of self-medication and the importance of professional guidance in medicine use. The role of healthcare professionals, especially pharmacists, is essential to ensure the rational use of medicines, prevent drug interactions, and optimize treatment effectiveness (Ferreira; Terra Júnior, 2018).

In addition to clinical risks, self-medication brings relevant social and economic implications, as it may generate complications that overload the public health system, increase hospital costs, and reduce the population's quality of life (Mota; Santos; Andrade, 2024).

What are the main risks associated with self-medication and drug interactions, and how can professional guidance contribute to reducing these problems?

Thus, this study aims to analyze the risks related to self-medication and drug interactions, highlighting the relevance of professional guidance for the safe use of medicines. Based on a literature review, it seeks to identify the main consequences of this practice and discuss preventive strategies, contributing to the rational use of medicines and the reduction of harm to public health (Rocha et al., 2023).

DEVELOPMENT

METHODOLOGY

This study aimed to conduct a bibliographic review. For its execution, a search was carried out in the scientific literature available on the SciELO and Google Scholar websites, using the terms "drug interactions," "self-medication," "rational use of medicines," and "polypharmacy." Articles published in the last 15 years (2010–2025) that addressed the topics of self-medication and drug interactions and discussed the risks of indiscriminate medicine use without professional guidance were included. Articles that were not relevant to the topic or that presented outdated information were excluded. The selected articles were read and analyzed in order to identify and discuss the main risks associated with medicine use without the guidance of a healthcare professional, as well as to analyze the most common drug interactions and their consequences for population health.

RESULTS AND DISCUSSION

The practice of self-medication has been widely studied worldwide and is recognized as a risk behavior that impacts public health. In Brazil, self-medication is strongly associated with the occurrence of drug interactions, which can generate clinical complications, increased morbidity and mortality, and severe adverse effects (Arrais et al., 2016). Easy access to non-prescription medicines, combined with recommendations from family members and the search for quick solutions, favors inappropriate use, often without individuals being aware of the risks involved (Domingues et al., 2017). According to the Ministry of Health (2022), approximately 35% of the Brazilian population uses medicines on their own initiative, a percentage higher than that observed in developed countries such as Canada and Germany, where self-medication rates range between 20% and 25% (WHO, 2023). This difference highlights not only cultural issues, but also structural factors that directly affect the prevalence and risks associated with the practice.

The culture of self-medication in Brazil is influenced by socioeconomic and educational factors. Low educational attainment, difficulty accessing healthcare services, and economic vulnerability increase the likelihood of risk behaviors, including the inappropriate combination of drugs without professional supervision (Domingues et al., 2017). A survey conducted by IBGE (2021) indicated that approximately 18% of the population earning up to one minimum wage resorts to self-medication, demonstrating the relationship between economic vulnerability and inappropriate medicine use. The sharing of medicines among family members and acquaintances, a common practice, intensifies the risk of interactions, which may result in hospitalizations and increased costs for the healthcare system (Arrais et al., 2016).

The indiscriminate use of antibiotics is one of the main concerns related to self-medication. Studies indicate that self-medication with antibiotics increases the selection of resistant strains, prolongs hospital stays, and raises mortality (Revista Pesquisa FAPESP, 2023; BJIH, 2021). National data show that antibiotic-resistant infections already account for approximately 15% of complications in large hospital units, mainly affecting older adults and patients with multiple comorbidities (Domingues et al., 2017). Antimicrobial resistance is exacerbated by the simultaneous use of multiple antibiotics without monitoring, increasing the risk of adverse interactions such as hepatotoxicity and severe gastrointestinal effects. The use of over-the-counter analgesics and anti-inflammatory drugs is highly prevalent in self-medication. Studies show that repeated intake or high doses may lead to complications such as gastritis, gastric ulcers, acute kidney failure, and increased cardiovascular risk (Arrais et al., 2016; Silva et al., 2020). Drug interactions with anticoagulants or antihypertensives are common and may result in bleeding or loss of blood pressure control. The combination of these drugs without professional guidance represents a significant risk, especially among older adults who already experience polypharmacy.

Self-medication with herbal medicines and dietary supplements also deserves attention. Although often considered natural and harmless, these products may interact with continuous-use medicines, reducing therapeutic efficacy or increasing toxicity (Domingues et al., 2017). A survey conducted by ANVISA (2023) indicated that 42% of herbal medicine users are unaware of possible interactions with conventional medicines. Examples include interactions between ginkgo biloba and anticoagulants, which increase bleeding risk, or between St. John's wort and antidepressants, which may induce serotonin syndrome. In addition to clinical consequences, self-medication generates significant economic impacts. Inappropriate medicine use results in intoxications, adverse reactions, and hospitalizations, increasing emergency care costs and corrective treatments (Silva et al., 2020). Data from the Ministry of Health (2023) indicate that approximately 12% of hospital admissions are related to problems resulting from drug interactions or inappropriate medicine use. A study in the Federal District estimated that expenditures on medicines reached approximately BRL 3 billion in 2023, reflecting the significant financial impact on public and household budgets (Correio Braziliense, 2023).

Vulnerable populations, such as older adults and patients with chronic diseases, are particularly susceptible to the adverse effects of self-medication. WHO data (2023) indicate that approximately 50% of older adults use five or more medicines simultaneously, significantly increasing the risk of clinically relevant drug interactions (Domingues et al., 2017). This polypharmacy compromises treatment adherence, hinders pharmacotherapeutic monitoring, and favors the occurrence of adverse events.

Regarding the understanding of package inserts, studies indicate that the technical language used on labels and instructions makes correct interpretation difficult for a large portion of the population. A survey by IDEC (2022) revealed that 62% of users reported difficulty understanding package inserts, which increases the risk of administration errors and inappropriate use. The literature emphasizes the need to investigate more effective communication strategies capable of improving understanding and reducing risks associated with self-medication (Silva; Silva; Almeida, 2020).

From a regulatory perspective, RDC No. 44/2009 establishes minimum criteria for good practices in pharmacies and drugstores, focusing on safety, quality, and rational medicine use (BVSMS, 2009). Recent studies indicate, however, that inspection and enforcement of these standards still present limitations, especially in regions with lower densities of healthcare professionals, contributing to the persistence of indiscriminate self-medication (Gov.br, 2023).

Among the most common drug–drug interactions, the combination of anticoagulants such as warfarin with NSAIDs (ibuprofen, diclofenac) stands out, significantly increasing the risk of hemorrhage due to their simultaneous effects on coagulation. Another important example is the concomitant use of SSRIs (such as sertraline) with opioid analgesics (tramadol), which may trigger serotonin syndrome, characterized by agitation, tremors, and autonomic changes. Additionally, anticonvulsants such as carbamazepine may reduce the effectiveness of oral contraceptives through hepatic enzyme induction, and azole antifungals such as ketoconazole may increase plasma concentrations of anticoagulants, raising bleeding risk. The interaction between proton pump inhibitors (omeprazole) and anticoagulants, which may alter the therapeutic action of the latter, is also relevant (Oliveira; Silva; Costa, 2018).

Regarding drug–food interactions, antibiotics such as tetracycline and ciprofloxacin are noteworthy, as their absorption may be reduced by the concomitant intake of dairy products (Silva et al., 2017). MAOIs such as phenelzine may cause hypertensive crisis when combined with foods rich in tyramine, such as aged cheeses and processed meats. In addition, antibiotics such as rifampicin may reduce the effectiveness of oral contraceptives due to enzyme induction that accelerates contraceptive metabolism (Silva et al., 2018).

Among drug–beverage interactions, metronidazole associated with alcohol causes a disulfiram-like reaction, characterized by nausea, vomiting, and tachycardia. Anticoagulants such as warfarin may have their effects enhanced by the consumption of cranberry juice, increasing bleeding risk (Costa, 2024). Lithium presents increased urinary excretion in the presence of caffeine, reducing its therapeutic efficacy and increasing the risk of treatment instability (Rosa et al., 2025).

Interactions involving medicines and supplements or herbal products also deserve attention. Ginkgo biloba, when used together with anticoagulants, may increase bleeding risk (Souza; Lima, 2021). St. John's wort, when combined with antidepressants, increases the risk of serotonin syndrome. In addition, garlic, ginger, and ginseng may intensify anticoagulant effects, once again increasing bleeding risk (Nicoletti, 2005).

These interactions demonstrate the complexity of using multiple medicines and natural products without professional guidance. Indiscriminate self-medication increases the likelihood of clinical complications and adverse effects, reinforcing the importance of studies investigating patterns of inappropriate medicine use and their impacts on public health (Melo et al., 2021).

In countries with more structured healthcare systems, such as Canada and Germany, supervision of medicine sales and the availability of reliable information result in lower rates of self-medication (WHO, 2023). In Brazil, regional, cultural, and economic inequalities hinder the reduction of this behavior, reflected in high rates of inappropriate medicine use, bacterial resistance, and increased clinical complications associated with drug interactions (Arroyo et al., 2024).

CONCLUSION

This study sought to analyze the risks of self-medication and drug interactions, highlighting how this widespread practice compromises the safety and effectiveness of pharmacological treatments. The objectives were achieved by demonstrating that indiscriminate medicine use, combined with the lack of professional guidance, generates serious consequences for public health, including an increased occurrence of adverse reactions and difficulties in therapeutic control among polymedicated patients.

In light of the research problem, it was found that self-medication is sustained by cultural, social, and economic factors that favor inappropriate drug use. It was observed that, despite existing efforts in educational campaigns and awareness actions, the practice remains frequent, especially among vulnerable groups such as older adults and individuals with chronic diseases. This scenario reinforces the need to expand public guidance policies, strengthen the role of the pharmacist, and invest in more accessible and continuous health education strategies.

As limitations, the dependence on studies available in scientific databases is highlighted, which may restrict the coverage of certain regional contexts or specific populations. It is recommended that future research further explore the relationship between self-medication and emerging social factors, such as the indiscriminate use of supplements and herbal medicines, as well as evaluate the impact of pharmaceutical care programs on daily population life. In this way, this study contributes to broadening reflection on the importance of rational medicine use and the need for more effective strategies to prevent risks associated with drug interactions.

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OPTIMIZATION OF THE SUPPLY CHAIN IN HOSPITAL PHARMACIES: EFFICIENCY IN MANAGEMENT

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Abstract

Supply chain management in hospital pharmacies represents a fundamental challenge for ensuring the continuous availability of medicines and supplies, reducing waste, and optimizing resources. This study aims to analyze strategies and tools aimed at optimizing this chain, with a focus on operational efficiency, cost reduction, and patient safety. The research, qualitative in nature and based on a literature review, identified the main challenges of hospital logistics administration, such as the lack of integration among sectors, failures in demand forecasting, and a high rate of losses due to medication expiration. In addition, it highlighted the impact of emerging technologies, such as automation, artificial intelligence, and predictive analytics, which contribute to greater precision in inventory control and purchasing planning. Management practices were also described, such as the monitoring of performance indicators, the application of Just in Time, and traceability, all of which favor waste reduction and process improvement. It is concluded that the incorporation of technological innovations combined with sound managerial practices is essential to strengthen the efficiency of the hospital supply chain and promote safety in patient care.

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Keywords: Hospital pharmacy, Supply chain, Automation, Inventory management, Patient safety.

INTRODUCTION

The supply chain in hospitals comprises a set of clinical processes, including the acquisition, storage, distribution, and disposal of medicines and medical materials. Effective management in these environments is crucial to ensure the continuous availability of essential medicines and minimize waste resulting from the deterioration or expiration of products (Pereira et al., 2019).

Logistical challenges in hospitals are distinct, requiring strict control of expiration dates, management of costly medicines, and accurate demand forecasting to avoid both shortages and surpluses (Silva; Almeida, 2021). According to data from the World Health Organization (WHO, 2018), about 10% of medicines acquired by hospitals are discarded due to inadequate inventory management practices, which compromises both the financial efficiency of institutions and the quality of patient care.

Recently, technological innovations such as process automation, the use of big data and artificial intelligence for demand forecasting, in addition to the implementation of integrated systems in hospital management, have contributed to optimizing supply chains in hospital pharmacies (Machado; Santos, 2020). This study aims to encourage pharmacists to adopt strategies that improve this chain in hospital pharmacies, with a focus on operational efficiency, cost reduction, and increased safety in supply.

The growing demand for efficient hospital services requires institutions to adopt effective methods in supply chain management. Inventory shortages may impair medical treatments, while surpluses may result in significant financial losses. A study conducted by the Institute for Health Policy Studies (IEPS, 2021) indicates that approximately 20% of operational costs are related to poor inventory management, highlighting an urgent need for improvements in this sector. Innovative technologies have enabled notable advances in logistics within hospitals; automated systems such as RFID (Radio Frequency Identification) and QR codes have been widely used to improve control over supplies and minimize failures during medication dispensing (Souza; Barros, 2019).

In addition, implementing ERP (Enterprise Resource Planning) systems has proven crucial for promoting greater integration among hospital sectors, facilitating planning in purchasing and distribution (Costa et al., 2020). Considering its importance for managerial improvement in hospitals and patient safety, this study seeks to enrich existing knowledge by bringing new perspectives on ideal practices applicable to the supply chain of hospital pharmacies.

Therefore, the following question arose: which strategies can be implemented to improve the supply chain in hospital pharmacies in order to increase efficiency, reduce waste, and ensure the constant availability of supplies?

Strategies and tools aimed at optimizing the supply chain in hospital pharmacies were discussed, with an emphasis on the effectiveness of medication management. The main challenges faced in administering this chain were presented; the impact of technologies such as automation, artificial intelligence, and predictive analytics on inventory control was examined; effective practices for controlling waste and reducing logistics costs were described; and successful models in hospital supply chain management were presented.

DEVELOPMENT

METHODOLOGY

This work was conducted through qualitative research grounded in a comprehensive literature review involving relevant scientific articles published since 2015 on the optimization of supply chains in hospital pharmacies. The survey was carried out using recognized academic databases such as SciELO, Google Scholar, PubMed, or CAPES Journals, with the primary search expression focused on ("optimization" **AND** "supply chain" **AND** "hospital pharmacy" **AND** "2015-2025" **AND** "literature review"). The selection criteria included works dealing with ("technological innovation" **AND** "hospital supplies") **OR** studies focused on ("demand prediction models" **AND** "process automation") **OR** studies concerning ("positive impact" **AND** "efficient management" **AND** ("reduction in operational costs" **OR** "waste" **AND** "hospital environment")). The analysis was carried out through a systematic review comparing methodologies available in contemporary literature, seeking to identify emerging best practices in this field.

RESULTS AND DISCUSSION

The literature review carried out showed that supply chain management in hospital pharmacies is a multifaceted and highly complex process whose efficiency depends on factors such as strategic planning, sectoral integration, and the use of information technologies aimed at automation and traceability. According to Pereira, Gomes, and Ferreira (2019), the absence of standardization in internal processes and failures in communication among the purchasing, warehouse, and pharmacy sectors compromise data accuracy and demand predictability. This lack of alignment generates stockouts, waste, and rework, directly affecting the quality of care and patient safety. In addition, Silva and Almeida (2021) point out that, in many hospitals, inventory management is still carried out manually, which makes it difficult to consolidate information in real time and prevents the use of performance indicators that assist in logistical decision-making.

The studies analyzed revealed that the use of technological tools has been one of the main differentiators in the modernization of the hospital supply chain. The use of tracking systems, such as RFID (Radio Frequency Identification) and QR Code, provides greater control over the movement of medicines, reducing the risk of loss and ensuring the traceability of each item throughout the entire process (Souza; Barros, 2019). These technological resources, combined with the implementation of ERP (Enterprise Resource Planning) systems, allow integration among the various departments and promote a systemic view of the flow of materials (Costa; Lima; Almeida, 2020). Such integration reduces human error, improves purchasing efficiency, and optimizes stock replenishment time, which is essential in hospital environments, where delays may compromise the continuity of treatments and care safety.

The incorporation of technologies based on artificial intelligence (AI) and predictive analytics has also stood out as an impactful innovation in hospital logistics. According to Machado and Santos (2020), these tools are capable of processing historical data and consumption patterns to anticipate future needs, minimizing the occurrence of shortages or surpluses of medicines.

The Institute for Health Policy Studies (IEPS, 2021) found that hospitals that adopted predictive models presented an average reduction of 15% in operational costs and a significant increase in the availability of critical supplies. This digital transformation contributes to more efficient resource management, favoring the economic and environmental sustainability of healthcare institutions. Alongside technological advancement, the importance of managerial methodologies aimed at operational efficiency, such as Just in Time (JIT) and Lean Healthcare, also stands out. JIT consists of a replenishment model based on actual demand, avoiding excess inventories and reducing losses due to medication expiration (Pereira et al., 2019). Lean Healthcare, in turn, emphasizes the elimination of activities that do not add value, promoting the continuous improvement of processes and the involvement of teams in the search for innovative solutions (Womack; Jones, 2017). According to Costa et al. (2020), the combination of these methodologies allows greater agility in supply management, improving decision-making and the rational use of hospital resources.

Another relevant factor identified in the literature is the need for the continuous qualification of professionals involved in hospital logistics management. Adequate technical and managerial training is indispensable for the understanding and effective use of technological tools and management practices (Machado; Santos, 2020). As emphasized by Moreira and Fernandes (2022), the absence of training may limit the effectiveness of the innovations implemented, generating resistance to change and impairing the achievement of the expected results. Thus, continuing education programs and specific training should be incorporated into the management policy of hospital pharmacies, strengthening the technical competence of teams and compliance with safety and quality protocols.

Traceability and the standardization of logistical processes constitute fundamental elements for increasing safety and efficiency in the hospital supply chain. Souza and Barros (2019) argue that traceability ensures transparency and reliability at all stages, from acquisition to medication dispensing, making it possible to quickly identify and correct failures or deviations. The National Health Surveillance Agency (ANVISA, 2020) also reinforces that traceability is an indispensable requirement for compliance with standards of good practices in the storage and distribution of medicines. In this way, the adoption of computerized systems that allow the recording and monitoring of each item is essential for regulatory compliance and patient safety.

In addition to operational benefits, hospital logistical efficiency has a direct impact on the quality of care. The World Health Organization (WHO, 2018) highlights that the continuous availability of medicines is one of the pillars of patient safety and treatment effectiveness. Interruptions in supply, even if occasional, may compromise critical procedures and aggravate patients' clinical condition. Integration between care and supply sectors through computerized systems is considered a strategic measure to mitigate this risk (IEPS, 2021). In this sense, supply chain management should not be treated merely as an administrative function, but as a strategic area directly linked to the quality and safety of care.

The results of the bibliographic analysis indicate that the sustainability of the hospital supply chain is also a growing topic in academic and institutional discussions. According to Dias and Rocha (2021), the implementation of sustainable practices, such as waste management, the reuse of materials, and rational energy consumption, can reduce environmental impacts and operational costs. This approach is aligned with the concept of the "green hospital," which seeks to integrate operational efficiency and socio-environmental responsibility. In this way, the adoption of sustainable technologies and management practices expands the benefits of logistical optimization, contributing not only to economic performance but also to the institutional image and ethical commitment of healthcare organizations.

The reviewed literature allows the conclusion that improving the hospital supply chain depends on the convergence of technology, management, and professional training. As pointed out by Ferreira and

Melo (2023), the integration of digital tools with management strategies based on data and indicators is the path to achieving higher levels of performance and transparency in operations. However, such advances are only consolidated in a lasting manner when accompanied by an organizational culture geared toward innovation and continuous improvement (Costa et al., 2020). Senior management must assume a leadership role in this process, ensuring resources, training, and the engagement of multidisciplinary teams.

It is possible to state that digital transformation and the application of sound managerial practices are fundamental pillars for strengthening the supply chain in hospital pharmacies. When associated with continuing education and institutional commitment, these strategies promote efficiency, waste reduction, and greater safety in patient care. Thus, hospital logistics management transcends its operational function, assuming a strategic and innovative character capable of sustaining the quality of care and the sustainability of the healthcare system.

CONCLUSION

The study made it possible to understand that the efficiency of the supply chain in hospital pharmacies depends directly on the adoption of strategies that combine technology, planning, and professional training. The analysis of the references showed that automation, artificial intelligence, and predictive analytics represent essential tools for reducing logistical failures, forecasting demands, and optimizing resources.

Likewise, managerial practices such as process standardization, traceability, and the monitoring of indicators strengthen patient safety and reduce waste. Thus, it is concluded that efficient supply chain management not only contributes to the economic-financial balance of hospital institutions, but also to the improvement of the quality of care.

Therefore, this work reinforces the need for hospital managers and pharmacists to adopt a strategic view of logistics, aligning technological innovation with sound management practices, in order to ensure a continuous and safe flow of medicines and supplies within the hospital environment.

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SUSTAINABLE PUBLIC POLICIES AS A TOOL FOR THE PROMOTION OF COLLECTIVE HEALTH

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Abstract

This study aims to analyze the role of sustainable public policies as a strategic tool for promoting collective health, considering their contribution to improving living conditions and reducing social inequalities. The methodology consists of a narrative literature review with a qualitative approach, based on national and international scientific publications addressing public health, sustainability, and governance. The results show that integrated public policies, which connect sectors such as environment, education, and health, can generate positive impacts on disease prevention, health promotion, and the development of healthier territories. Furthermore, intersectorality and social participation are highlighted as essential elements for the effectiveness of these policies. It is concluded that the implementation of sustainable public policies strengthens health systems and significantly contributes to the promotion of collective health, being essential for sustainable development and social equity.

Keywords: Collective health, Health promotion, Public policies, Sustainability, Sustainable development.

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INTRODUCTION

The social, economic, and environmental transformations observed in recent decades have intensified the challenges faced by health systems worldwide, especially with regard to the promotion of collective health. In this context, sustainable public policies emerge as fundamental strategies for integrating intersectoral actions aimed not only at disease prevention, but also at improving the living conditions of populations. Sustainability, as a guiding principle, broadens the understanding of health by considering social, environmental, and economic determinants.

Given this scenario, the following research question is defined: in what ways can sustainable public policies contribute to the promotion of collective health and to the reduction of health inequalities? This problem becomes particularly relevant when considering the need for effective strategies that articulate different sectors and promote lasting impacts on population quality of life.

The general objective of this study is to analyze the role of sustainable public policies as a tool for promoting collective health. The specific objectives are: to understand the theoretical foundations of sustainability applied to health; to identify the main challenges in implementing these policies; and to discuss the impacts of intersectoral actions on the improvement of health indicators.

The justification for this study lies in the growing need to rethink traditional health management models by incorporating sustainable practices that promote equity and social inclusion. Furthermore, the academic and social relevance of the topic is associated with the search for solutions to complex problems such as social inequalities, environmental degradation, and limited access to health services.

With regard to the brief theoretical review, it is highlighted that health promotion, as proposed by authors such as Buss and Pellegrini Filho, is directly related to action on the social determinants of health. Moreover, the sustainability perspective discussed by Sachs reinforces the need for integration between economic development, social justice, and environmental preservation. In addition, the intersectoral approach, widely debated by authors such as Akerman, demonstrates that effective public policies depend on articulation between different governmental areas and the active participation of civil society.

METHODOLOGY

TYPE OF RESEARCH

This study is characterized as qualitative research with a descriptive and exploratory approach. This design was chosen because it allows for an in-depth understanding of sustainable public policies and their relationship with the promotion of collective health, considering the complexity and multidimensionality of the topic. Qualitative research enables the analysis of social phenomena within their contexts, valuing interpretations and meanings constructed from the scientific literature.

METHODOLOGICAL PROCEDURES

Literature review

As the main technique, a narrative literature review was conducted with the objective of collecting, analyzing, and synthesizing relevant scientific productions on public policies, sustainability, and collective health. Databases such as SciELO, PubMed, and Google Scholar were consulted, prioritizing articles published in recent years, without excluding classical references of significant theoretical relevance.

Inclusion and exclusion criteria

Studies that directly addressed the relationship between sustainable public policies and health promotion were included, provided they were available in Portuguese, English, or Spanish. Duplicate works, studies lacking methodological rigor, and publications that did not directly engage with the proposed theme were excluded.

DATA COLLECTION TECHNIQUES AND INSTRUMENTS

Data collection was carried out through a bibliographic survey using descriptors such as “public policies,” “sustainability,” and “collective health.” As an instrument, an analytical matrix was employed to organize information, including aspects such as study objectives, methodology used, main results, and contributions to the field of public health.

DATA ANALYSIS

Data analysis followed an interpretative approach based on thematic content analysis. Initially, an exploratory reading of the selected materials was conducted, followed by the categorization of the main thematic axes, such as intersectorality, social determinants of health, and sustainable development. Subsequently, a critical interpretation of the findings was performed, seeking to identify convergences, gaps, and contributions of the analyzed studies.

METHODOLOGICAL FOUNDATION

The choice of the narrative review as a methodological strategy is based on its capacity to provide a broad and integrated view of a given theme, as discussed by authors in the field of scientific methodology. In addition, the qualitative approach allows for an understanding of the relationship between public policies and collective health in a contextualized manner, considering social, economic, and environmental aspects. Thus, the adopted methodology is appropriate to the objectives of the study, contributing to the construction of a critical and reflective analysis of the role of sustainable public policies in the promotion of collective health.

RESULTS AND DISCUSSION

The results of this study demonstrate that sustainable public policies play a strategic role in the promotion of collective health, especially when structured in an intersectoral manner and guided by the social determinants of health. The literature analysis made it possible to identify that integrated actions between sectors such as health, education, environment, and social assistance contribute significantly to the improvement of population living conditions, reflected in the reduction of health problems and the promotion of well-being. It is observed that programs focused on environmental sustainability, such as basic sanitation, solid waste management, and access to potable water, have a direct impact on reducing infectious and parasitic diseases, corroborating the findings of Buss and Pellegrini Filho regarding the influence of social determinants on health.

Furthermore, policies promoting healthy eating and encouraging physical activity reinforce the prevention of non-communicable chronic diseases, aligning with health promotion guidelines discussed in contemporary literature. Intersectorality emerges as a central element in the effectiveness of these policies, as it enables coordination between different governmental areas and the development of more comprehensive strategies. As discussed by Akerman, the integration of public policies expands the capacity to respond to complex social demands, promoting greater equity in health. However, the literature also points to significant challenges, such as fragmentation of actions, limited resources, and low levels of social participation in certain contexts.

Below is a synthesis of the main findings identified in the analyzed literature:

Table 1

Relationship between sustainable public policies and impacts on collective health

Type of public policy	Action developed	Impact on collective health
Basic sanitation	Expansion of access to treated water	Reduction of infectious diseases
Solid waste management	Collection and proper disposal	Reduction of environmental and sanitary risks
Health education	Educational campaigns	Increase in prevention and self-care
Promotion of healthy eating	Encouragement of adequate dietary habits	Reduction of chronic diseases
Sustainable urban mobility	Encouragement of active transportation	Improvement in quality of life and physical health

The data presented reinforce that the promotion of collective health depends on public policies that transcend the health sector, incorporating sustainability as a guiding principle. This perspective aligns with the concept of sustainable development proposed by Sachs, which integrates social, economic, and environmental dimensions.

Additionally, the importance of social participation in the planning and implementation of public policies is emphasized. Community inclusion in decision-making processes contributes to greater legitimacy and effectiveness of actions, while also strengthening social control and citizenship.

Table 2

Challenges and potentialities of sustainable public policies in collective health

Analyzed aspects	Identified challenges	Observed potentialities
Public management	Fragmentation of policies	Intersectoral integration
Financial resources	Budgetary limitations	Optimization of investments
Social participation	Low adherence in some contexts	Strengthening of social control
Planning	Lack of continuity of actions	Development of long-term policies
Sustainability	Difficulty in practical implementation	Promotion of healthy environments

Thus, the results indicate that despite existing challenges, sustainable public policies have great potential to promote collective health in an equitable and lasting manner. The discussion reinforces the need to strengthen these strategies, with emphasis on sector integration, continuous investment, and expanded social participation, aiming at the construction of more resilient and sustainable health systems.

CONCLUSION

The present study aimed to analyze the role of sustainable public policies as a tool for promoting collective health, seeking to understand their contributions to improving living conditions and reducing health inequalities. Based on the literature review, it was possible to demonstrate that integration between different sectors, combined with sustainability principles, constitutes a fundamental element for strengthening public health actions.

The main results indicate that public policies guided by intersectorality and the social determinants of health have positive impacts on disease prevention, the promotion of well-being, and the construction of healthier environments. It was also highlighted that initiatives related to basic sanitation, health education, healthy eating, and sustainable urban mobility contribute significantly to the promotion of collective health. However, important challenges were also identified, such as fragmentation of actions, resource limitations, and the need for greater social participation.

As a contribution, this study reinforces the relevance of incorporating sustainability as a structural axis of public health policies, broadening the understanding of health beyond the biomedical model and promoting a more integrated and equitable approach. Furthermore, the research contributes to academic debate by systematizing evidence that highlights the importance of articulation between different areas in the promotion of collective health.

Finally, it is suggested that future research delves deeper into the empirical analysis of the implementation of sustainable public policies in local contexts, as well as evaluate their long-term impacts on population health. It is also recommended to investigate strategies that strengthen social participation and collaborative governance, aiming at the consolidation of more effective, inclusive, and sustainable policies.

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BAYESIAN INFERENCE AS A TOOL FOR REDUCING DIAGNOSTIC UNCERTAINTIES IN CANCER

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Abstract

The increasing complexity of oncological diagnosis, associated with tumor heterogeneity and limitations of traditional methods, highlights the need for approaches capable of reducing clinical uncertainties and improving decision-making. In this context, Bayesian inference emerges as a relevant tool by enabling the integration of prior probabilities with new clinical evidence. This study aimed to analyze the application of Bayesian inference in reducing diagnostic uncertainties in cancer through an integrative literature review. The search was conducted in the SciELO, PubMed, and Scopus databases, considering publications from 2021 to 2026 in Portuguese, English, and Spanish. Studies addressing the use of Bayesian methods in diagnosis, prognosis, and clinical trials in oncology were included. The results demonstrated that Bayesian inference significantly enhances clinical reasoning by allowing continuous updating of diagnostic probabilities and reducing cognitive biases. Furthermore, its application in predictive models, survival analysis, and adaptive clinical trials showed greater methodological flexibility and statistical robustness, especially in scenarios involving high uncertainty and small sample sizes. Its role in precision oncology was also highlighted, particularly in integrating clinical and molecular data to support personalized care. It is concluded that Bayesian inference represents a promising approach to improve oncological diagnosis, contributing to more accurate and evidence-based clinical decisions.

Keywords: Bayesian Inference, Cancer, Diagnosis, Diagnostic Uncertainty, Oncology.

INTRODUCTION

The complexity inherent to oncological diagnosis represents one of the greatest contemporary challenges in the field of health, especially due to the biological variability of tumors, the clinical heterogeneity of patients, and the limitations of traditional diagnostic methods. In this context, clinical decision-making often occurs under conditions of uncertainty, which may compromise diagnostic accuracy and, consequently, the effectiveness of therapeutic interventions. Evidence-based medicine has sought strategies to minimize such uncertainties, among which the use of advanced probabilistic approaches stands out, such as Bayesian inference, which allows the integration of prior information with current clinical data to improve diagnostic reasoning (Sousa; Aguiar, 2022).

Bayesian inference is grounded in Bayes' theorem, which enables the continuous updating of probabilities as new evidence is incorporated into the decision-making process. This approach has been widely discussed as both a pedagogical and practical tool in the clinical context, promoting greater diagnostic accuracy by considering both pre-test probability and the results of complementary examinations (Lorca; Aguila, 2024). In addition, its applicability goes beyond teaching, being incorporated into clinical studies and advanced statistical models, which reinforces its relevance in contemporary medicine, especially in complex areas such as oncology (Taylor et al., 2025).

In this sense, Figure 1 illustrates the probabilistic updating process characteristic of Bayesian inference, highlighting the relationship between prior knowledge, observed evidence, and posterior probability in the diagnostic context.

Figure 1

Diagram of Bayesian Inference in the Diagnostic Process

$$P(H \mid E) = \frac{P(E \mid H) \cdot P(H)}{P(E)}$$

Source: A matemática por trás das decisões clínicas *[The mathematics behind clinical decisions]* (2024)

Bayesian inference, represented in Figure 1, is based on the continuous updating of probabilities as new evidence is incorporated into the analytical process. From this perspective, the posterior probability P(H/E) expresses the chance that a hypothesis H is true after the observation of evidence E, being calculated from the prior probability P(H), which reflects initial knowledge, and the likelihood P(E/H), which indicates the degree of compatibility between the observed evidence and the hypothesis considered. The term P(E), in turn, acts as a normalization factor, ensuring that the resulting probabilities are consistent within the model.

The application of Bayesian inference to cancer diagnosis has proven particularly promising, as it enables the integration of multiple sources of data, including laboratory tests, imaging findings, genomic information, and the patient's clinical history. Recent evidence indicates that Bayesian models are capable of increasing accuracy in prognostic prediction and early detection of neoplasms, favoring more assertive clinical decisions (Chu et al., 2022; Teng et al., 2022). Furthermore, the use of dynamic and adaptive models allows monitoring disease progression over time, continuously adjusting risk estimates (Zhou et al., 2021).

Another relevant aspect concerns the ability of Bayesian inference to deal with scenarios characterized by small samples and incomplete data, a recurrent situation in oncological studies, especially in rare cancers or in early phases of clinical investigation. In this context, the incorporation of prior evidence and the use of methods such as information borrowing become essential to increase the robustness of analyses and reduce the uncertainty associated with estimates (Sondhi et al., 2021; Su et al., 2022). This characteristic gives the Bayesian approach a significant advantage over traditional frequentist methods, which generally depend on large samples to ensure statistical validity.

Additionally, Bayesian inference has been widely applied in the development and analysis of clinical trials in oncology, contributing to the construction of more flexible and efficient experimental designs. Bayesian models allow adaptations throughout the study, such as dose adjustments, early stopping for efficacy or futility, and incorporation of external data, optimizing the process of developing new therapies (Chen et al., 2022; Song; Wen, 2023). At the same time, innovative approaches, such as Bayesian generative models and informed survival analyses, have expanded the possibilities for understanding tumor dynamics and therapeutic response (Pourzanjani et al., 2024; Bartoš et al., 2022).

Within the scope of precision oncology, the integration of multi-omics data with Bayesian models has enhanced care personalization, enabling more accurate identification of biomarkers and patient stratification. This approach favors individualized therapeutic decisions contributing to the reduction of uncertainties and increased clinical effectiveness (Correa-Aguila et al., 2022). Complementarily, Bayesian tools have been incorporated into clinical decision-making environments, such as tumor boards, assisting professionals in interpreting complex data and defining more appropriate management strategies (Pasetto et al., 2021).

Moreover, Bayesian analysis has been employed in the evaluation of therapeutic interventions, including radiotherapy and pharmacological regimens, providing a more in-depth understanding of treatment effects in real-world contexts (Fornacon-Wood et al., 2022). The use of advanced predictive models, such as deep Bayesian networks and survival models with multiple change points, reinforces the potential of this approach in anticipating clinical outcomes and reducing prognostic uncertainties (Zhang et al., 2022; Xu, 2026).

Another relevant point concerns the applicability of Bayesian inference in the validation of health instruments and metrics, as evidenced by the use of the Bayesian omega coefficient, which contributes to greater precision in assessing the reliability of clinical and psychometric measures (Banos-Chaparro; Caycho-Rodriguez, 2024). This methodological advance strengthens the quality of evidence used in diagnostic and therapeutic processes, increasing the safety of clinical decisions.

In view of this context, it is observed that Bayesian inference has become established as a robust and versatile tool in reducing diagnostic uncertainties in cancer by integrating different sources of information and promoting a more dynamic, adaptive, and personalized approach to clinical practice. Its application ranges from individual clinical reasoning to the development of clinical trials and complex predictive models, highlighting its significant impact on contemporary oncology.

Thus, the present study aims to analyze the application of Bayesian inference as a tool for reducing diagnostic uncertainties in cancer, highlighting its contributions to improving clinical reasoning, decision-making, and diagnostic accuracy in the oncological context.

METHODOLOGY

This is an integrative literature review, qualitative in nature and with a descriptive-analytical approach, whose objective was to gather, analyze, and synthesize scientific evidence regarding the application of Bayesian inference as a tool for reducing diagnostic uncertainties in cancer. The choice of this type of review is justified by its ability to integrate results from studies with different methodological designs, enabling a comprehensive understanding of the investigated phenomenon and contributing to the consolidation of knowledge in the area.

The conduct of the study was guided by the following stages: (1) identification of the theme and development of the guiding question; (2) definition of inclusion and exclusion criteria; (3) establishment of the search strategy; (4) selection of studies; (5) analysis and interpretation of results; and (6) synthesis of knowledge. These stages were systematically organized, ensuring methodological rigor and reproducibility.

The guiding question that directed this review was: "How has Bayesian inference been applied to reduce diagnostic uncertainties in cancer in the clinical context and in oncological research?" This question was structured to encompass both practical applications in clinical reasoning and the use of Bayesian models in diagnostic and prognostic studies.

The search for studies was conducted in the Scientific Electronic Library Online (SciELO), PubMed, and Scopus databases, recognized for their relevance and scope in the health field. Controlled and uncontrolled descriptors were used, combined by Boolean operators AND and OR, in Portuguese, English, and Spanish. The main descriptors employed were: “Inferência Bayesiana,” “Bayesian Inference,” “Diagnóstico,” “Diagnosis,” “Câncer,” “Cancer,” “Oncologia,” “Oncology,” “Incerteza Diagnóstica,” and “Diagnostic Uncertainty.” The search strategy was adapted according to the specificities of each database, aiming to broaden the sensitivity and scope of study retrieval.

The inclusion criteria were: (a) scientific articles published between 2021 and 2026; (b) studies available in full text; (c) publications in Portuguese, English, or Spanish; (d) research addressing the application of Bayesian inference in diagnosis, prognosis, or decision-making in oncology; and (e) studies with diverse methodological designs, including clinical trials, observational studies, reviews, and statistical modeling.

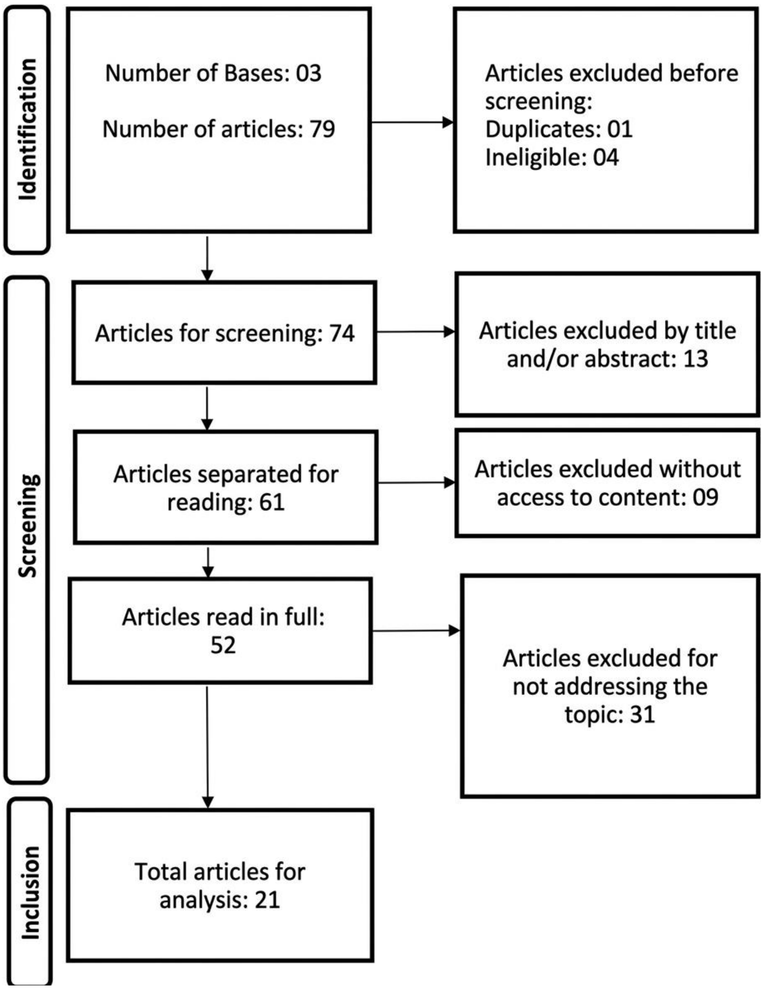
The exclusion criteria were: (a) duplicate articles; (b) studies that did not answer the guiding question; (c) incomplete publications, such as abstracts, editorials, letters to the editor, and expert opinions without methodological support; and (d) studies whose focus was not directly related to the use of Bayesian methods in oncology.

The study selection process occurred in three stages: initially, titles and abstracts were read to identify potential relevance; subsequently, the full texts of preselected articles were read; finally, studies that met all established criteria were included in the final sample. To ensure greater rigor, selection was conducted carefully, prioritizing studies with higher levels of evidence and scientific relevance.

In this context, Figure 2 presents the flowchart of the study selection process, detailing the stages of identification, screening, eligibility, and inclusion, according to the criteria established in this review.

Figure 2

Flowchart of the Study Selection Process



Source: Authors (2026)

Data analysis was conducted through critical reading and interpretation of the included studies, followed by the organization of information into thematic categories aligned with the research objectives. Aspects such as study type, application of Bayesian inference, clinical context, contributions to oncological diagnosis, and the main limitations identified by the authors were considered. This approach enabled the identification of patterns, gaps, and advances in the use of Bayesian methods in oncology.

Finally, the synthesis of results was carried out in a narrative and analytical manner, articulating findings from different studies and highlighting the contributions of Bayesian inference to reducing diagnostic uncertainties in cancer. The methodological rigor adopted throughout all stages aims to ensure the reliability of the presented results and their relevance to clinical practice and future research in the field.

RESULTS AND DISCUSSION

The analysis of the selected studies revealed that the application of Bayesian inference in the oncological context has expanded significantly in recent years, particularly with respect to reducing diagnostic uncertainties, improving clinical reasoning, and developing more robust predictive models. The included studies exhibited methodological diversity, encompassing clinical trials, statistical modeling, observational studies, and theoretical reviews, reinforcing the versatility of the Bayesian approach in contemporary oncology. Overall, the findings point to three main axes of application: (1) support for diagnostic reasoning and clinical decision-making; (2) development of prognostic and predictive models; and (3) optimization of clinical trials and evaluation of therapeutic interventions. These axes reflect the breadth of use of Bayesian inference, from the individual patient level to the planning of complex clinical research.

In this context, Table 1 synthesizes the main characteristics of the analyzed studies, including authors, year of publication, type of study, and main contributions related to the use of Bayesian inference in oncology.

Table 1

Characterization of the Studies Included in the Review

Author/Year	Application Context	Analytical Synthesis of Contributions
Sousa; Aguiar (2022)	Medical education and clinical reasoning	Structuring of probabilistic clinical reasoning, integrating deduction and induction in a Bayesian approach applied to decision-making
Lorca; Aguila (2024)	Clinical diagnosis	Application of Bayes' theorem to enhance clinical judgment and reduce cognitive biases
Cerda *et al.* (2025); Taylor *et al.* (2025)	Clinical trials	Consolidation of Bayesian analysis as a more flexible and clinically meaningful interpretive alternative in experimental studies
Sondhi et al. (2021); Su et al. (2022)	Small samples and data integration	Strengthening inference in scenarios of high uncertainty through the incorporation of external evidence (information borrowing)
Chen et al. (2022); Song; Wen (2023)	Oncological clinical trials	Development of Bayesian adaptive designs, expanding efficiency and methodological flexibility
Chu et al. (2022)	Cancer prognosis	Integration of clinical and molecular data to construct more accurate prognostic models
Teng et al. (2022); Zhang et al. (2022)	Oncological prognosis	Use of dynamic models and deep Bayesian networks to improve the prediction of clinical outcomes
Zhou et al. (2021); Bartoš et al. (2022)	Survival models	Application of Bayesian averaging and informed models for greater robustness in the analysis of longitudinal data
Yao et al. (2023)	Immuno-oncology	Integrated longitudinal modeling for the analysis of complex clinical outcomes
Fornacon-Wood et al. (2022); Pourzanjani et al. (2024); Xu (2026)	Tumor dynamics and interventions	Expanded understanding of tumor evolution and therapeutic effects through advanced Bayesian models
Pasetto et al. (2021); Correa-Aguila et al. (2022); Agema et al. (2025)	Precision oncology and clinical decision-making	Integration of complex data and support for personalized clinical decision-making in multidisciplinary settings
Banos-Chaparro; Caycho-Rodriguez (2024)	Instrument validation	Application of the Bayesian omega coefficient for greater precision in assessing the reliability of measures

Source: Authors (2026)

From the analysis of the studies, it was found that Bayesian inference has been widely used as a tool to support clinical reasoning, enabling the integration of prior probabilities with new diagnostic evidence. According to Sousa and Aguiar (2022), this approach contributes to the development of more structured clinical reasoning by articulating deductive and inductive elements within a dynamic probabilistic model. Corroborating this perspective, Lorca and Aguila (2024) emphasize that applying Bayes' theorem in the diagnostic process favors more grounded decisions, reducing cognitive biases and increasing clinical accuracy.

With regard to prognostic models, the analyzed studies demonstrate significant advances in the use of Bayesian methods for predicting cancer outcomes. Chu et al. (2022) show that these models allow integration of clinical and molecular data, resulting in more accurate prognostic estimates. Complementarily, Teng et al. (2022) present a dynamic Bayesian model applied to breast cancer, capable of continuously updating survival predictions based on new clinical data. In the same context, Zhang et al. (2022) highlight the use of deep Bayesian networks, which expand the capacity to model complex relationships among clinical variables.

Another relevant aspect concerns the application of Bayesian inference in oncological clinical trials. Taylor et al. (2025) emphasize that this approach allows greater flexibility in experimental designs, enabling adaptations during the study based on emerging evidence. Chen et al. (2022) highlight the use of two-stage designs that optimize therapeutic efficacy evaluation, while Song and Wen (2023) point to the relevance of innovative designs in neuro-oncology. In addition, Cerda et al. (2025) emphasize that Bayesian analysis of clinical trials provides more intuitive interpretations of results, facilitating clinical decision-making.

The studies also highlight the importance of Bayesian inference in analyzing data with small samples and high uncertainty. Sondhi et al. (2021) demonstrate that incorporating additional evidence improves estimate robustness, while Su et al. (2022) discuss information borrowing methods as strategies to integrate data from different sources. Zhou et al. (2021) complement this analysis by presenting mediation models based on Bayesian averaging, enabling understanding of complex relationships among variables in survival studies.

Furthermore, Bayesian inference has been applied to the evaluation of therapeutic interventions and modeling of tumor dynamics. Fornacon-Wood et al. (2022) highlight its usefulness in analyzing real-world radiotherapy data, while Pourzanjani et al. (2024) present generative models capable of estimating tumor evolution from published data. Xu (2026) reinforces this approach by proposing survival models with multiple change points, expanding the ability to detect relevant clinical patterns.

In the field of precision oncology, Correa-Aguila et al. (2022) demonstrate that integrating multi-omics data with Bayesian models allows greater accuracy in biomarker identification, contributing to treatment personalization. Pasetto et al. (2021) complement this perspective by demonstrating the applicability of Bayesian frameworks in tumor boards, supporting multidisciplinary clinical decision-making.

Additionally, Bartoš et al. (2022) emphasize the importance of informed Bayesian survival analysis, while Yao et al. (2023) present predictive averaging models applied to immuno-oncology clinical trials. Agema et al. (2025) point to the application of Bayesian models in dose optimization in oncology, reinforcing the relevance of this approach in clinical practice.

Finally, Banos-Chaparro and Caycho-Rodriguez (2024) demonstrate the application of the Bayesian omega coefficient in validating health instruments, contributing to greater precision in measuring clinical and psychometric variables.

Table 2 presents a synthesis of the main contributions of Bayesian inference in oncology, organized by thematic categories identified in the analysis.

Table 2

Synthesis of the Contributions of Bayesian Inference in Oncology

Analytical Category	Application Dimension	Epistemological and Clinical Contributions
Probabilistic clinical reasoning	Integration between pre-test and post-test probability	Restructuring of the diagnostic process based on probabilistic inference, reducing cognitive biases and promoting more rational decisions
Oncological diagnosis	Integrated interpretation of clinical, laboratory, and imaging data	Expansion of diagnostic accuracy through the continuous updating of probabilities
Prognostic modeling	Prediction of survival and tumor progression	Development of dynamic and adaptive models capable of incorporating new evidence over time
Adaptive clinical trials	Planning and analysis of experimental studies	Methodological flexibilization, allowing dynamic adjustments and greater efficiency in the production of evidence
Management of uncertainty in small samples	Integration of prior and external data	Reduction of statistical variability and increase in inferential robustness
Precision oncology	Integration of multi-omics and clinical data	Therapeutic personalization based on individual biological profiles
Modeling of tumor dynamics	Longitudinal analysis and simulation of clinical scenarios	Expanded understanding of disease evolution and treatment response
Evaluation of therapeutic interventions	Analysis of efficacy in real-world contexts	Support for clinical decision-making based on probabilistic evidence
Multidisciplinary clinical decision-making	Application in tumor boards	Integration of multiple sources of knowledge and specialties
Instrument validation	Evaluation of the reliability of measures	Strengthening methodological quality and the precision of clinical inferences

Source: Authors (2026)

The analysis of the studies shows that Bayesian inference represents a paradigmatic shift in how uncertainty is understood and managed in the oncological context. Unlike traditional approaches, which often treat uncertainty as a methodological limitation, the Bayesian model incorporates it as a central element of the analytical process, allowing quantification and continuous updating. In this sense, Sousa and Aguiar (2022) emphasize that probability-based clinical reasoning favors more consistent decisions by integrating multiple sources of information in a structured manner.

The applicability of this approach to cancer diagnosis is particularly relevant given the disease's inherent complexity. Lorca and Aguila (2024) argue that using Bayes' theorem in the diagnostic process contributes to reducing cognitive biases often associated with subjective interpretation of clinical data. This perspective is reinforced by Taylor et al. (2025), who state that Bayesian analysis provides more intuitive and clinically relevant interpretations of results, facilitating decision-making.

In prognostic modeling, Bayesian inference enables significant advances in predicting clinical outcomes. Chu et al. (2022) highlight that integrating clinical and molecular data enhances predictive capacity, while Teng et al. (2022) emphasize the importance of dynamic models in continuously updating risk estimates. Moreover, Zhang et al. (2022) demonstrate that deep Bayesian networks allow modeling of complex relationships, contributing to greater prognostic accuracy.

Another relevant aspect concerns the flexibility of clinical trial designs based on Bayesian inference. Chen et al. (2022) emphasize that adaptive models allow adjustments throughout the study, optimizing resources and increasing research efficiency. Song and Wen (2023) complement this analysis by highlighting innovative designs in neuro-oncology, while Cerda et al. (2025) underscore the relevance of probabilistic interpretation of results for clinical practice.

The ability to handle small samples and incomplete data is one of the main advantages of the Bayesian approach. Sondhi et al. (2021) show that incorporating additional evidence improves analytical robustness, while Su et al. (2022) highlight the role of information borrowing in integrating data from different sources. Zhou et al. (2021) reinforce this perspective by presenting Bayesian averaging models that elucidate complex relationships in survival studies.

In precision oncology, integrating multi-omics data represents a significant advance in care personalization. Correa-Aguila et al. (2022) argue that combining multiple layers of biological information with Bayesian models allows greater accuracy in biomarker identification. Pasetto et al. (2021) add that Bayesian frameworks can be incorporated into clinical decision-making environments, promoting a more collaborative and evidence-based approach.

Furthermore, applying Bayesian inference to evaluate therapeutic interventions and model tumor dynamics expands possibilities for understanding disease progression. Fornacon-Wood et al. (2022) highlight its usefulness in real-world data analysis, while Pourzanjani et al. (2024) and Xu (2026) demonstrate advances in modeling dynamic processes and identifying clinical patterns.

Finally, the use of Bayesian metrics in instrument validation strengthens the quality of scientific evidence. Banos-Chaparro and Caycho-Rodriguez (2024) emphasize that the Bayesian omega coefficient provides greater precision in reliability assessment, contributing to safer clinical decisions.

Thus, Bayesian inference has become established as an essential tool in contemporary oncology, not only due to its ability to reduce diagnostic uncertainties, but also because it promotes a more integrated, adaptive, and patient-centered approach. Its methodological advances and practical applications point to a promising path for improving clinical practice and health research, especially in scenarios marked by high complexity and uncertainty.

CONCLUSION

This integrative review enabled a comprehensive understanding of the role of Bayesian inference as a strategic tool in reducing diagnostic uncertainties in the oncological context, highlighting its relevance in both clinical reasoning and the development of statistical models applied to healthcare practice. Revisiting the proposed objective—to analyze the application of this approach in reducing diagnostic uncertainties in cancer—the results fully address the investigated problem by demonstrating that Bayesian inference significantly contributes to improving clinical decision-making.

Regarding the guiding question, the findings indicate that its application occurs in a transversal and integrated manner, ranging from support for individual clinical reasoning to the construction of predictive models and the conduct of clinical trials. In this sense, the use of updatable probabilities allows greater precision in interpreting clinical and diagnostic data, reducing subjectivity and promoting more grounded decisions.

Among the main results identified, the ability of Bayesian inference to integrate multiple sources of information stands out, including clinical, laboratory, imaging, and molecular data, favoring a more robust and dynamic diagnostic approach. Its applicability in high-uncertainty scenarios, such as studies with small samples where traditional methods face limitations, was also evident. The flexibility of Bayesian models—especially in adaptive clinical trials and survival modeling—represents a relevant differential, expanding methodological efficiency and result reliability.

Another important aspect concerns the contributions of Bayesian inference to precision oncology, as it enables personalized therapeutic decisions through the integration of complex and heterogeneous data. Incorporating this approach into clinical decision-making environments, such as tumor boards, reinforces its potential to improve multidisciplinary care by aligning scientific evidence with clinical practice. Moreover, its use in evaluating therapeutic interventions and modeling tumor dynamics demonstrates significant advances in understanding disease progression.

The contributions of this research lie mainly in systematizing knowledge on the applications of Bayesian inference in oncology, highlighting its relevance as both a methodological and clinical tool. By bringing together recent and diverse evidence, the study broadens understanding of this approach's potential and identifies gaps that may guide future investigations. Thus, it reinforces the importance of incorporating advanced probabilistic methods into the education and practice of health professionals, particularly in contexts marked by high diagnostic complexity.

Finally, empirical research in the Brazilian context is recommended, especially in oncological services within the Unified Health System, to assess the practical applicability of Bayesian models in routine clinical care and their impact on diagnostic quality and decision-making. Studies integrating real patient data and combining Bayesian tools with clinical decision-support systems may significantly contribute to consolidating this approach, promoting advances in diagnostic precision and the quality of oncological care.

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THE LONG-TERM ADVERSE EFFECTS OF ANTIRETROVIRALS ON THE HEART

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Abstract

There are medications that aid in the treatment of people living with the HIV virus so that the disease does not progress or may even never develop; these are antiretroviral medications that are part of antiretroviral therapy (ART). The continuous use of these medications may bring a series of long-term side effects, including heart disease. ART contributes to an increase in inflammatory factors and carotid thickening, being associated with atherosclerosis and myocardial infarction; this thickening is directly linked to the use of protease inhibitors (PIs). As a result, first-generation PI drugs were replaced by others with lower toxicity, such as darunavir (DRV) and atazanavir (ATV). Routine cardiovascular assessment is essential in these patients in order to achieve greater control over the development of the disease and thus manage the appropriate choice of ART. Even with the adverse effects developed over the long term, ART would still be the best form of treatment to combat HIV due to its extreme efficacy in preventing the development of the disease.

Keywords: HIV, Antiretroviral Therapy (ART), Cardiovascular Diseases, Protease Inhibitors (PIs), Side Effects.

INTRODUCTION

The long-term adverse effects of antiretrovirals on the heart have been a matter of concern in global health, where the degree of toxicity that some antiretrovirals may cause to the heart of those

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undergoing antiretroviral therapy (ART) has been discussed. Continuous use of this medication may lead to gastrointestinal problems, liver and kidney injury, osteoporosis, diabetes, and hypertension. The most frequent reports highlight cardiac problems. However, if the risk is analyzed in relation to the benefits that ART provides, it is clear that the possible comorbidities developed are far outweighed by the major benefits it produces in the body carrying the virus (Brazil, 2021).

This study on the adverse effects of prolonged use of antiretrovirals on the heart is currently of extreme relevance in health care. With the increase in life expectancy of people living with HIV, heart diseases have become one of the main causes of morbidity and mortality. Understanding how the cumulative toxicity of this drug acts directly on the heart is essential to ensure that the success of virological control is not overshadowed by metabolic complications (Lima, 2019).

The research problem was to verify how the continuous use of antiretrovirals has contributed to the increase in cardiovascular risk and the development of chronic cardiac pathologies.

The general objective was to analyze the scientific evidence currently present in the literature regarding the main cardiovascular complications arising directly from the prolonged use of antiretrovirals in patients with HIV.

The specific objectives were to study the main risk factors and the cardiovascular diseases most frequently reported in users who made prolonged use of antiretrovirals and to verify and describe the mechanism of action of the main antiretrovirals and their direct relationship with cardiac toxicity.

DEVELOPMENT

METHODOLOGY

The type of research conducted was a Literature Review of a qualitative and descriptive nature. The study was not exploratory, experimental, or a case study; it focused exclusively on the theoretical analysis of materials already published on the topic. The search was conducted in renowned scientific databases, such as Google Scholar, SciELO, and PubMed, aiming to select articles that discussed the adverse effects of antiretrovirals on the heart.

The search period comprised works published in the last 10 years (2016 to 2026), ensuring the currency of the scientific evidence presented. As inclusion criteria, scientific articles, dissertations, and technical books available in full text, in Portuguese and English, were selected.

To locate the material, the following descriptors and keywords were used: "Antiretroviral Therapy," "HIV," "Cardiovascular Toxicity," and "Adverse Effects." Data analysis was carried out descriptively, through critical reading of the abstracts and, subsequently, the full content of the selected texts, allowing the synthesis of the information necessary to answer the proposed research problem.

Table 1

Articles selected for review.

Authors	Objectives	Methodology	Results	Conclusion
LEITE et al. (2020)	To evaluate inflammatory biomarkers and carotid thickness in patients with HIV receiving ART.	Cross-sectional study with patients at low cardiovascular risk.	The presence of persistent subclinical inflammation was observed even with controlled viral load.	ART and the virus contribute to an inflammatory state that favors cardiovascular risk.
LIMA (2019)	To analyze the adverse effects of ART and the difficulties in adherence to treatment.	Monograph with an integrative literature review.	It identified drug toxicity as the main cause of changes in therapeutic regimens.	Side effects impair adherence, requiring greater clinical support for the patient.
MANSUR (2020)	To analyze the cardiovascular conditions	Clinical review of guidelines on cardiovascular	It identified a high prevalence of	Early monitoring of cardiac risk factors is

Authors	Objectives	Methodology	Results	Conclusion
	of patients undergoing HIV treatment.	management in seropositive patients.	dyslipidemia and hypertension in long-term ART users.	necessary to avoid serious events.
MATEUS et al. (2022)	To investigate drug interactions involving antiretrovirals in the treatment of adults.	Integrative literature review in scientific databases.	It identified interactions that potentiate toxicity and reduce treatment efficacy.	Pharmaceutical management is essential to minimize serious adverse events and interactions.
OBARE et al. (2024)	To investigate inflammation in HIV and its impact on atherosclerotic cardiovascular disease.	Clinical follow-up study and analysis of inflammatory markers.	It demonstrated that chronic inflammation accelerates the process of atherosclerosis in patients with HIV.	Control of inflammation should be an integral part of cardiovascular management in HIV.
PONTES et al. (2020)	To identify factors associated with chronic kidney disease in people living with HIV/AIDS.	Cross-sectional study with analysis of clinical and laboratory data.	It found a correlation between prolonged use of certain antiretrovirals and decline in renal function.	Renal function should be continuously monitored together with cardiovascular health.
RIBAS et al. (2020)	To describe the pathologies associated with the use of antiretroviral therapy.	Integrative review exploring various associated comorbidities.	It listed a wide range of secondary pathologies, especially metabolic and bone changes.	Therapy requires constant surveillance regarding secondary pathologies induced by treatment.
SILVA, A. G. et al. (2020)	To evaluate subclinical carotid atherosclerosis in HIV-positive patients.	Observational study applying the DAD score for risk stratification.	Patients on ART presented greater thickening of the carotid intima-media.	Duration of exposure to antiretrovirals is linked to increased risk of atherosclerosis.
SILVA, J. N. et al. (2025)	To analyze the evolution of HIV/AIDS medications in Brazil.	Documentary and historical study presented at a scientific congress.	It traced the evolution of drugs, noting improvement in efficacy and reduction in toxicity.	Pharmacological evolution seeks to reduce adverse effects without losing viral suppression.
SILVA, L. L. G. et al. (2020)	To investigate lipodystrophic syndrome and its associated factors.	Quantitative cross-sectional study with analysis of medical records.	High prevalence of fat redistribution associated with disorders of blood glucose and cholesterol.	Lipodystrophy negatively impacts metabolic health and the patient’s self-image.

Authors	Objectives	Methodology	Results	Conclusion
VALIM & EIRA (2020)	To relate cardiovascular diseases to HIV and antiretroviral therapy.	Literature review focused on cardiovascular pathophysiology.	ART, especially protease inhibitors, negatively alters the lipid profile.	Treatment must balance virological efficacy with protection of the cardiovascular system.
VENDRUSCOLO (2016)	To study the adverse effects resulting from the use of antiretrovirals in patients.	Monograph based on a descriptive clinical study in Salvador.	It reported a significant incidence of gastrointestinal disorders and early metabolic changes.	Understanding the local profile of adverse effects is fundamental to the management of care.
VILAÇA et al. (2021)	To identify orofacial lesions and side effects in patients under potent ART.	Clinical follow-up study of patients using HAART.	Metabolic systemic changes were reported in addition to oral manifestations.	Multiprofessional follow-up is vital to manage the side effects of therapy.

Source: Authors, 2026

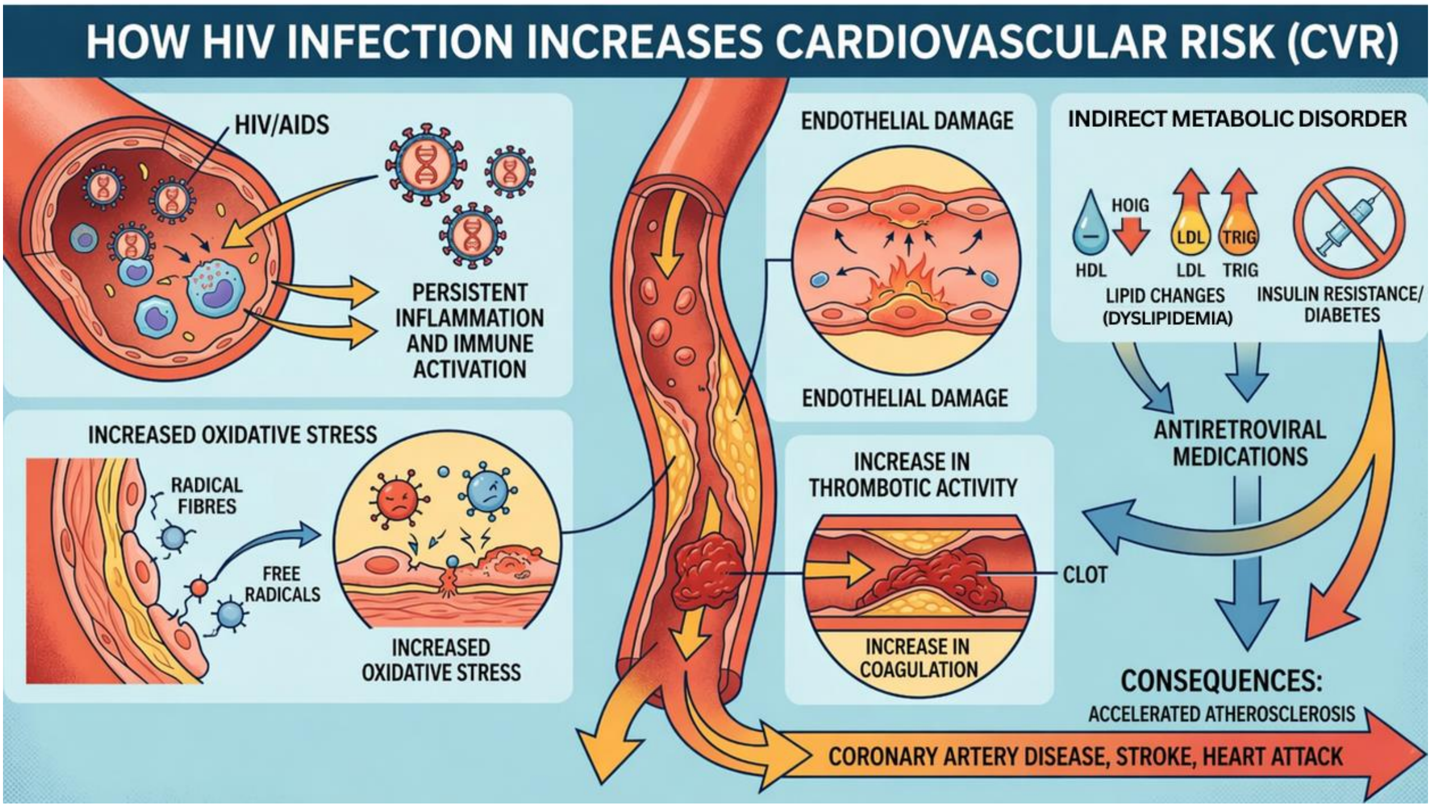
RESULTS AND DISCUSSION

The human immunodeficiency virus (HIV) causes acquired immunodeficiency syndrome (AIDS), a disease that remains a worldwide public health problem to this day. According to the global document AIDS Up Date, in 2017 there were 1.8 million new HIV infections in the world population, totaling 36.9 million people living with HIV worldwide (Vilaça et al., 2021).

HIV infection increases cardiovascular risk (CVR) through persistent inflammation and immune activation, **Figure 1**, as well as greater oxidative stress, endothelial damage, increased thrombotic activity, and indirect metabolic disturbance (Aguiar; Eira, 2020).

Figure 1

HIV: Increased risk of coronary disease



Source: (Adapted). Hsue and Waters, 2019.

Therapy against the HIV virus is quite complex, involving the use of several medications, especially antiretrovirals. Thus, the occurrence of drug interactions becomes common, which may decrease the efficacy of the medication, increase adverse reactions, or cause toxicity to the organism (Bernardes et al., 2021).

The initial treatment protocol consists of the use of three antiretrovirals: two are NRTIs/NtRTIs (nucleoside/nucleotide reverse transcriptase inhibitors) and one from another class, which may be an NNRTI (non-nucleoside reverse transcriptase inhibitor), PI/r (protease inhibitor boosted with ritonavir), or INSTI (integrase inhibitor). Tenofovir and lamivudine are generally used as NRTIs/NtRTIs and dolutegravir as an INSTI (Brazil, 2018).

Dyslipidemia is an important toxicity of antiretrovirals (ARVs), generally arising after 2 to 3 months of use. Associated with the use of PIs, NRTIs, and NNRTIs, increases in triglycerides, HDL, and LDL cholesterol are commonly found, which raises the risk of atherosclerosis and coronary disease. For its control, non-pharmacological therapeutic measures should begin first (diet, exercise, smoking cessation, etc.) and, depending on severity, the drug class should be changed and/or lipid-lowering drugs added (Vendruscolo, 2016).

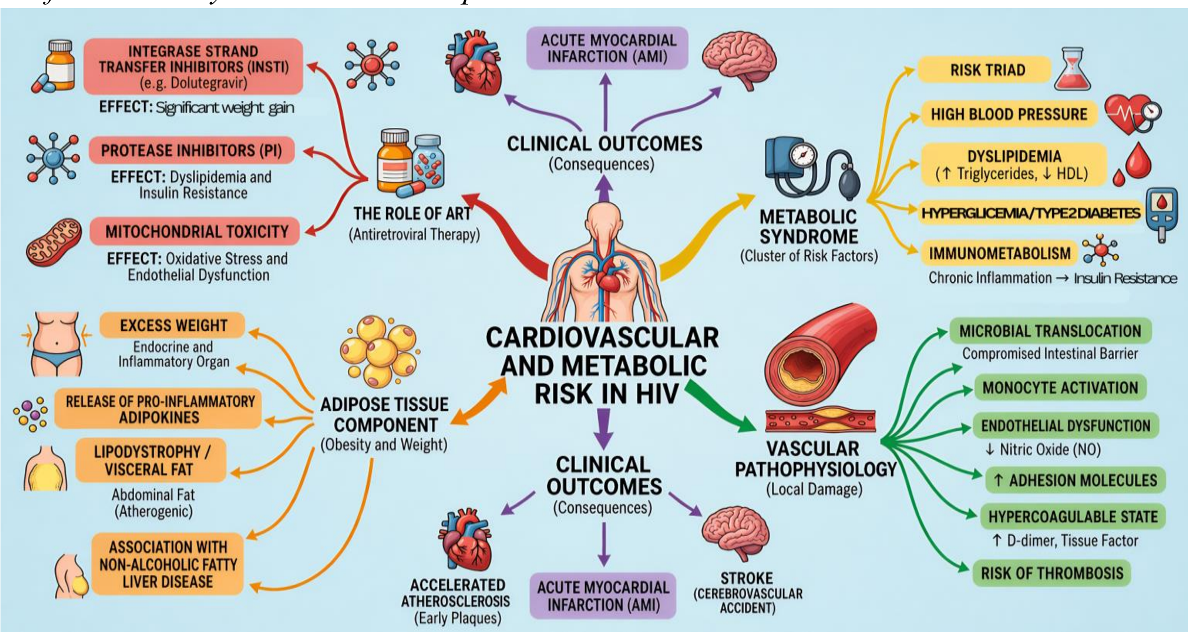
However, people living with HIV have come to present elevated risks of developing comorbidities (cardiovascular, hepatic, and renal diseases) as a consequence of the complex association between immunodeficiency, chronic inflammation, aging, and antiretroviral toxicity (Pontes et al., 2020).

Antiretroviral therapy (ART) is associated with oxidative stress, infiltration of oxLDL through arterial walls activating adhesion molecules, and increased monocyte-platelet aggregation in endothelial cells, which leads to lipid accumulation and altered vascular permeability that further contribute to the formation of atherosclerotic plaque (Aguiar; Eira, 2020).

In addition, other studies have also demonstrated the presence of excess weight in this population as a worrying finding, since the use of ART associated with overweight and fat accumulation predisposes these patients to the development of metabolic syndrome and cardiovascular diseases (Silva et al., 2019).

Figure 2

The risk of metabolic syndrome in an HIV patient



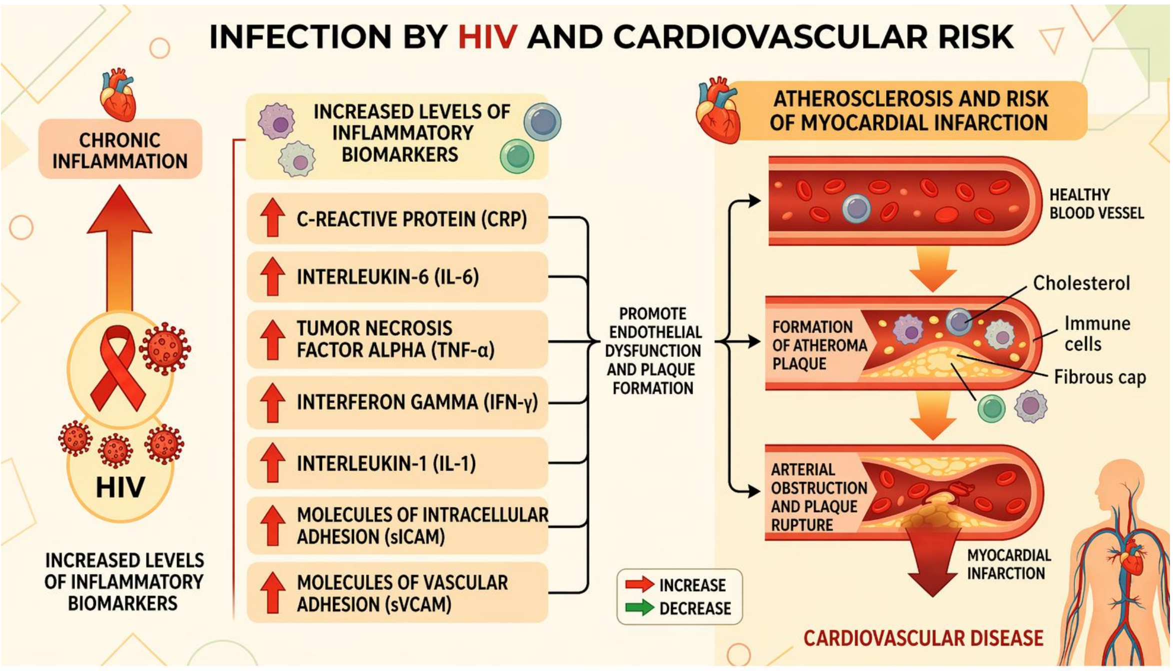
Source: (Adapted). Silva et al., 2019

Cardiovascular diseases emerged as an important cause of morbidity and mortality. Data from the DAD study (Data Collection on Adverse Effects of Anti-HIV Drugs), published in 2014, indicate that 11% of deaths among HIV-positive patients are caused by cardiovascular diseases. Patients infected with HIV have a risk twice as high as the general population of suffering myocardial infarction and four times as high a risk of sudden death. In addition to the increased risk, people living with HIV experience cardiovascular events, on average, approximately 10 years earlier than the general population (Silva; Paulo; Silva-Vergara, 2019).

According to some studies, the virus and antiretroviral therapy (ART) are factors that favor the increase of inflammatory factors and carotid thickening. Individuals infected with HIV present high levels of C-reactive protein, associated with atherosclerosis and myocardial infarction. Levels of interleukin-6 (IL-6), tumor necrosis factor alpha (TNF-α), interferon gamma (IFN-γ), interleukin-1 (IL-1), intracellular adhesion molecules (sICAM), and vascular adhesion molecules (sVCAM), which increase in the progression of cardiovascular disease, are also elevated in this population, Figure 3 (Leite et al., 2020).

Figure 3

HIV infection and cardiovascular risk



Source: (Adapted). Leite et al., 2020

These findings contribute to the assessment of patients on successful HIV therapy and once again emphasize the achievements of contemporary comprehensive clinical care for patients, probably including therapeutic counseling on cardiovascular risk factors such as smoking, hypertension, dyslipidemia, and diabetes (Mansur, 2020).

Initially, the risk of the emergence of cardiological illnesses is attributed to protease inhibitors (PIs), due to the lipid alterations caused by them. The most plausible explanation among these factors is that the introduction of PIs interferes mainly in the exogenous pathway of lipid metabolism, responsible for an increase in cardiovascular risk (Ribas et al., 2020).

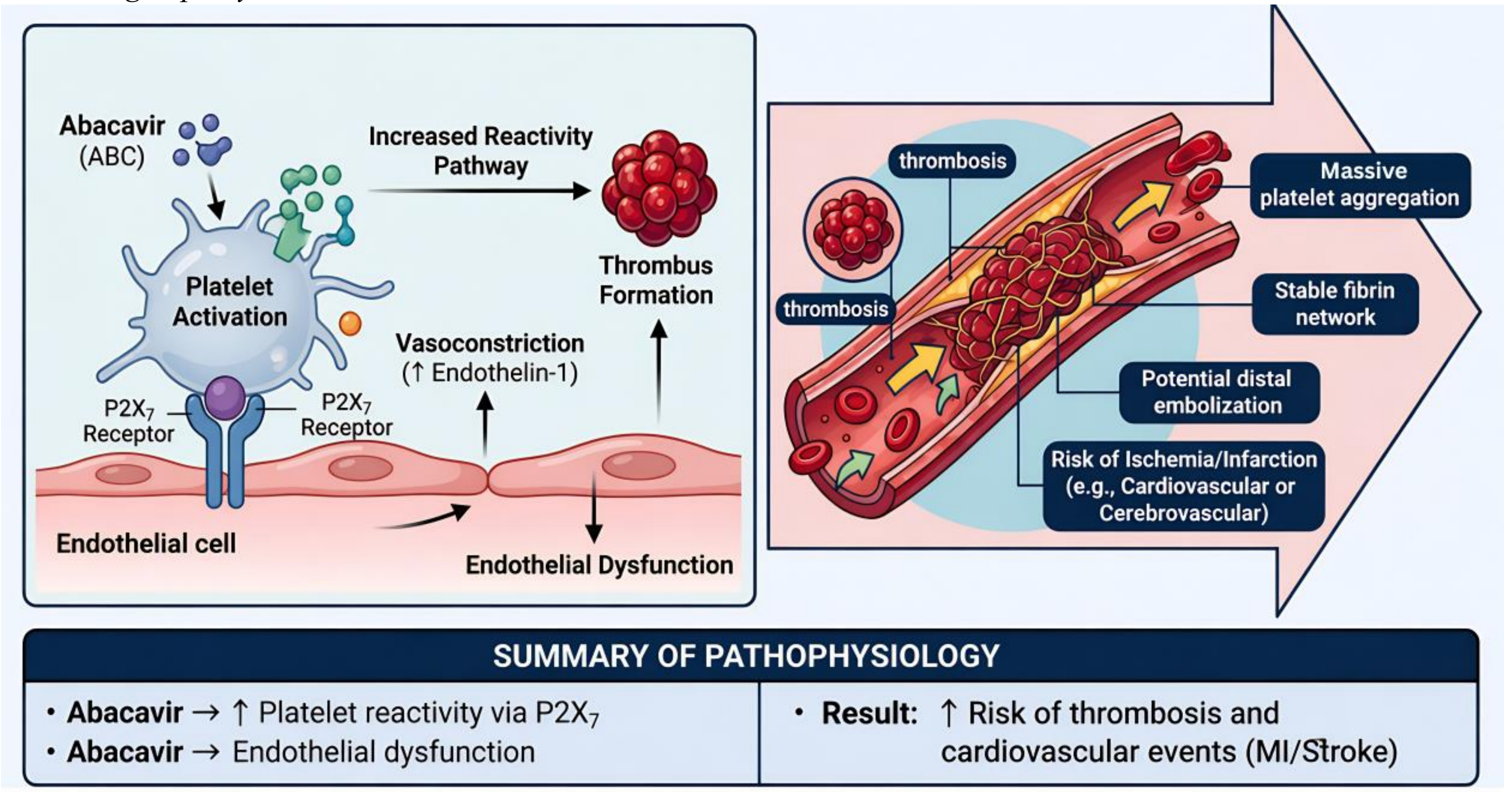
Linked to the class of protease inhibitors (PIs) are metabolic changes that include dyslipidemia, defined by increased serum cholesterol and triglycerides, insulin resistance, and even diabetes mellitus, all of which promote greater risk of cardiovascular diseases in these patients. The antiretrovirals with adverse reactions directly linked to the heart are from the class of NRTIs (stavudine, abacavir) and PIs (lopinavir) (Lima, 2019).

Some authors demonstrated increased carotid intima-media thickness (CIMT) and its progression (a subclinical marker of atherosclerotic disease) in an observational study of patients treated with ART, particularly when using protease inhibitors (PIs). Both HIV infection and ART promote cardiovascular disease (CVD) through the induction of dyslipidemia and pro-inflammatory cytokines with oxidative stress, endothelial damage, and hypercoagulability. Some ARVs such as ritonavir (RTV), indinavir (IDV), lopinavir (LPV), zidovudine (AZT), and NRTIs may induce metabolic effects, endothelial dysfunction, oxidative stress, and provoke an inflammatory response (Aguiar; Eira, 2020).

The abacavir (ABC) combination from the NRTI class increases platelet reactivity, **Figure 4**. INSTIs, on the other hand, have been related to beneficial effects on these processes. One of the hypotheses raised is that some ARVs may cause cardiac dysfunction through mitochondrial toxicity. The protease inhibitors LPV and atazanavir (ATV) may be associated with QT interval prolongation and subsequent arrhythmias. Efavirenz (EFV), from the NNRTI class, promotes adhesion of leukocytes to endothelial cells and prolongs the QT interval; the presence of this alteration on the electrocardiogram warns of a predisposition to the emergence of polymorphic ventricular tachycardia torsades de pointes, which may lead to sudden death, **Figure 5.** PIs are related to atrioventricular block (AVB) and left bundle branch block (LBBB). Observational data suggest that LPV and IDV modify the size of LDL particles and cause insulin resistance, which would increase the risk of CVD (Aguiar; Eira, 2020).

Figure 4

Coagulopathy associated with ARV – Abacavir



Source: (Adapted). Aguiar., 2020.

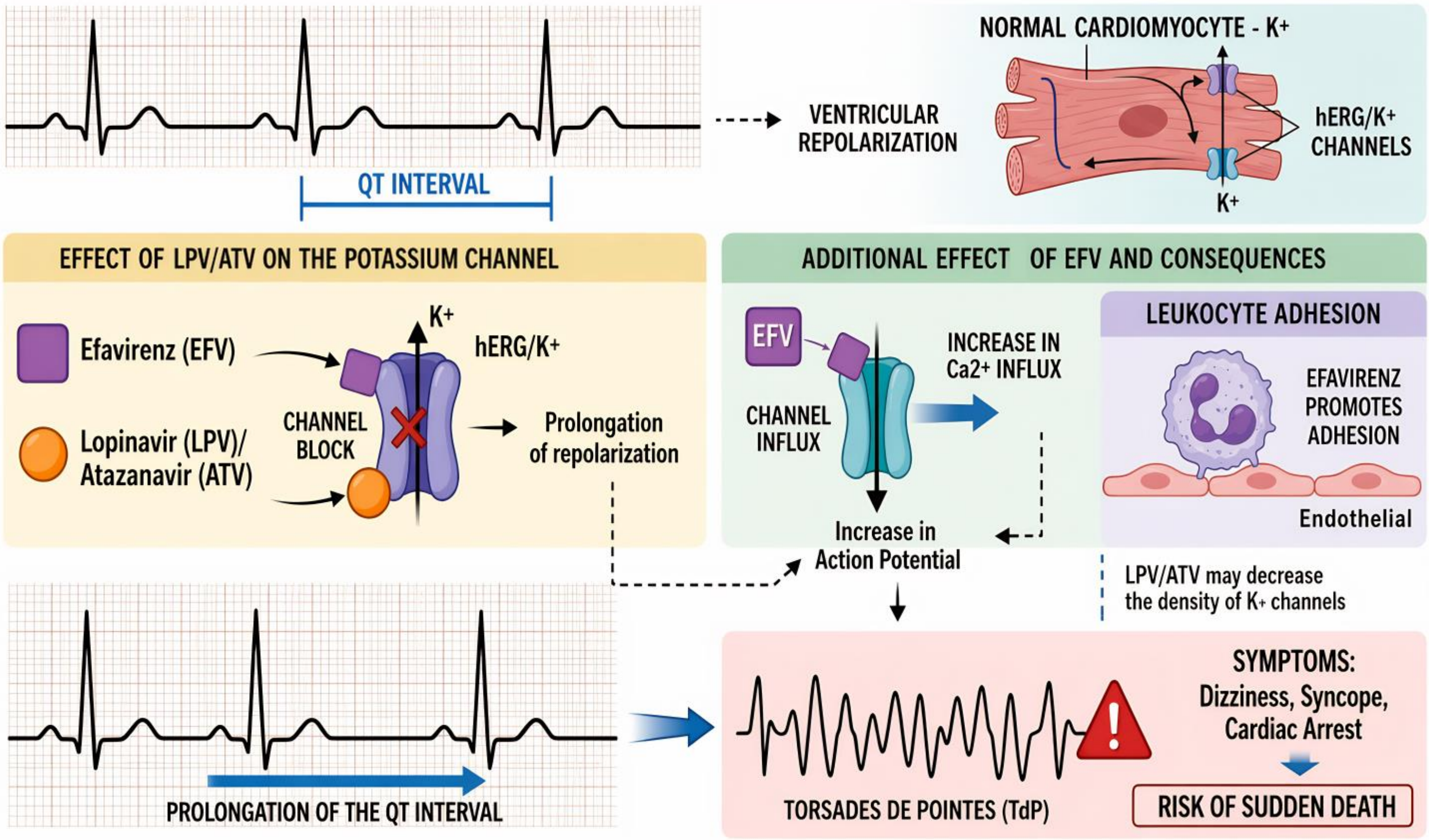
Switching from boosted PIs to raltegravir or dolutegravir results in a better plasma lipid profile and changes in biomarkers associated with cardiovascular events than continuing boosted PI therapy (Obare et al., 2024).

In order to detect and adequately manage early signs of CVD, routine cardiovascular evaluation should be performed in these patients, allowing guidance in the management of risk factors and the choice of ART, particularly among higher-risk individuals (Aguiar; Eira, 2020).

In addition to the direct effects of HIV, plasma cytokines and chemokines also stimulate the endothelium, leading to persistently elevated levels of sVCAM-1 (vascular cell adhesion molecule-1) and sICAM-1 (soluble intercellular adhesion molecule-1). Notably, sVCAM-1 levels decrease with antiretrovirals. Despite the reduction in sVCAM-1 levels, PLWH on ART with effective viral suppression still present higher levels of endothelial inflammation compared with people without HIV. This is confounded by data that implicate ART in endothelial dysfunction, adding complexity to the understanding of the underlying mechanisms in PLWH; endothelial dysfunction among PLWH on therapy has also been associated with monocyte activation (Obare et al., 2024).

Figure 5

Mechanisms of QT interval prolongation caused by antiretrovirals and cardiac risks



Source: (Adapted). Aguiar., 2020

Although treatment with the more recent and highly active ART generally improves low HDL cholesterol, it does not fully normalize the lipid profile in treated PLWH. Notably, several ART classes have also been implicated in altered lipid metabolism and increased oxidative stress in PLWH, potentially contributing independently to elevated cardiovascular risk (Obare et al., 2024).

Analyzing the risk versus benefits promoted by the use of such medications, it is evident that the comorbidities developed during treatment are minimal when compared with their benefits (Ribas et al., 2020).

There is still much to investigate with the recent introduction of new medications into clinical practice that are not yet available in our country, such as tenofovir alafenamide (TAF) and bictegravir (Aguiar; Eira, 2020). The results of the Randomized Trial to Prevent Vascular Events in HIV (REPRIEVE) provided evidence to support specific recommendations for statin therapy as primary prevention of CVD in people with HIV aged 40 to 75 years in the United States. The REPRIEVE results now provide clear evidence to inform the use of statin therapy as primary prevention among people with HIV aged ≥ 40 years, on continuous antiretroviral therapy, and with low to intermediate ASCVD (atherosclerotic cardiovascular disease) risk (Silva; Silva; Santos, 2025).

These discussions should take into account the benefits together with side effects, costs, potential for drug interaction, and other patient-centered factors. For people with low 10-year ASCVD risk who may experience a more modest absolute benefit from statin therapy, it is particularly important to weigh the potential benefits for the individual against the risks. The REPRIEVE results that reported greater absolute benefit from statin therapy among people with HIV aged 40 to 75 years with higher ASCVD risk informed the panel's decision to recommend the use of at least moderate-intensity statin therapy, with a strong recommendation for those with a 10-year ASCVD risk score >5% to <20% (Silva; Silva; Santos, 2025).

Initiation of statin therapy should be delayed until after pregnancy for people with HIV and ASCVD risk, and statin therapy should be discontinued if pregnancy occurs in the context of HIV. As in the general population, breastfeeding is not recommended during statin therapy. In REPRIEVE, pitavastatin was chosen in part due to the lower potential for drug interaction with certain ARV drugs compared with other statins. Although there are no comparative efficacy trials of clinical outcomes analyzing different statins among people with HIV, some studies support the treatment effect of other moderate-intensity statins for lipid reduction or reductions in inflammation and immune activation, as well as a treatment effect on surrogate measures of CVD (Silva; Silva; Santos, 2025).

Pitavastatin, atorvastatin, and rosuvastatin are all associated with greater reductions in LDL among people with HIV than pravastatin. In addition, pitavastatin (4 mg), rosuvastatin (10 mg), and high-dose atorvastatin (80 mg) have demonstrated reductions in inflammatory disease, monocytes, and biomarkers of T-cell immune activation among people with HIV. In two separate placebo-controlled randomized phase 2 trials of statin therapy in people with HIV, atorvastatin (initiated at 20 mg per day) was associated with reductions in non-calcified coronary plaque by computed tomography angiography, and rosuvastatin (10 mg) was associated with slower progression of common carotid artery intima-media thickness, **Table 2** (Silva; Silva; Santos, 2025).

Table 2

Comparison of Statins in the Context of HIV

Statin	Cited Dosage	Impact on LDL	Inflammatory and Immunological Markers	Vascular Effect / Clinical Outcome	Interaction Considerations (ART)
Pitavastatin	4 mg	**High**: Superior to pravastatin.	Reduces monocytes (sCD14) and T-cell activation.	35% reduction in major cardiovascular events (REPRIEVE Study).	**Minimal: It is not metabolized by CYP3A4; ideal for those using Protease Inhibitors.**
Rosuvastatin	10 mg	**Very High**: One of the most potent for LDL reduction.	Significant reduction in biomarkers of immune activation.	Reduction in progression of carotid intima-media thickness.	**Low interaction, but doses >20 mg require caution with some ART regimens.**
Atorvastatin	20 mg to 80 mg	**Very High**: Dose-dependent.	Reduction of inflammatory disease (especially at high doses – 80 mg).	Reduction of **non-calcified coronary plaque** (vulnerable plaque).	**High**: Metabolized by CYP3A4. Strongly interacts with Ritonavir and Cobicistat (requires dose adjustment).
Pravastatin	Generally 40 mg	**Moderate**: Inferior to the three mentioned above.	Limited impact on systemic inflammation compared with newer generations.	Less effective in plaque stabilization in PLWHIV.	Low interaction, but less potent for high-risk patients.

Source: (Adapted). Silva; Silva; Santos., 2025

These data motivated the panel's recommendation for the use of at least moderate-intensity statins to include pitavastatin 4 mg per day, atorvastatin 20 mg per day, or rosuvastatin 10 mg per day. The recommendation for which statin agent to select and the intensity of therapy is based on the person's overall risk profile. However, it should also be noted that the magnitude of LDL lowering is variable in clinical practice. Mild increases in liver enzymes are observed in some individuals, although they are generally transient without clinical complications. Nevertheless, the overall clinical benefits of statin use outweigh the overall risks of adverse effects, especially for people with higher estimated 10-year CVD risk (Silva; Silva; Santos, 2025).

CONCLUSION

The research confirmed that prolonged use of Antiretroviral Therapy (ART) establishes a direct correlation with increased cardiovascular risk. Although ART remains the indispensable pillar for controlling viral load and patient survival, the metabolic consequences over the years have become evident. The increase in cardiac vulnerability stems from a multifactorial mechanism involving the intrinsic toxicity of the drugs, persistent inflammatory processes, and profound metabolic disorders, such as dyslipidemia and insulin resistance. Such pathologies do not emerge immediately but become consolidated as deleterious long-term effects that require constant clinical attention.

The main limitation observed lies in the difficulty of isolating pharmacological variables from extrinsic factors, such as lifestyle, suggesting that the cardiac impact may be even more complex than current models describe. In view of this, it is imperative that the clinical management of the seropositive patient transcend virological control. The implementation of continuous follow-up protocols that prioritize cardioprotective diets and regular physical exercise is recommended. The central challenge for contemporary medicine lies in balancing the efficacy of viral suppression with the preservation of cardiovascular integrity, reaffirming that, despite metabolic challenges, ART continues to be the gold-standard intervention and the safest option for maintaining life.

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CHAGAS DISEASE IN BRAZIL: EPIDEMIOLOGICAL ANALYSIS AND EVALUATION OF HEALTH EDUCATION STRATEGIES IN LIGHT OF THE SOCIAL DETERMINANTS OF HEALTH

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Abstract

Chagas disease remains a significant public health problem in Brazil, strongly influenced by social, economic, and environmental determinants. This study aimed to analyze the epidemiological profile of the disease in the country and to evaluate health education strategies in light of the social determinants of

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health. It is an integrative review with an epidemiological approach, conducted through searches in the SciELO, PubMed, and Latindex databases, as well as official documents, covering the period from 2022 to 2026. The findings revealed a heterogeneous distribution of the disease, with higher concentration in the North and Northeast regions, predominance among adults and older individuals, and association with low educational levels and racially vulnerable populations. A transition in transmission patterns was also observed, particularly the increase in oral transmission in specific regions. Regarding health education, participatory and context-sensitive strategies demonstrated greater effectiveness, although challenges related to continuity, intersectoral articulation, and sociocultural adequacy persist. It is concluded that the persistence of Chagas disease is directly linked to social inequalities, highlighting the need to strengthen integrated public policies focused on health education and equity. This study contributes to a broader understanding of the disease and supports the development of more effective control strategies.

Keywords: Chagas Disease, Epidemiology, Health Education, Public Health, Social Determinants of Health.

INTRODUCTION

Chagas Disease, also known as American trypanosomiasis, constitutes an important public health problem in Latin America, with significant relevance in Brazil due to its high historical, social, and epidemiological burden. It is a disease caused by the protozoan Trypanosoma cruzi, transmitted mainly by triatomine vectors, although other forms of transmission, such as transfusional, congenital, and oral, are also recognized (Sousa et al., 2024; Hochberg; Montgomery, 2023). Despite advances in vector control, the disease remains a persistent challenge, especially among vulnerable populations, reflecting structural inequalities and limitations in access to health services (WHO, 2024; PAHO, 2023).

In the Brazilian context, Chagas Disease presents complex epidemiological characteristics, marked by the transition from the classic vector-borne transmission profile to forms associated with the ingestion of contaminated food, especially in the Amazon region (Brazil, 2024). In addition, recent estimates indicate a significant prevalence of chronic cases distributed heterogeneously among municipalities, demonstrating the persistence of the disease even after decades of public health interventions (Laporta et al., 2024). This spatial heterogeneity is strongly associated with environmental, socioeconomic, and cultural factors, which influence both exposure to the vector and access to diagnosis and treatment (Lino; Azeredo; Oliveira, 2024).

From a clinical perspective, Chagas Disease presents a biphasic course, comprising an acute phase that is often asymptomatic or oligosymptomatic, followed by a chronic phase that may progress to severe forms, especially Chagas cardiomyopathy, considered the main cause of morbidity and mortality associated with the disease (Jimenez; Winokur, 2023; Marin-Neto et al., 2023). This condition significantly affects the quality of life of affected individuals and places a burden on health systems, reinforcing the need for effective strategies for prevention, early diagnosis, and appropriate clinical management (Santos; Costa; Silva, 2025).

However, beyond biomedical aspects, Chagas Disease must be understood in light of the social determinants of health, which encompass housing conditions, income, schooling, access to health services, and sociocultural contexts. Historically associated with rural poverty and precarious housing, the disease remains a marker of social inequities, perpetuating cycles of vulnerability and exclusion (Gomes, 2022; Pereira-Silva; Mello; Araújo-Jorge, 2022). In this sense, the social invisibility of chronic patients, often neglected by public policies, constitutes one of the main obstacles to the effective control of the disease.

Given this scenario, the need emerges for integrated approaches that articulate epidemiological surveillance, health care, and health education actions, especially in contexts of greater vulnerability. Health education constitutes a strategic tool for promoting knowledge, strengthening individuals' autonomy, and encouraging the adoption of preventive practices (Aguiar et al., 2022; Oliveira; Barbosa; Rodrigues, 2023). Experiences developed in riverside and quilombola communities demonstrate that contextualized educational interventions can contribute significantly to risk reduction and improvements in health indicators (Jesus et al., 2025).

Despite these initiatives, it is observed that health education strategies still face challenges related to their effectiveness, continuity, and sociocultural adequacy, especially in territories marked by structural inequalities. In this context, Primary Health Care (PHC) plays a fundamental role in the implementation of educational actions and in the longitudinal follow-up of patients, being essential for the consolidation of comprehensive and resolutive practices (Dariva, 2023; Brazil, 2021).

Thus, the persistence of Chagas Disease in Brazil, even in the face of advances in control and public policies, constitutes the research problem, highlighting gaps in addressing the social determinants of health and in the effectiveness of health education strategies. The question therefore arises as to the extent to which educational actions have contributed to reducing incidence and improving the living conditions of affected populations, considering the epidemiological and social specificities of the disease.

The present study aims to analyze the epidemiological profile of Chagas Disease in Brazil and to evaluate the health education strategies implemented, in light of the social determinants of health. It thus seeks to understand the relationships between social, environmental, and cultural factors and the dynamics of the disease, as well as to identify the potentialities and limitations of educational actions in confronting this condition.

The relevance of this research is justified by the need to deepen understanding of a historically neglected disease that still represents an important challenge for Brazilian public health. By integrating epidemiological analysis with the evaluation of educational strategies and social determinants, the study contributes to the formulation of more equitable and effective policies, aligned with the principles of the Unified Health System (SUS), especially with regard to the comprehensiveness and equity of care.

Finally, it is emphasized that confronting Chagas Disease requires intersectoral and sustainable approaches that consider not only clinical and epidemiological aspects but also the social dimensions that perpetuate its occurrence. In this sense, innovative and culturally sensitive strategies, combined with the strengthening of health surveillance and health education, are fundamental to reducing inequalities and to the effective control of the disease in Brazil (Hernández-Flores et al., 2025).

METHODOLOGY

The present research is characterized as an epidemiological study, with a qualitative and quantitative approach, of the integrative literature review type, with the objective of analyzing the epidemiological profile of Chagas Disease in Brazil, as well as evaluating health education strategies in light of the social determinants of health. This type of study allows for the synthesis of available scientific evidence, favoring a broader understanding of the phenomenon investigated and supporting health-related decision-making.

The research was guided by the following question: what are the current epidemiological characteristics of Chagas Disease in Brazil, and in what way have health education strategies contributed to confronting it, considering the social determinants of health in the period from 2022 to 2026?

To construct the study, a systematized search was carried out in the scientific databases Scientific Electronic Library Online (SciELO), Latindex, and PubMed, in addition to consulting official documents made available by Brazilian governmental bodies, such as the Ministry of Health and the National Health Surveillance Agency. The inclusion of these sources is justified by the relevance and reliability of the information, especially with regard to epidemiological data and public health guidelines.

Controlled and uncontrolled descriptors were used, combined using the Boolean operators AND and OR, in Portuguese and English. Among the main descriptors, the following stand out: “Doença de Chagas,” “Epidemiologia,” “Educação em Saúde,” “Determinantes Sociais da Saúde,” “Chagas Disease,” “Epidemiology,” “Health Education,” and “Social Determinants of Health.” The search strategy was adapted according to the specificities of each database, aiming to increase the sensitivity and specificity of the results.

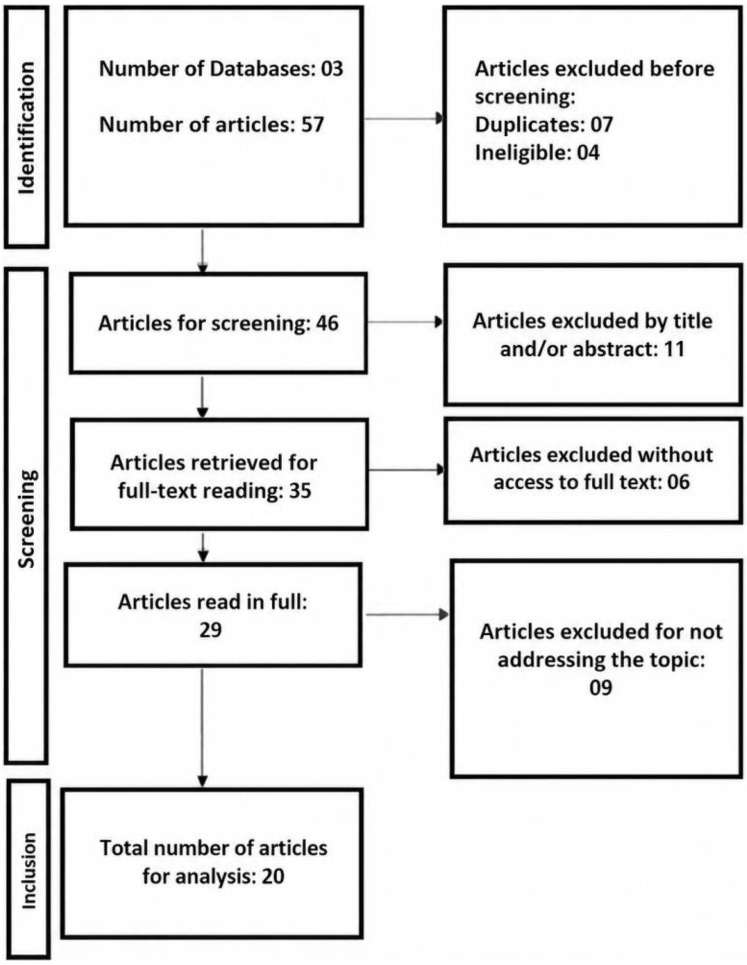
The inclusion criteria adopted were: full scientific articles published between 2022 and 2026; studies available in Portuguese, English, or Spanish; research addressing epidemiological aspects of Chagas Disease in Brazil or health education strategies related to the disease; and updated official documents addressing guidelines, protocols, and epidemiological data. Conversely, duplicate studies, articles not directly related to the proposed topic, publications prior to the established time frame, simple abstracts, editorials, letters to the editor, and works without access to the full text were excluded.

The study selection process occurred in sequential stages: identification, screening, eligibility, and inclusion. Initially, studies were identified in the databases based on the defined search strategy. Subsequently, titles and abstracts were read to exclude irrelevant articles. The full texts were then analyzed for compliance with the established criteria. At the end of this process, the selected studies comprised the review sample.

The systematization of the search and selection process is represented in Figure 1, which illustrates the flowchart of the methodological stages adopted, from the identification of records to the final inclusion of the analyzed articles.

Figure 1

Flowchart of the study selection process



Source: Authors (2026)

For data analysis, the thematic content analysis technique was used, allowing the organization and interpretation of information into analytical categories related to the epidemiological profile of the disease, the social determinants of health, and health education strategies. This approach made it possible to identify patterns, gaps, and convergences in the literature, contributing to a critical and well-founded analysis.

Finally, it is emphasized that the ethical principles of scientific research were respected, with proper citation of the sources used, in accordance with the standards of the Associação Brasileira de Normas Técnicas (ABNT), ensuring the reliability and integrity of the information presented.

RESULTS AND DISCUSSION

The results of this integrative review show that Chagas Disease remains an important public health problem in Brazil, presenting a heterogeneous distribution and being strongly influenced by social, environmental, and structural determinants. The analysis of studies selected for the period from 2022 to 2026 made it possible to identify relevant epidemiological patterns, as well as persistent gaps in coping strategies, especially with regard to health education and equity in access to services.

With respect to geographic distribution, it is observed that the occurrence of the disease varies significantly among Brazilian regions, with a higher concentration of cases in the North and Northeast regions, especially in rural areas and traditional communities. This distribution is associated both with the presence of vectors and with socioenvironmental conditions favorable to transmission, such as precarious housing and difficulties in accessing health services (Brazil, 2024; PAHO, 2023). Furthermore, the Amazon region has stood out due to the increase in cases related to oral transmission, especially through the consumption of contaminated foods, such as açaí (Santos; Costa; Silva, 2025).

Figure 2 presents the distribution of the number of confirmed cases by region, showing predominance in the North and Northeast regions, followed by the Center-West, while the South and Southeast regions show lower incidence, albeit with a significant contingent of chronic cases.

Figure 2

Number of confirmed cases by region

Year 1st Symptom(s)	1 North Region	2 Northeast Region	3 Southeast Region	4 South Region	5 Central-West Region	Total
TOTAL	**1,923**	**49**	**16**	**11**	**10**	**2,009**
2019	22	-	-	-	1	23
2020	162	1	4	-	1	168
2021	324	9	1	4	2	340
2022	387	16	7	2	3	415
2023	526	9	3	4	1	543
2024	502	14	1	1	2	520

Source: Adapted from Ministério da Saúde/SVSA - Sistema de Informação de Agravos de Notificação - Sinan Net (2026)

With regard to sex, the analyzed studies demonstrate a slight predominance of males among confirmed cases, which may be related to occupational factors, such as greater exposure to rural environments and agricultural activities, as well as lower adherence to health services among men (Lino; Azeredo; Oliveira, 2024). Nevertheless, it is noteworthy that the disease significantly affects both sexes, making it necessary to consider care approaches that address gender-specific characteristics.

Figure 3 illustrates the distribution of confirmed cases by sex, showing the percentage difference between men and women, although without a marked discrepancy between the groups.

Figure 3

Number of confirmed cases by sex

Year 1st Symptom(s)	Male	Female	Total
TOTAL	**1.077**	**932**	**2.009**
2019	9	14	23
2020	106	62	168
2021	178	162	340
2022	208	207	415
2023	294	249	543
2024	282	238	520

Source: Adapted from Ministério da Saúde/SVSA - Sistema de Informação de Agravos de Notificação - Sinan Net (2026)

Regarding age group, a higher prevalence of Chagas Disease is observed among adults and older adults, especially those over 40 years of age, reflecting the chronic nature of the disease and past exposure to conditions of higher transmission risk (Laporta et al., 2024). This finding is consistent with the history of vector control in Brazil, which reduced incidence among younger generations but maintained a high disease burden among individuals previously infected.

Figure 4 presents the distribution of cases by age group, highlighting the predominance among middle-aged adults and older adults, reinforcing the need for specific clinical follow-up strategies for this population group.

Figure 4

Number of confirmed cases by age group

Year 1st Symptom(s)	<1 Year	1-4	5-9	10-14	15-19	20-39	40-59	60-64	65-69	70-79	80 and older	Total
TOTAL	**28**	**94**	**141**	**166**	**167**	**673**	**529**	**60**	**61**	**68**	**22**	**2.009**
2019	1	5	2	1	2	7	4	-	-	1	-	23
2020	-	4	10	9	10	64	61	2	2	4	2	168
2021	5	14	22	28	30	108	95	9	10	16	3	340
2022	5	21	23	39	24	139	107	21	18	14	4	415
2023	11	33	43	38	57	175	134	16	14	15	7	543
2024	6	17	41	51	44	180	128	12	17	18	6	520

Source: Adapted from Ministério da Saúde/SVSA - Sistema de Informação de Agravos de Notificação -Sinan Net (2026)

With regard to education level, it is observed that most cases are concentrated among individuals with low levels of schooling, especially those with incomplete elementary education or no formal education. This finding highlights the direct relationship between Chagas Disease and the social determinants of health, since lower educational levels are associated with less understanding of preventive measures, limited access to information, and greater social vulnerability (Aguiar et al., 2022).

Figure 5 shows the distribution of confirmed cases according to education level, evidencing predominance among individuals with low schooling, reinforcing the need for accessible health education strategies adapted to the sociocultural context of these populations.

Figure 5

Number of confirmed cases by education level

Year 1st Symptom(s)	White/Blank	Illiterate	1st to 4th grade incomplete of ES	4th grade complete of ES	5th to 8th grade incomplete of ES	Complete elementary education	Incomplete high school education	Complete high school education	Incomplete higher education	Complete higher education	Does not apply	Total
TOTAL	**333**	**66**	**344**	**116**	**298**	**100**	**151**	**296**	**43**	**88**	**174**	**2.009**
2019	1	-	3	3	4	1	1	4	-	-	6	23
2020	30	6	23	11	33	12	7	21	4	12	9	168
2021	56	14	60	21	49	12	23	57	7	13	28	340
2022	56	12	89	18	68	28	34	61	4	10	35	415
2023	101	20	80	26	75	21	45	71	19	25	60	543
2024	89	14	89	37	69	26	41	82	9	28	36	520

Source: Adapted from Ministério da Saúde/SVSA - Sistema de Informação de Agravos de Notificação - Sinan Net (2026)

Regarding race/color, studies indicate a higher incidence among self-declared brown and Black populations, reflecting historical and structural inequalities in access to health care, housing, and adequate living conditions (Pereira-Silva; Mello; Araújo-Jorge, 2022). This scenario highlights the intersectionality between social and epidemiological factors, reinforcing the need for public policies that promote equity and social justice.

Figure 6 presents the distribution of confirmed cases by race/color, highlighting the higher proportion among Black and brown populations, in line with the analyzed literature.

Figure 6

Number of confirmed cases by race

Year 1st Symptom(s)	White/Blank	White	Black	Yellow	Brown	Indigenous	Total
TOTAL	**29**	**139**	**122**	**7**	**1.687**	**25**	**2.009**
2019	-	3	-	-	19	1	23
2020	1	14	3	-	144	6	168
2021	5	30	19	1	280	5	340
2022	9	23	24	1	353	5	415
2023	8	41	34	3	451	6	543
2024	6	28	42	2	440	2	520

Source: Adapted from Ministério da Saúde/SVSA - Sistema de Informação de Agravos de Notificação - Sinan Net (2026)

In addition to sociodemographic variables, the analysis of studies made it possible to identify relevant aspects related to health education strategies. It is observed that educational interventions developed in community contexts, especially in rural, riverside, and quilombola areas, yield positive results in increasing knowledge about the disease, adopting preventive practices, and seeking diagnosis and treatment (Jesus et al., 2025). However, these actions are still sporadic and lack greater systematization and continuity.

In this sense, Table 1 synthesizes the main health education strategies identified in the analyzed studies, as well as their impacts and limitations in the Brazilian context.

Table 1

Synthesis of health education strategies in Chagas Disease

Health Education Strategy	Main Actions Developed	Observed Impacts	Identified Limitations	References
Participatory community education	Development of discussion circles, dialogical workshops, and contextualized educational activities, with valuing of popular knowledge and the use of accessible language, considering the sociocultural specificities of the territories	Significant expansion of knowledge about forms of transmission, prevention, and control of the disease; strengthening of community leadership and encouragement of the adoption of sustainable preventive practices	Discontinuity of educational actions, weakness in institutional support, and limited resources for maintaining initiatives over the long term	Jesus *et al*., 2025; Aguiar *et al.,* 2022
Educational actions within Primary Health Care	Carrying out individual and collective educational activities, including lectures, guidance during consultations, home visits, and longitudinal follow-up, integrating education and care	Improvement in the early identification of cases, strengthening of the bond between professionals and users, and greater adherence to clinical follow-up	Team workload overload, limited specific training, and structural weaknesses in health services	Dariva, 2023; Brasil, 2021
Institutional informational campaigns	Preparation and dissemination of educational materials, campaigns in traditional and digital media, and awareness-raising actions at national and regional levels	Increased visibility of the disease and dissemination of basic information to the general population	Communication that is often decontextualized, with low effectiveness among vulnerable populations and difficulty reaching remote areas	Brasil, 2024; OPAS, 2023

Health education in the school environment	Inclusion of content about the disease in pedagogical activities, interdisciplinary projects, and educational actions aimed at health promotion in the school context	Formation of individuals who multiply knowledge, early awareness, and potential intergenerational impact on prevention	Lack of continuous curricular institutionalization and weaknesses in the articulation between the health and education sectors	Oliveira; Barbosa; Rodrigues, 2023
Training and continuing education of health professionals	Promotion of courses, training, and technical-scientific updates on diagnosis, clinical management, and epidemiological surveillance of the disease	Improvement in the quality of care provided, strengthening of surveillance actions, and greater problem-solving capacity of health services	Unequal access to training, discontinuity of educational actions, and regional disparities in professional qualification	Santos; Costa; Silva, 2025
Health education guided by the social determinants	Implementation of integrated educational actions that address living conditions, housing, income, and access to services, articulating health with other public policies	Broader understanding of the health-disease process, strengthening of individuals' autonomy, and greater adherence to care practices	Difficulties in intersectoral operationalization, limited integration among public policies, and persistence of structural challenges	Pereira-Silva; Mello; Araújo-Jorge, 2022

Source: Authors (2026)

Overall, the most effective strategies are those that consider the sociocultural context of populations, use accessible language, and promote active community participation. In contrast, verticalized and decontextualized actions tend to show lower effectiveness, highlighting the importance of a territorial approach and the valorization of local knowledge (Oliveira; Barbosa; Rodrigues, 2023).

Another relevant aspect identified concerns the role of Primary Health Care in confronting Chagas Disease. Studies indicate that PHC plays a central role in case identification, follow-up of chronic patients, and implementation of educational actions, being fundamental to consolidating a comprehensive and continuous approach to care (Dariva, 2023). However, structural limitations, such as resource scarcity and insufficient professional training, still represent significant challenges.

Additionally, the persistence of the social invisibility of individuals affected by the disease, especially in the chronic phase, is noteworthy, contributing to delayed diagnosis and low adherence to treatment (Pereira-Silva; Mello; Araújo-Jorge, 2022). This invisibility is directly related to social factors such as stigma, poverty, and exclusion, reinforcing the need for strategies that integrate health actions with broader social policies.

Finally, the results show that, although there have been advances in the control of Chagas Disease in Brazil, important challenges persist regarding epidemiological surveillance, access to health services, and the effectiveness of health education strategies. Overcoming these challenges requires the adoption of intersectoral approaches that consider the social determinants of health and promote equity in access to care (Hernández-Flores et al., 2025).

Thus, the data analysis reinforces the need to strengthen public policies aimed at confronting Chagas Disease, with emphasis on integrating surveillance, care, and health education, in order to reduce inequalities and improve the living conditions of affected populations.

The discussion of the findings shows that Chagas Disease remains a complex and multifactorial health condition, whose persistence in Brazil is directly related to the interaction between epidemiological, social, and structural factors. In this sense, the critical analysis of the results will be structured into three thematic axes: (1) epidemiological profile and regional inequalities; (2) social determinants of health and vulnerability; and (3) health education strategies in the Brazilian context. These dimensions make it possible to understand the disease more broadly, in light of recent scientific evidence and transformations in the national health scenario.

EPIDEMIOLOGICAL PROFILE AND REGIONAL INEQUALITIES

The epidemiological profile of Chagas Disease in Brazil reveals a heterogeneous spatial distribution, strongly influenced by historical regional inequalities. As highlighted by Sousa et al. (2024), although vector control has shown significant advances in recent decades, the disease remains endemic in several regions, especially in the North and Northeast, where socio-environmental conditions favor the maintenance of transmission. From this perspective, Brazil (2024) emphasizes that the persistence of cases is associated with the coexistence of different forms of transmission, particularly the oral route, which has become predominant in certain localities.

Santos, Costa and Silva (2025) emphasize that the Amazon region has growing epidemiological relevance due to the increase in outbreaks associated with the consumption of contaminated foods, demonstrating a shift in the disease's classical profile. This transformation imposes new challenges on epidemiological surveillance, which must adapt its strategies to address these emerging dynamics. At the same time, Laporta et al. (2024) point out that the high prevalence of chronic cases in regions such as the Southeast and Center-West reflects the epidemiological legacy of earlier periods, when vector-borne transmission was more intense.

With regard to sociodemographic characteristics, Jimenez and Winokur (2023) highlight that the greater concentration of cases among adults and older adults is related to the long latency period of the disease, as well as to its progression to chronic forms, especially Chagas cardiomyopathy. This scenario reinforces the need for care strategies focused on the management of chronic conditions, with emphasis on the comprehensiveness of care. In addition, Hochberg and Montgomery (2023) stress that internal migratory flows have contributed to the urbanization of the disease, expanding its geographic distribution and epidemiological complexity.

Thus, it is observed that the epidemiological profile of Chagas Disease in Brazil cannot be analyzed in isolation, since it is deeply embedded in social and territorial contexts. The persistence of regional inequalities highlights the need for more equitable public policies, capable of responding to local specificities and reducing health inequities.

SOCIAL DETERMINANTS OF HEALTH AND VULNERABILITY

The analysis of the social determinants of health reveals that Chagas Disease remains strongly associated with contexts of vulnerability, being considered a neglected disease that reflects structural inequalities. In this sense, Gomes (2022) highlights that the historicity of the disease is intrinsically linked to rural poverty, precarious housing conditions, and social exclusion, factors that continue to influence its distribution throughout the Brazilian territory.

Pereira-Silva, Mello and Araújo-Jorge (2022) emphasize that the social invisibility of individuals affected by the disease, especially in the chronic phase, constitutes one of the main obstacles to confronting it. According to the authors, this invisibility is related to social marginalization, stigma, and the low prioritization of the disease on public health agendas, which contributes to underdiagnosis and poor adherence to treatment. In this context, the disease goes beyond the biomedical field, taking shape as an expression of persistent social inequalities.

Additionally, Lino, Azeredo and Oliveira (2024) demonstrate the correlation between environmental and social factors, such as poor housing conditions, low income, and limited access to education, and the increase in the number of disease cases. These determinants not only favor exposure to the vector but also hinder access to information and health services, increasing the vulnerability of affected populations. In this sense, education emerges as a relevant variable, since lower educational levels are associated with less understanding of preventive measures and lower use of health services.

With regard to racial inequalities, Pereira-Silva, Mello and Araújo-Jorge (2022) highlight that the higher incidence of the disease among Black and brown populations reflects the impact of structural racism on the determination of health conditions. The intersectionality between race, social class, and territory shows that Chagas Disease disproportionately affects historically marginalized groups, reinforcing the need for public policies that promote equity.

The World Health Organization (WHO, 2024) also emphasizes that Chagas Disease remains among the main neglected tropical diseases, predominantly affecting populations living in poverty and exclusion. Such international recognition reinforces the need for global and local strategies that address not only clinical aspects but also the social determinants that sustain the disease.

Thus, it is understood that Chagas Disease is an expression of a complex social context in which structural inequalities perpetuate its occurrence. Confronting this condition therefore requires intersectoral approaches that articulate health, education, housing, and social assistance, with the aim of reducing vulnerabilities and promoting equity.

HEALTH EDUCATION STRATEGIES IN THE BRAZILIAN CONTEXT

Health education strategies constitute a central element in confronting Chagas Disease, especially with regard to the promotion of knowledge, prevention, and the strengthening of individuals' autonomy. In this sense, Aguiar et al. (2022) highlight that educational actions based on participatory and contextualized methodologies are more effective, since they take into account the sociocultural specificities of the populations involved.

Corroborating this perspective, Jesus et al. (2025) show that interventions carried out in riverside and quilombola communities contributed significantly to increasing knowledge about the disease and to the adoption of preventive practices. According to the authors, the valuing of local knowledge and the use of accessible language are determining factors for the success of educational actions, especially in contexts of social vulnerability.

However, Oliveira, Barbosa and Rodrigues (2023) emphasize that health education strategies still present important limitations, such as the discontinuity of actions and the lack of articulation with other public policies. This fragmentation compromises the effectiveness of interventions, reducing their long-term impact. In this context, the institutionalization of educational practices within health services is fundamental to ensure their sustainability.

Within the scope of Primary Health Care, Dariva (2023) highlights that health education plays a strategic role in the early identification of cases and in patient follow-up, contributing to the comprehensiveness of care. However, challenges such as team workload overload, limited specific training, and structural weaknesses in health services hinder the systematic implementation of these actions.

Moreover, Hernández-Flores et al. (2025) emphasize that effectively confronting Chagas Disease requires integration among different sectors, including health, education, and social assistance. According to the authors, the absence of intersectoral articulation constitutes one of the main obstacles to the success of educational strategies, evidencing the need for more integrated and sustainable approaches.

Another relevant aspect concerns the adequacy of educational strategies to different sociocultural contexts. The use of technical language and the disregard for local specificities may limit the understanding of information, especially among populations with low levels of schooling. In this sense, culturally sensitive and participatory approaches are fundamental for expanding the reach and effectiveness of actions.

Therefore, the analysis of health education strategies shows that, although they have significant potential for confronting Chagas Disease, they still face challenges related to continuity, articulation, and sociocultural adequacy. Overcoming these limitations is essential to promote sustainable changes and reduce the inequalities associated with the disease.

CONCLUSION

Chagas Disease remains a relevant public health problem in Brazil, standing out as a complex and multifactorial condition, deeply influenced by social, economic, and environmental determinants. From the analysis conducted, it was possible to understand that, despite advances in control and surveillance policies, the disease still shows high persistence, especially among socially vulnerable populations, reinforcing its character as a neglected disease.

In response to the guiding question, the findings demonstrate that the disease presents a heterogeneous distribution across the national territory, with greater concentration in the North and Northeast regions, and a strong association with factors such as low educational attainment, precarious housing conditions, and racial inequalities. Furthermore, it was found that health education strategies, although relevant, still show limitations in terms of effectiveness, continuity, and adequacy to sociocultural contexts.

With regard to the proposed objectives, the study achieved an analysis of the epidemiological profile of Chagas Disease in Brazil, highlighting patterns related to age group, sex, education, and race/color, as well as identifying the influence of social determinants in maintaining the disease. In addition, it was possible to critically evaluate health education strategies, highlighting both their transformative potential and the challenges that limit their effective implementation.

The main results indicate that the persistence of Chagas Disease is directly related to structural social inequalities, which favor exposure to risk and hinder access to health services. It was also observed that the transition in the transmission profile, with an increase in the oral route, imposes new challenges on epidemiological surveillance. In the field of health education, it became evident that participatory and contextualized strategies yield better results, although they are still insufficiently systematized within public policies.

As a contribution, this research broadens the understanding of Chagas Disease through an integrated approach that articulates epidemiological, social, and educational aspects. By highlighting the centrality of the social determinants of health, the study reinforces the need for more equitable and intersectoral public policies and supports the work of health professionals, especially in Primary Health Care, in developing more effective and contextualized educational practices.

The study also contributes to strengthening the scientific debate on neglected diseases by emphasizing the importance of health education as a fundamental strategy for promoting equity and confronting health inequities. Furthermore, by systematizing recent evidence, the research provides support for the formulation of interventions more aligned with the needs of affected populations.

Finally, it is suggested that future research further explore the effectiveness of health education strategies in different regional contexts, as well as investigate intersectoral interventions that integrate health, education, and social assistance. It is also recommended to develop longitudinal studies that assess the impact of these strategies on reducing disease incidence and improving the quality of life of affected individuals, contributing to the advancement of knowledge and the strengthening of public policies aimed at controlling Chagas Disease in Brazil.

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POPULATION AGING AND THE SUSTAINABILITY OF THE SUS: CHALLENGES FOR LONG-TERM CARE

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Abstract

Population aging in Brazil has led to significant changes in the organization of health systems, especially the Unified Health System (SUS), requiring new strategies for long-term care. This study aims to analyze the main challenges to the sustainability of SUS in the context of an increasing elderly population, focusing on continuous and comprehensive care. This is a narrative literature review based on national and international scientific publications addressing aging, public policies, and elderly healthcare. The results indicate that the growing demand for long-term care, combined with limited resources, weaknesses in the healthcare network, and a lack of specific policies for caregivers, undermines system effectiveness. Furthermore, the need for integration across levels of care and the strengthening of primary healthcare as the coordinator of care is highlighted. It is concluded that ensuring the sustainability of SUS in the face of population aging requires structural investments, professional training, and the expansion of public policies aimed at long-term care, thereby ensuring equity and quality in healthcare delivery for the elderly population.

Keywords: Elderly healthcare, Population aging, Public policies, SUS sustainability.

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INTRODUCTION

Population aging constitutes one of the most relevant demographic phenomena of the 21st century, characterized by the progressive increase in the proportion of older people within the population. In Brazil, this transition has occurred rapidly, directly affecting the organization of health services and requiring adaptations in the Unified Health System (SUS), especially with regard to long-term care. This scenario imposes challenges related to the expansion of demand for services, the complexity of chronic conditions, and the need for continuous and integrated care.

Given this context, the following research question is established as the study problem: how can the sustainability of the SUS be ensured in the face of population aging, considering the growing demands for long-term care and the system's structural and financial limitations?

The general objective of this study is to analyze the challenges related to the sustainability of the SUS in the context of population aging, with a focus on long-term care. The specific objectives are: to discuss the implications of aging for health services; to identify weaknesses in the organization of the care network; and to reflect on strategies that contribute to improving the quality of care for the elderly population.

The justification for conducting this study is grounded in the social and public health relevance of the topic, considering that population aging directly affects public health policies and requires effective responses from the system. The insufficiency of services directed toward prolonged care, together with family overload and the shortage of trained professionals, demonstrates the need for greater theoretical and practical exploration of the theme, contributing to the improvement of health actions.

From a theoretical perspective, population aging is associated with the demographic and epidemiological transition, characterized by reduced fertility and mortality rates and by the increase in chronic noncommunicable diseases. In this context, the SUS faces the challenge of reorganizing its care model, traditionally centered on curative actions, toward a model that values comprehensiveness, longitudinal care, and person-centered care. In addition, policies such as the National Health Policy for

Older Persons reinforce the need to promote active and healthy aging, as well as to structure care networks that ensure continuous and humanized assistance.

METHODOLOGY

TYPE OF STUDY

This is a qualitative study of a descriptive-analytical nature, developed through a narrative literature review. This type of research allows for a broader understanding of complex phenomena, such as population aging and its impacts on the sustainability of the health system, making it possible to integrate different theoretical perspectives and scientific evidence.

SEARCH STRATEGY AND STUDY SELECTION

The bibliographic search was conducted in widely recognized scientific databases, including Latin American and Caribbean Health Sciences Literature (LILACS), Scientific Electronic Library Online (SciELO), and PubMed. Descriptors in Portuguese and English were used, such as “population aging,” “older person,” “long-term care,” “health system,” and “sustainability,” combined using Boolean operators (AND and OR).

The inclusion criteria encompassed articles published in the last ten years, available in full text, in Portuguese, English, or Spanish, and directly addressing the proposed theme. Duplicate studies, simple abstracts, editorials, and works unrelated to the research objective were excluded.

DATA ANALYSIS PROCEDURES

The selected studies were subjected to exploratory and analytical reading, followed by the organization of information into thematic categories. The analysis was conducted interpretively, seeking to identify convergences, divergences, and gaps in the literature. The main emerging categories included:

structural challenges of the health system, demands for long-term care, and strategies for the sustainability of the SUS.

ETHICAL ASPECTS

As this research was based on secondary data in the public domain, submission to a research ethics committee was not required. Nevertheless, ethical principles related to scientific integrity were respected, with appropriate citation of sources and fidelity to the ideas of the consulted authors.

METHODOLOGICAL FOUNDATION AND DISCUSSION

The choice of narrative review as a method is justified by the need to comprehensively understand the multiple factors that influence the sustainability of the SUS in the face of population aging. Unlike systematic reviews, this type of approach allows greater flexibility in analysis and discussion, favoring articulation among different fields of knowledge, such as public health, public policies, and gerontology.

However, it is recognized that the absence of rigorously standardized selection criteria may introduce interpretive biases. Even so, the adoption of clear inclusion and exclusion criteria, as well as the use of well-established databases, contributes to the reliability of the findings. Thus, the adopted methodology proves adequate to achieve the proposed objectives, allowing for a critical and contextualized analysis of the challenges related to long-term care within the scope of the SUS.

RESULTS AND DISCUSSION

The findings of this study show that population aging has caused significant impacts on the organization and sustainability of the Unified Health System (SUS), especially with regard to the growing demand for long-term care. The analysis of the literature made it possible to identify three central axes: increased care demand, structural weaknesses in the system, and the need to reorganize the care model.

The growth of the elderly population is directly associated with the increase in chronic noncommunicable diseases, such as hypertension, diabetes, and neurodegenerative diseases, which require continuous and multidisciplinary follow-up. This scenario places pressure on health services, especially primary care, which plays a fundamental role in care coordination.

Table 1

Main impacts of population aging on the SUS

Category	Identified Impacts
Demand for services	Increase in appointments and hospitalizations
Epidemiological profile	Predominance of chronic diseases
Need for continuous care	Greater demand for longitudinal follow-up
Health costs	Increase in public expenditures
Support network	Family overload and insufficient formal caregivers

In addition, it was observed that the SUS still presents important structural weaknesses, such as an insufficient number of specialized services in geriatrics and gerontology, low integration among levels of care, and limitations in financing. These factors compromise the effectiveness of long-term care.

The literature indicates that countries that experienced population aging more gradually were able to structure their care networks more effectively. In the Brazilian case, the speed of this demographic transition makes the planning and implementation of effective public policies more difficult.

Table 2

Weaknesses and challenges of the SUS in long-term care

Weaknesses	Consequences
Low integration of the care network	Discontinuity of care
Shortage of trained professionals	Reduced quality of care
Insufficient financing	Limited service provision
Absence of policies for caregivers	Family overload and informality of care
Curative focus	Difficulty in health promotion and prevention

Another relevant aspect is the need for change in the care model, which is still predominantly centered on curative actions. The literature reinforces the importance of adopting a model based on comprehensive care, with the strengthening of primary care, health promotion, and encouragement of active aging.

In this sense, strategies such as the expansion of home care, the creation of continuous care networks, and investment in the training of specialized professionals are identified as fundamental to ensuring the sustainability of the system.

Table 3

Strategies for SUS sustainability in the face of aging

Strategies	Expected Benefits
Strengthening of primary care	Improved care coordination
Expansion of home care	Reduction in hospitalizations
Professional training	Improved quality of care
Integration of the care network	Continuity and effectiveness of care
Policies to support caregivers	Reduction of family overload

Therefore, the results demonstrate that the sustainability of the SUS in the face of population aging depends on structural and organizational changes aligned with scientific evidence and the needs of the elderly population. The articulation among public policies, efficient management, and the qualification of care proves essential to confronting the challenges of long-term care.

CONCLUSION

The present study aimed to analyze the challenges related to the sustainability of the Unified Health System (SUS) in the face of population aging, with emphasis on long-term care. Based on the literature review, it was possible to understand that the ongoing demographic transition in Brazil imposes growing demands on the health system, requiring structural and functional reorganization of services.

The main results showed that the increase in the elderly population is directly associated with a higher prevalence of chronic diseases and the need for continuous follow-up, which intensifies the demand for health services. In addition, important weaknesses were identified in the SUS, such as insufficient integration of the care network, limitations in financing, shortage of qualified professionals, and the absence of effective policies to support long-term care, especially in the home and family context.

As a contribution, this study reinforces the importance of rethinking the current care model, highlighting the need to strengthen primary health care, expand continuous care strategies, and invest in professional training. Furthermore, it demonstrates the urgency of formulating and implementing public policies that address population aging comprehensively, promoting equity and quality in healthcare for older persons.

Finally, it is suggested that future research should deepen the analysis of innovative long-term care models, including international experiences and intersectoral strategies, as well as investigate the effectiveness of public policies already implemented. Empirical studies that take into account the local reality of health services are also essential to support more assertive decision-making aligned with the needs of the elderly population.

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PATERNITY TEST: USE OF MARKERS IN GENOMIC ANALYSIS TO INVESTIGATE BIOLOGICAL BOND

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Abstract

This study aimed to investigate new techniques used for DNA testing in paternity analysis, presenting novel methods that ensure quality and reliability in their results. It highlights the most commonly used approaches, such as STR markers, while also addressing their limitations and the need for additional strategies, including SNP identification and emerging perspectives in the investigation of biological relationships. Furthermore, it discusses how genetic markers have a broad applicability, even in situations where only a limited amount of sample is available, enabling effective analysis. This is due to the use of key molecular markers, with STRs being the most commonly employed in such cases. Paternity testing has become increasingly detailed, allowing, in cases where the alleged father is deceased or missing, the confirmation of biological relationships through samples from close relatives. Additionally, even when samples are degraded or available in small quantities, analysis remains feasible. This level of accuracy is achieved through techniques such as STRs, SNPs, Y-chromosome STRs, and autosomal STRs. The results become even more reliable when two or more of these markers are analyzed together, increasing the robustness of the conclusions.

Keywords: Polymorphism, DNA test, Forensic genetics, Genetic test.

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INTRODUCTION

With scientific advances, studies continue to improve and new techniques are developed, especially in the field of genomics involving DNA (deoxyribonucleic acid). Likewise, in paternity testing—particularly in cases involving victims of sexual abuse, when an investigation must be carried out during pregnancy—new techniques are chosen so that there is no risk to either the fetus or the pregnant woman, as is the case, for example, with amniocentesis, since it is considered an invasive examination (Damour, 2023).

Thus, mention should be made of the non-invasive prenatal test (NIPT), which initially began using the STR genetic marker (Short Tandem Repeats), conventionally employed in these analyses; however, its detection proved insufficient to obtain a precise result, since its reach extended to only a limited number of alleles (Shen, 2021). Other markers have also been used in recent years, such as SNPs (single nucleotide polymorphisms), DNA methylation, and microhaplotypes; however, for database purposes, their public reference still lacks evaluation (Shen, 2021).

Additionally, forensic genetic genealogy (FGG), whose genomic databases contain hundreds of thousands of single nucleotide polymorphisms (SNPs), provides broad scope for identifying both close and distant maternal and paternal relatives, due to this extensive allele coverage (de Vries, 2021).

It is known that autosomal DNA has been used over the years, although, regarding the reconstruction of a genetic profile of individuals who lived in the last century, it is still considered a recent line of research. As in the case of Joseph Smith Jr., in which DNA testing was employed to study his ancestry, the investigation began with the use of autosomal STR markers; however, they would not have been sufficiently informative, and thus SNP genetic information was used, since these enabled the typing of second- to fifth-degree relatives separated by two centuries (Perego, 2019).

In view of the foregoing, this study aimed to investigate new techniques used in DNA paternity testing, presenting new methods that ensure quality and confidence in their results, portraying the most commonly used methods, such as STR markers, while also addressing their limitations, the need to use additional approaches such as SNP identification, and the perspectives in the investigation of biological relationships. It also considers new DNA tests and cases involving kinship through family members, even when samples are obtained from relatives up to the fifth degree.

METHODOLOGY

In this scientific article, an integrative review of the scientific literature was carried out for discussion of the theme guided by the following research question: DNA testing for the investigation of paternity, and its new methods, and its importance for the reliability of results? – identifying the principal techniques used, their advantages and disadvantages. The scientific databases used were: National Institutes of Health (PubMed), Scientific Electronic Library Online (SciELO), Latin American and Caribbean Health Sciences Literature (LILACS), and ScienceDirect.

For the inclusion criteria, studies published between 2014 and 2024 in Portuguese, English, and Spanish were selected, using the descriptors contained in Health Sciences Descriptors (DeCS): paternity, DNA, genetic markers, SNP, STR, forensic genetics, genetic testing, and polymorphism.

Studies that did not encompass the established theme and terms, were outside the publication period, or were duplicates in the databases were excluded.

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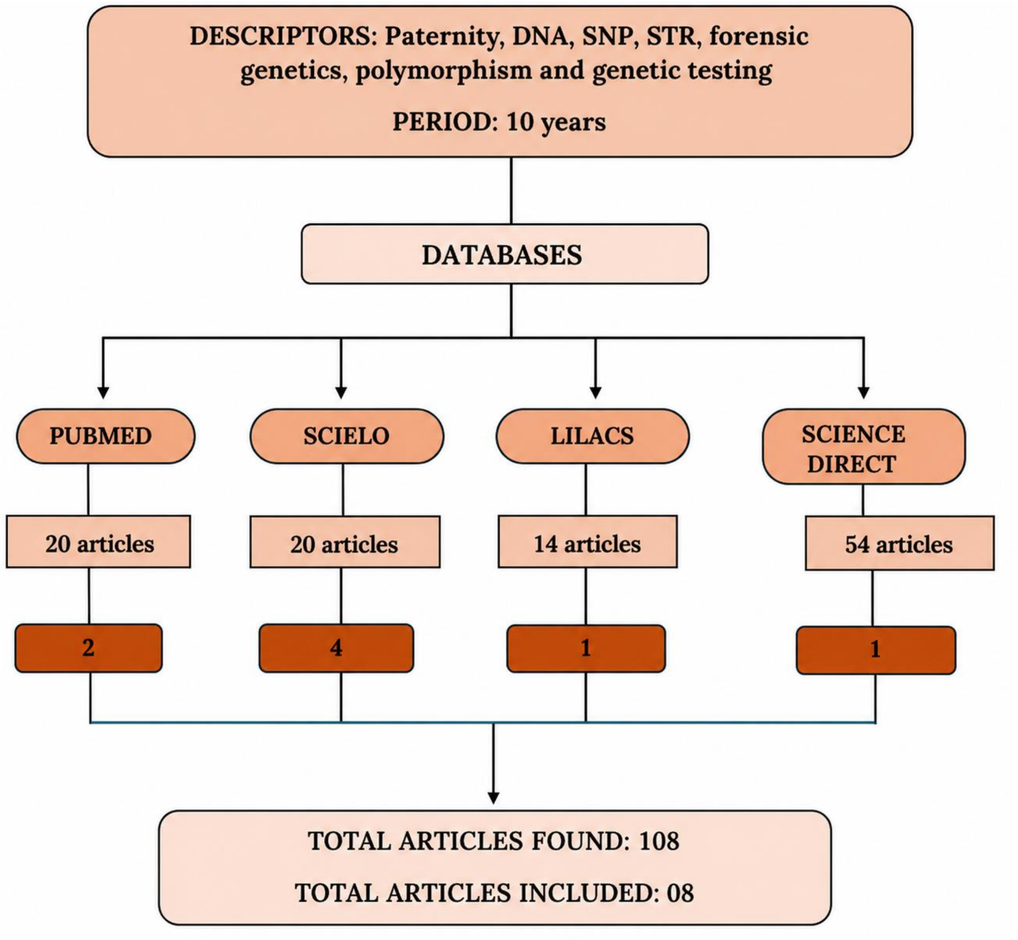
RESULTS AND DISCUSSION

This research was conducted through a systematized search in the selected databases using the established descriptors. After the initial search, the studies were filtered according to the inclusion and exclusion criteria. Figure 1 demonstrates the methodology established for this process, as well as the total number of studies found in this search and the articles included to compose this integrative review of the scientific literature.

Figure 1

Search for studies to carry out the integrative review, descriptors, databases, established period, total number of articles found and included.



Source: Authors

The following table (Table 1) was prepared to provide a better understanding of the selected articles and presents the distribution of each study included in the review. The data are presented according to author and year, article title, study design, study objective, and main results.

Table 1

Description of studies included in the integrative review.

Author and year	Article title	Study design	Study objective	Main results
Fonseca, 2019	DNA e o deslocamento de certezas no direito de família brasileiro [DNA and the displacement of certainties in Brazilian family law]	Original article	Shows the impacts of DNA paternity testing on decisions and policies in Brazilian family law	This study reports cases in which alleged children did not come forward for years before the emergence of DNA paternity testing, since it was normally not possible to obtain sufficient witnesses to report the case, and with the advent of the test it became possible to be certain of the biological father. In Brazil, even with several advanced technologies for genetic identification, the area did not attract as much attention from the media and society as paternity testing.
Machado; Leite; Barcelos, 2017.	Aplicabilidade do cromossomo X no DNA forense [Applicability of the X chromosome in forensic DNA]	Review article	Assists in solving cases by making use of genetic polymorphisms of molecular markers located on the X chromosome	This article investigated molecular polymorphisms and, because complete genetic material was unavailable or degraded, nuclear molecular markers and mitochondrial DNA were also used. The greatest use of X-chromosome polymorphism was in complex cases of human identification that could not be solved due to the lack of genetic material from relatives.
Caulfield; Stern, 2017.	Sombras da dúvida: a difícil incorporação da ciência de identificação na determinação legal da paternidade no Brasil [Shadows of doubt: the difficult incorporation of identification science in the legal determination of paternity in Brazil]	Original article	Even the most precise technology for human identification becomes irrelevant, and therefore such technologies were incorporated as supplementary methods in legal, social, and cultural decisions surrounding families	It reports the history of paternity testing, including in the colonial period, when illegitimacy rates were high, especially among the poor enslaved and free population. When Brazil's first Civil Code was approved, children could sue for paternal recognition, and when this code was implemented it instantly became one of the most common proceedings in family court. As the examination became more popular, the rights of families in favor of single mothers were also revolutionized, particularly by putting an end to humiliation in trials. However, in the search for truth in identification and legal science, it was not found in DNA, but rather in relation to the biology and culture of individual and collective identity.
Finamori, 2015.	Cuidado e consanguinidade na	Original article	The trajectory of DNA testing intertwined with the determination of	This article reports family cases involving famous individuals, in which the first denied being the biological

	atribuição de responsabilidade intergeracionais [Care and consanguinity in the attribution of intergenerational responsibility]		laws and with some cases involving famous individuals was highlighted, in which the test result assists in resolving cases	father of his alleged daughter, even though the examination result affirmed positive consanguinity, claiming that because he had not had affective contact with her, it projected a negative image. In the other case, even after years of assuming he was the biological father, the DNA examination proved negative; nevertheless, even with the result, he did not sever affective ties with his son, despite not being biologically related. These were two cases with different endings and corresponding results, also generating different repercussions before the public.
Fonseca, 2016.	Deslocando o gene: o DNA entre ouras tecnologias de identificação familiar [Displacing the gene: DNA among other technologies of family identification]	Original article	Shows the reach of the technology and its advances, especially concerning DNA testing, and highlights cases in which the entire outcome was followed, potentially involving feelings of affection and abandonment	This article presents an analysis of the hypothesis that the use of DNA testing in judicial paternity investigations may have caused a “geneticization” of social life. It contextualizes its effects on the evolution of scientific paternity evidence, on improving governance practices, and on the affective and material framework of some families.
Ambrosio *et al.,* 2020	Dados mutacionais e perfil populacional de 23 Y-STRs em três populações brasileiras [Mutational data and population profile of 23 Y-STRs in three Brazilian populations]	Original article	In order to achieve broader scope in forensic identification, Y-STRs are applied mainly in more complex cases, serving as a complement to autosomal STRs; however, for accurate interpretation, estimates of Y-STR haplotype frequencies must be reliable	This study made it possible to improve estimates of the frequency of the PowerPlex Y23 haplotype, increasingly expanding the number of profiles in the Brazilian database. Markers with GAAA or GATA repeats showed an increase in mutation rate with allele size, and there was also an increase in mutation rate with the father’s age.

Basgalupp *et al.,* 2014	Investigação de paternidade com suposto pai falecido ou desaparecido análise do êxito ao final do relatório [Paternity investigation with alleged father deceased or missing: analysis of success at the end of the report]	Original article	A study in which the alleged father is deceased or missing, and, through DNA testing and its results in these cases, the genetic profile was reconstructed using DNA profiles from close relatives	The results showed that the greater the number of close relatives, the higher the success rate of conclusive reports. In these cases, without the presence of the alleged father, the investigation becomes more complex and ultimately generates inconclusive results, resulting in the loss of all effort and investment.
Rêgo; Carvalho; Gusmão, 2019	Linhagens masculinas em populações brasileiras e desempenho de ferramentas de predição de haplogrupos [Male lineages in Brazilian populations and the performance of haplogroup prediction tools]	Original article	Reports on the use of the Y chromosome in forensic investigations, contributing to Brazilian databases, showing the development of software in its results, and in other tests with their result percentages	These studies are aimed at increasingly supporting the growing list of genetic profiles in Brazilian databases, with results showing our high diversity of haplotypes across all samples.

DNA – deoxyribonucleic acid; Y-STRs – Short Tandem Repeats genetic marker of the Y chromosome; GAAA – nitrogenous bases Adenine and Guanine; GATA – nitrogenous bases Guanine, Adenine, and Thymine. Source: Authors, 2024.

Brazil was the first country in Latin America to develop DNA testing, which is not surprising given its history of advanced use in genetic research and testing, both in clinical medicine and in the forensic field, since the 1980s (Caulfield; Stern, 2017). Innovation in DNA technology, particularly aimed at Brazilian family rights (Fonseca, 2019), also made it possible to elucidate criminal investigations, enabling individuals to be accused or exonerated even in cases with minimal quantities of biological samples (Fonseca, 2019). This gave rise to new scientific technologies aimed at supporting science in the lives of the population (Fonseca, 2016).

Judicially, this test became the gold standard for paternity examinations, being widely requested between the 1990s and 2000s as its use became more widespread. Television media helped popularize it, leading many individuals to seek the courts to confirm or contest paternity (Finamori, 2015). Although it remains a widely debated topic, especially due to the defendant's refusal to undergo testing or the argument that DNA alone would be sufficient to attest compatibility, case law maintained that this alone was not enough to eliminate paternity in unlawful cases (Caulfield; Stern, 2017).

This issue also opens space for another discussion: the true family bond between father and child is not limited to biological relationships but also involves the so-called "socio-affective truth." This conflict arises especially when fathers who raised and registered children as their own discover, through DNA testing, that there is no biological compatibility, alleging that they were deceived by the mother (Fonseca, 2019).

In cases where there is paternal absence or absence of ascendants, difficulty arises in elucidating autosomal molecular markers, Y-chromosome markers, and those located in mitochondrial DNA, making the use of DNA testing indispensable (Machado; Leite; Barcelos, 2017).

According to Machado, Leite, and Barcelos (2017), in the field of forensic genetics, the main molecular markers are STRs and SNPs, with autosomal STR markers being the most widely used due to their high polymorphic level and low mutation rates. This allows effective analysis even in degraded or highly fragmented samples, as they require only small quantities of base pairs.

For Ambrosio et al. (2020), obtaining results in more complex cases in which paternal relatives are distant, or understanding paternal ancestry, became possible through Y-chromosome STRs, which, when combined with autosomal STRs, have high discriminatory power between individuals.

According to Basgalupp et al. (2014), in investigations to reconstruct the genetic profile of an alleged missing or deceased father, approximately 81.0% of genetic markers are analyzed in first-degree relatives. This enables obtaining a result, although accuracy increases proportionally to the number of close relatives' samples available for analysis.

Likewise, Jannuzzi et al. (2020) state that Y-chromosome genetic markers form databases and characterize male lineages, mainly because they do not undergo recombination, as most of their length—the non-recombining region of the Y chromosome (NRY)—does not recombine with the X chromosome. Thus, they are passed from generation to generation without mutation, making them valuable allies in investigations where autosomal DNA analysis alone is insufficient.

As cited by Ambrosio et al. (2020), to study Y-STR mutation rates, only father–son pairs were compared to avoid diverse mutations. As a result, many studies were unable to compile data to estimate allele mutation rates because they did not provide information on the distribution of allele frequencies in paternal samples.

However, Machado et al. (2017) state that X-chromosome markers complement and increase reliability together with autosomal markers, as they present high Mean Exclusion Chance (MEC) values, thus providing greater discriminatory power. In paternity investigations in which genetic material from the alleged father is unavailable, autosomal tests are normally used; however, their analysis may be limited or incomplete. In such cases, X-chromosome analysis has greater applicability. Nevertheless, in situations involving direct analysis between father and male child, the use of the X chromosome becomes redundant, since men do not inherit the X chromosome from their father, but from their mother.

CONCLUSION

This study analyzed various aspects related to paternity testing, considering that it has become one of the most frequently requested examinations in judicial proceedings. It represents hope for those seeking to legally prove biological paternity or for individuals who, through the examination, wish to demonstrate genetic incompatibility with a child whom the mother alleged to be their biological offspring.

Given the increase in such cases, the judiciary has sought to adapt in order to judge and conclude these demands in the best possible manner. However, many still argue that paternity testing does not constitute definitive proof, questioning the reliability of its results. Despite this, in many cases the examination is essential, as it provides conclusive biological evidence regarding the existence or absence of a paternity relationship.

Paternity test analysis has become increasingly detailed, allowing, in cases where the alleged father is deceased or missing, the confirmation of ancestry using samples from close relatives. In addition, even in situations where samples are degraded or available in small quantities, analysis is possible.

This precision is achieved through techniques such as STR, SNP, Y-chromosome STR, and autosomal STR. The results become even more reliable when two or more of these markers are analyzed together, increasing the robustness of the conclusions.

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HEALTHCARE-ASSOCIATED INFECTIONS CAUSED BY MULTIDRUG-RESISTANT BACTERIA: A MULTIPROFESSIONAL APPROACH AND ADHERENCE TO PROTOCOLS IN THE SUS CONTEXT

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Abstract

Healthcare-associated infections (HAIs) caused by multidrug-resistant bacteria represent a major challenge for health systems, particularly within the Brazilian Unified Health System (SUS). This study aims to analyze the importance of a multiprofessional approach and adherence to protocols in the prevention and control of these infections. It is a narrative review based on scientific evidence from authors such as Didier Pittet, Barry M. Farr, and Ramanan Laxminarayan, as well as guidelines from the World Health Organization and the Ministry of Health. The results indicate that strategies such as hand

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hygiene, rational antimicrobial use, and epidemiological surveillance significantly reduce HAI rates. The integrated performance of multiprofessional teams enhances protocol implementation and improves patient safety. It is concluded that consistent adherence to best practices, combined with continuous health education, is essential to address infections caused by multidrug-resistant microorganisms in the SUS context.

Keywords: Healthcare-associated infections, Multidrug-resistant bacteria, Infection control, Multiprofessional team, Patient safety.

INTRODUCTION

Healthcare-associated infections (HAIs) constitute an important public health problem on a global scale, being responsible for high morbidity and mortality rates, prolonged hospital stays, and increased healthcare costs. This scenario becomes even more concerning in light of the growing spread of multidrug-resistant bacteria, a phenomenon widely discussed by researchers such as Didier Pittet and Ramanan Laxminarayan, who highlight antimicrobial resistance as one of the greatest threats to contemporary health (Pittet, 2001; Laxminarayan et al., 2013). In the context of the Brazilian Unified Health System (SUS), the challenges are intensified by structural limitations and the need to standardize care practices.

Given this panorama, the following research question is defined: how do the multiprofessional approach and adherence to care protocols contribute to the prevention and control of HAIs caused by multidrug-resistant bacteria in the SUS?

The general objective of this study is to analyze the importance of multiprofessional practice and adherence to protocols in reducing these infections. The specific objectives are: (a) to discuss the main factors associated with the occurrence of HAIs caused by multidrug-resistant microorganisms; (b) to evaluate the role of multiprofessional teams in controlling these infections; and (c) to identify effective strategies based on institutional protocols and national and international guidelines.

The justification for carrying out this study lies in the epidemiological and care-related relevance of HAIs, especially in view of the increase in bacterial resistance, as highlighted by the World Health Organization (World Health Organization, 2014). The adoption of evidence-based practices and the strengthening of the patient safety culture are fundamental to minimizing risks and improving the quality of care provided.

With regard to the theoretical review, classic and contemporary studies indicate that measures such as proper hand hygiene, rational use of antimicrobials, and continuous epidemiological surveillance are essential for the control of HAIs, as evidenced by Barry M. Farr (Farr, 2000). In addition, integration among professionals from different health fields favors the effective implementation of protocols and contributes to better clinical outcomes, reinforcing the need for a multiprofessional approach in addressing this problem.

METHODOLOGY

TYPE OF RESEARCH

The present study is characterized as a narrative review with a qualitative approach, with the objective of synthesizing and analyzing scientific evidence related to healthcare-associated infections (HAIs) caused by multidrug-resistant bacteria, focusing on the multiprofessional approach and adherence to protocols in the context of the Brazilian Unified Health System (SUS). The narrative review allows the integration of different types of studies and contributes to a broad understanding of complex phenomena in the health field, as discussed by Roberto Hernández Sampieri (Sampieri; Collado; Lucio, 2013).

SEARCH STRATEGY AND DATA SOURCES

Data collection was carried out through searches in recognized scientific databases, including Latin American and Caribbean Health Sciences Literature (LILACS), Medical Literature Analysis and Retrieval System Online (MEDLINE), and Scientific Electronic Library Online (SciELO). Controlled descriptors and keywords such as “hospital infection,” “multidrug-resistant bacteria,” “infection control,” and “multiprofessional team” were used, combined with Boolean operators (AND, OR). The search strategy followed methodological recommendations widely used in scientific reviews, according to the guidelines of Douglas G. Altman (Altman, 1991).

INCLUSION AND EXCLUSION CRITERIA

Scientific articles published between 2010 and 2024, available in full text, in Portuguese, English, and Spanish, that directly addressed HAIs associated with multidrug-resistant microorganisms and control strategies in the hospital environment were included. Duplicate studies, editorials, letters to the editor, and works that did not have a direct relationship with the proposed theme were excluded. The definition of rigorous selection criteria contributes to the quality and reliability of the findings, as highlighted by Matthias Egger (Egger; Smith; Altman, 2001).

ANALYSIS TECHNIQUES AND INSTRUMENTS

The data extracted from the selected studies were organized into thematic categories, allowing comparative analysis of the findings. The content analysis technique was used to interpret the qualitative data, making it possible to identify patterns, trends, and gaps in the literature. This approach is widely employed in health research, as proposed by Laurence Bardin (Bardin, 2011).

ETHICAL ASPECTS

As this is research based on secondary data available in the scientific literature, there was no need for submission to a Research Ethics Committee. However, the ethical principles related to scientific integrity were respected, with proper citation of the sources and authors used.

METHODOLOGICAL DISCUSSION

The choice of narrative review as the method proved to be appropriate for the objective of the study, since it enables articulation between different theoretical and practical perspectives on the control of HAIs caused by multidrug-resistant bacteria. However, it is recognized that this type of approach may present limitations regarding reproducibility and bias control when compared to systematic reviews. Even so, its applicability is widely recognized in the health field, especially in exploratory and integrative studies, as discussed by Trisha Greenhalgh (Greenhalgh, 2014).

RESULTS AND DISCUSSION

The results of the present review show that healthcare-associated infections (HAIs) caused by multidrug-resistant bacteria remain a significant challenge for health services, especially in middle-income countries such as Brazil. Studies indicate that pathogens such as *Staphylococcus* aureus resistant to methicillin (MRSA) and carbapenemase-producing enterobacteria have a high prevalence in hospital environments, contributing to worse clinical outcomes (Laxminarayan et al., 2013).

Table 1

Main multidrug-resistant microorganisms associated with HAIs

Microorganism	Resistance mechanism	Clinical impact
Staphylococcus aureus (MRSA)	Methicillin resistance	Severe infections, sepsis
Klebsiella pneumoniae	Carbapenemase production	High mortality
Pseudomonas aeruginosa	Multiple antibiotic resistance	Respiratory infections
Acinetobacter baumannii	Carbapenem resistance	Infections in the ICU

Source: Adapted from Laxminarayan et al. (2013).

One of the main findings refers to the effectiveness of prevention measures based on institutional protocols. Hand hygiene, considered the single most important intervention in the prevention of HAIs, has a direct impact on reducing infection rates, as demonstrated by Didier Pittet (Pittet et al., 2000).

Table 2

Main HAIs prevention measure

Measure	Description	Effectiveness
Hand hygiene	Use of alcohol-based hand rub or soap and water	High
Use of PPE	Gloves, masks, gowns	Moderate to high
Patient isolation	Reduction of cross-transmission	High
Environmental cleaning	Surface disinfection	Moderate

Source: Adapted from Pittet et al. (2000).

Another relevant aspect concerns the rational use of antimicrobials. The implementation of antimicrobial stewardship programs has been associated with reduced bacterial resistance and improved clinical outcomes. According to Ramanan Laxminarayan (Laxminarayan et al., 2013), the inappropriate use of these medications is one of the main drivers of resistance.

Multiprofessional practice also stands out as a central element in HAI control. Integration among physicians, nurses, pharmacists, and other professionals favors the implementation of preventive measures and compliance with institutional guidelines.

Table 3

Role of the multiprofessional team in HAI control

Professional	Main function
Physician	Appropriate prescription of antimicrobials
Nurse	Monitoring and prevention of infections
Pharmacist	Antimicrobial management
Physiotherapist	Prevention of respiratory infections

Source: Adapted from Farr (2000).

In addition, international guidelines, such as those proposed by the World Health Organization (World Health Organization, 2014), reinforce the need for continuous epidemiological surveillance and the implementation of public policies aimed at patient safety. In the context of the Brazilian Unified Health System (SUS), such strategies must be adapted to local realities.

In general, the findings corroborate the literature by demonstrating that the reduction of HAIs caused by multidrug-resistant bacteria depends on an integrated approach based on evidence and strict adherence to care protocols. However, challenges such as low adherence to recommended practices and structural limitations still persist, indicating the need for continuous investment in training and health management.

CONCLUSION

The present study aimed to analyze the importance of the multiprofessional approach and adherence to care protocols in the prevention and control of healthcare-associated infections (HAIs) caused by multidrug-resistant bacteria in the context of the Brazilian Unified Health System (SUS). Based on the literature review, it was possible to understand that such infections represent a relevant challenge for public health, requiring integrated strategies grounded in scientific evidence.

The main results showed that the adoption of measures such as hand hygiene, rational use of antimicrobials, and continuous epidemiological surveillance contribute significantly to the reduction of HAIs. In addition, it was highlighted that multiprofessional practice plays a fundamental role in the implementation and compliance with care protocols, promoting greater patient safety and quality of the care provided.

As a contribution, this study reinforces the importance of articulation among different health fields and the standardization of care practices as essential elements in addressing bacterial resistance. It also highlights the need to strengthen public policies aimed at infection control, especially in health systems such as the SUS, which deal with structural challenges and high care demand.

Finally, it is suggested that future research should deepen the analysis of innovative strategies for controlling multidrug-resistant microorganisms, including the use of health technologies, continuous educational programs, and evaluation of protocol effectiveness in different regional contexts. Investigations with more robust methodological designs, such as systematic reviews and intervention studies, are also recommended to expand the evidence base in the area.

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THE LEADING ROLE OF VITAMIN C AND ITS PHARMACOLOGICAL REPOSITIONING DURING THE COVID-19 PERIOD: SCIENTIFIC EVIDENCE versus FAKE NEWS

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Abstract

The present study addresses the analysis of the quality of scientific evidence related to the pharmacological leading role of vitamin C and its repositioning in the context of COVID-19, in the face of the dissemination of misinformation in digital environments. This is a bibliographic review whose

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objective was to critically evaluate the therapeutic role of ascorbic acid, as well as to confront unsupported information widely disseminated during the pandemic. The methodology was based on the search for and analysis of scientific articles, clinical trials, and technical documents available in databases such as PubMed, Web of Science, ScienceDirect, and Embase, as well as preprint repositories and clinical study registries. The results show that vitamin C has relevant antioxidant, anti-inflammatory, and immunomodulatory properties and may act as adjuvant therapy in patients with severe conditions, especially in reducing hospitalization time and improving clinical parameters. However, it was observed that the evidence remains inconclusive regarding its isolated efficacy in the treatment of COVID-19, especially due to the heterogeneity of the studies and the lack of definition of ideal doses. Furthermore, the widespread dissemination of false information associating vitamin C with curing the disease was identified, which may compromise evidence-based prevention measures. It is concluded that, although promising, the use of vitamin C should be guided by robust scientific evidence, and the strengthening of health education strategies is essential for confronting misinformation.

Keywords: Vitamin C, COVID-19, Drug repositioning, Fake news, Health education.

INTRODUCTION

Vitamin C, also called an antiscorbutic, consists of an indispensable dietary micronutrient that is crucial for maintaining organic processes (Verma et al., 2026). According to its redox state, it can be found in the following forms: reduced, called ascorbic acid (AA), and oxidized, called dehydroascorbic acid (DHA), influencing its antioxidant properties (under physiological conditions), pro-oxidant properties (in pathological states), anti-inflammatory, antiviral, and immunostimulatory properties (Yun et al., 2015; Macan; Kraljević; Raić-Malić, 2019; Banna et al., 2019; Chanphai; Tajmir-Riahi, 2019; Ravindran et al., 2019; Alberts et al., 2025).

Vitamin C is widely found in fresh fruits and vegetables, and may also be present in a range of oral supplements, such as tablets (conventional, chewable, and effervescent), capsules, crystalline powders, effervescent lozenges, gummy candies, liquids, as well as intravenous (IV) administration, which has been well tolerated in clinical trials (Vannucchi; Rocha, 2012; Boretti; Banik, 2020; Verma et al., 2026).

Due to its antioxidant action, vitamin C, especially in the form of AA, has been extensively investigated as a possible agent in the prevention and treatment of the disease caused by Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) (Qin et al., 2025). Although scientific evidence does not show that vitamin C intake translates into a significant benefit in the treatment of respiratory infections, its activity in critically ill patients, mediated by several mechanisms, has also already been proposed. Thus, research addressing the action of vitamin C specifically for COVID-19 would add valuable information (Gómez et al., 2018; Hemilä; Chalker, 2019; Carr, 2020).

Alongside the COVID-19 pandemic, the world is also facing an “infodemic” of low-credibility information regarding COVID-19. Several news websites contribute to the publication of false information, known as Fake News, about the novel coronavirus, which may lead the population to believe in such information and even in a supposed cure for the disease, resulting in a greater number of infected people, in addition to inhibiting effective actions for protection against the virus (Chen; Guestrin, 2016; Chen; Lerman; Ferrara, 2020; Dong; Du; Gardner, 2020; Silva et al., 2023).

Currently, there are vaccines with proven efficacy in preventing COVID-19, as well as pharmacological therapies used in the management of the disease (Ma et al., 2025); however, the search for more effective and specific treatments remains in constant development. A widely employed strategy today is drug repositioning, which consists of using therapeutic agents previously approved for certain clinical conditions, redirecting them as potential antiviral agents in the treatment of the disease in question (Pushpakom et al., 2018; Neuberger et al., 2019; Li et al., 2020; Maxmen, 2020; Singh et al., 2025).

In this context, the present study aims to analyze the repositioning of vitamin C as a potential therapeutic agent in COVID-19, with emphasis on the available scientific evidence and on the refutation of false information disseminated on the subject.

This was a bibliographic review study, carried out with scientific articles, editorials, preprints, and documents in general, with a time frame between 2016 and 2026, available in databases (ScienceDirect, Embase, Web of Science, and PubMed), reliable repositories (medRxiv and bioRxiv), as well as websites of trustworthy scientific entities. Additionally, due to the limited number of published studies on the topic, a search was conducted in ClinicalTrials.gov and in the Brazilian Registry of Clinical Trials (ReBEC), using the terms “Covid-19” and “ascorbic acid,” or their equivalents in Portuguese, retrieved up to July 2020.

Records of ongoing studies were selected whose protocol included at least one group of patients receiving oral and/or intravenous supplementation with ascorbic acid as prophylaxis, monotherapy, and adjuvant therapy for COVID-19. For the selection of bibliographic materials, titles and abstracts related to the topic were used as inclusion criteria. The bibliography was analyzed and selected, and the subjects were segmented into topics for better comprehension and understanding.

SARS-COV-2 AND COVID-19: SHALL WE LEARN ABOUT THEM?

At the end of the last decade, the World Health Organization (WHO) was first notified of an outbreak of pneumonia in Wuhan, Hubei Province (China), a city with 11 million inhabitants. On March 12, 2020, 125,048 cases and 4,614 deaths (nearly 3.7% of cases) were reported for the new virus (WHO, 2020a), then called novel coronavirus-2019 (2019-nCoV) and later renamed SARS-CoV-2 (Perrella et al., 2020).

The WHO named this new disease COVID-19 and, on March 11, 2020, characterized it as a pandemic (WHO, 2020b; Perrella et al., 2020). Three months after the emergence of the new virus, almost half a million cases of infection had been identified in 197 countries and, almost six months later, the total number of infected people worldwide was 7,273,958, with 413,372 confirmed deaths (Dong; Du; Gardner, 2020; WHO, 2020c).

SARS-CoV-2 is an enveloped RNA virus of the genus Betacoronavirus, which is distributed among birds, humans, and other mammals (Del Rio; Malani, 2020; Zhu et al., 2020; Oh et al., 2025). Compared to other coronaviruses, it is closest to two strains of the SARS virus (bat-SL-CoVZC45 and bat-SL-CoVZXC21) found among bats in Zhoushan, Zhejiang Province, China, in 2018 (Lu et al., 2020).

It is noteworthy that two thirds of the first 41 confirmed cases of COVID-19 in China were related to the Huanan Seafood Wholesale Market (in Wuhan), where live animals were sold, and the modes of person-to-person transmission, through droplets, fecal-oral route, and conjunctiva, subsequently led to many cases worldwide (Xu et al., 2020; Dong; Du; Gardner, 2020; Lu et al., 2020; Li et al., 2020).

Patients with COVID-19 may be asymptomatic or present various clinical manifestations, including acute symptoms such as fever, fatigue, headache, sore throat, dry cough, anosmia, dyspnea, and diarrhea; pneumonia presenting as acute respiratory distress syndrome (ARDS); as well as multiple organ failure (Guarienti et al., 2024). According to data published in China, 80% of patients with COVID-19 developed mild symptoms, 15% had a severe course, and fewer than 5% had a critical course accompanied by sepsis and multiple organ failure (Huang et al., 2020; Chen et al., 2020; Wang et al., 2020; Zhou et al., 2020).

Currently, although effective vaccines and specific therapies exist for the management of COVID-19, there is no single and definitive regimen applicable to all cases. Thus, preventive measures remain fundamental, including the adoption of good hygiene practices, well-ventilated environments, and general health care, which remain important strategies for reducing disease transmission (von Agris et al., 2025). Among the preventive measures, the following stand out: washing hands for at least 20 seconds, using soap or disinfectant with at least 60 to 80% alcohol; avoiding touching the facial T-zone (eyes, nose, mouth); avoiding contact with symptomatic people, or at least maintaining distance from them; avoiding crowds and travel to outbreak areas; sterilizing frequently handled surfaces and using full personal protective equipment (PPE) (surgical masks, double gloves, procedure gowns with full sleeves, and eye protection) for health professionals (Wu et al., 2020; von Agris et al., 2025).

THE DRUG REPOSITIONING STRATEGY IN THE TREATMENT OF INFECTIOUS DISEASES

Drug repositioning has recently emerged as an alternative for the faster identification of effective treatments against infectious diseases and has gained prominence because it is an essential and universal strategy in the therapeutics of some diseases due to factors such as: 1) lower costs and shorter time to market; 2) existing pharmaceutical supply chains are available for formulation and distribution; 3) possibility of combination with other drugs in treatments more effective than monotherapy; and 4) enabling the discovery of new mechanisms of action for previously approved drugs (Mercorelli et al., 2018; Pushpakom et al., 2018; Augustin et al., 2023). This strategy also has limitations, including patent barriers, complexity of regulatory pathways, lack of funding opportunities, greater access to data from other industry-sponsored clinical trials, and population heterogeneity for new clinical studies (Akodad et al., 2026). Nevertheless, this strategy still represents a promising approach for identifying new pharmacological classes with innovative potential (Pushpakom et al., 2018; Neuberger; Oraiopoulos; Drakeman, 2019; Akodad et al., 2026).

With regard to the treatment of COVID-19, all available therapeutic resources and drugs have been redirected based on patients' symptomatic conditions. Considering Acute Respiratory Distress Syndrome (ARDS), followed by secondary infections, some antibiotics, antivirals, systemic corticosteroids, and anti-inflammatory agents are frequently being used in COVID-19 treatment regimens; in addition to neuraminidase inhibitors, RNA synthesis inhibitors, convalescent plasma, and traditional herbal medicines (Lu, 2020).

In the investigation by Rosa and Santos (2020), 24 clinical trials on drug repositioning in the treatment of COVID-19 were identified. The pharmaceutical interventions found included: human immunoglobulin, interferons, hydroxychloroquine/chloroquine, azithromycin, arbidol, remdesivir, oseltamivir, favipiravir, carrimycin, methylprednisolone, bevacizumab, thalidomide, vitamin C, pirfenidone, bromhexine, fingolimod, danoprevir, ritonavir, darunavir, cobicistat, and lopinavir.

SCIENTIFIC EVIDENCE ON THE REPOSITIONING OF VITAMIN C IN THE TREATMENT OF COVID-19: EXTRA, SUPPORTING ACTOR, OR PROTAGONIST?

Vitamin C is a water-soluble micronutrient, an essential cofactor in numerous enzymatic reactions that mediates a variety of important biological functions, as it has immunomodulatory effects, anti-inflammatory and antiviral properties, and possible antimutagenic effects, with one of its main activities being antioxidant action, through the direct neutralization of reactive oxygen species (ROS), a fundamental action in defense against the toxicity of these molecules and in maintaining cellular redox status (Combs; McClung, 2017; Dennis; Witting, 2017; Hernández et al., 2020; Alberts et al., 2025).

Vitamin C, in the form of AA, is an electron donor and therefore a reducing agent that combats excess free radicals in cells, which reiterates its antioxidant action (Dennis; Witting, 2017). Recently, vitamin C has been investigated as an effective, accessible, and safe therapeutic alternative. It is estimated that its use may promote improved functioning of the immune system through several mechanisms, including increased phagocytic and lymphocytic activity (Baladia et al., 2020).

Van Gorkom et al. (2018) showed that vitamin C positively affects the development and maturation of T lymphocytes and natural killer (NK) cells, which are involved in the immune response to viral agents. This micronutrient also contributes to the inhibition of reactive oxygen species (ROS) and prevents the production and remodeling of the cytokine network, characteristic of systemic inflammatory syndrome.

In a more recent study, the authors revealed that high-dose intravenous vitamin C (HDIVC) is frequently being used in the adjuvant treatment of a variety of pathological conditions, such as sepsis, sepsis-induced acute lung injury, cancer, and burns. However, despite all the benefits, in the case of supplementation with excessive doses of AA, there may be a transition from a healthy state to a pathological one, triggering pro-oxidant activity. Furthermore, the optimal dose to be ingested and the threshold between a beneficial and harmful dose are debatable (Santos et al., 2019).

Thus, despite all the cited benefits of vitamin C, mainly due to its antioxidant action, it has been strongly associated with the prevention and treatment of COVID-19; for this reason, studies are being conducted in search of scientific evidence that proves or disproves such advantages (ClinicalTrials.Gov, 2020a; Kashiouris et al., 2020).

Because of this information, a phase II clinical trial (NCT04264533) was initiated in China to evaluate HDIVC in ICU patients with severe pneumonia associated with COVID-19 (Medicine USNLO, 2020). Some hospitals reported giving infected patients 1500 mg of vitamin C as supportive treatment. However, in China, HDIVC was administered at doses between 2 and 10 g/day in the treatment of 50 patients with severe COVID-19, over a period of 8 to 10 hours per infusion. The result was that the oxygenation index improved in real time and all patients eventually recovered and were discharged (Cheng, 2020; National Cancer Institute, 2020).

In the literature, to date, only one study has evaluated the effects of vitamin C on COVID-19 and found that intravenous AA (100 mg/kg/day) for 7 days reduced the length of hospitalization in the group with moderate SARS-CoV-2 infection (Anderson, 2020). However, it is important to consider the study's small sample size; therefore, further research is needed.

On the other hand, this evidence may be supported by recent meta-analyses with severely ill patients with other diseases, in which vitamin C administration reduced ICU length of stay by 7.8% (Hemilä; Chalker, 2019), mechanical ventilation time, and the need for vasopressor medications (Wang et al., 2019).

According to **Table 1**, ongoing studies are using an oral dose of 250 to 500 mg/day of ascorbic acid as prophylaxis against COVID-19. Intravenous AA at a dose of 8 to 10 g/day is being used as adjuvant therapy to standard drug treatment in hospitalized patients. The results of these studies are important for the future direction of COVID-19 treatment.

Table 1

Studies registered on ClinicalTrials.gov on vitamin C therapy and COVID-19.

ClinicalTrials Identifier	Country	Estimated General Population	Type of Therapy	Vitamin C Dose	Primary Outcome	Estimated Primary Completion
NCT04446104	Singapore	5000 adult male individuals at risk of COVID-19	Prophylaxis	500 mg/day for 42 days (control group)	COVID-19 diagnosis	July/2020
NCT04328961	United States	2000 individuals > 18 years old, both sexes, at risk of COVID-19	Prophylaxis	500 mg of ascorbic acid for 3 days and 250 mg for 11 days (oral route) (control group)	COVID-19 diagnosis	September/2020
NCT04357782	United States	20 hospitalized patients > 18 years old, both sexes, with sepsis including due to SARS-CoV-2	Monotherapy	200 mg/kg/day of intravenous ascorbic acid for 4 days	Adverse events	June/2020
NCT04264533	China	140 hospitalized patients > 18 years old, both sexes, with SARS-CoV-2 pneumonia	Monotherapy	24 g of intravenous ascorbic acid/day for 7 days	Ventilator-free days (up to 28 days)	September/2020
NCT03680274	Canadá	800 hospitalized patients > 18 years old, both sexes, with sepsis including due to SARS-CoV-2	Monotherapy	200 mg/kg/day of intravenous ascorbic acid for 4 days	Mortality or organ dysfunction (up to 28 days)	December/2021
NCT04342728	United States	520 outpatients > 18 years old, both sexes, diagnosed with COVID-19	Adjuvant	8000 mg of ascorbic acid/day for 10 days (group A)	Symptom reduction (up to 28 days)	December/2020
NCT04323514	Italy	500 hospitalized patients (children, adults, and elderly people), both sexes, with SARS-CoV-2 pneumonia	Adjuvant	10 g of intravenous ascorbic acid/day	In-hospital mortality (up to 3 days)	March/2021

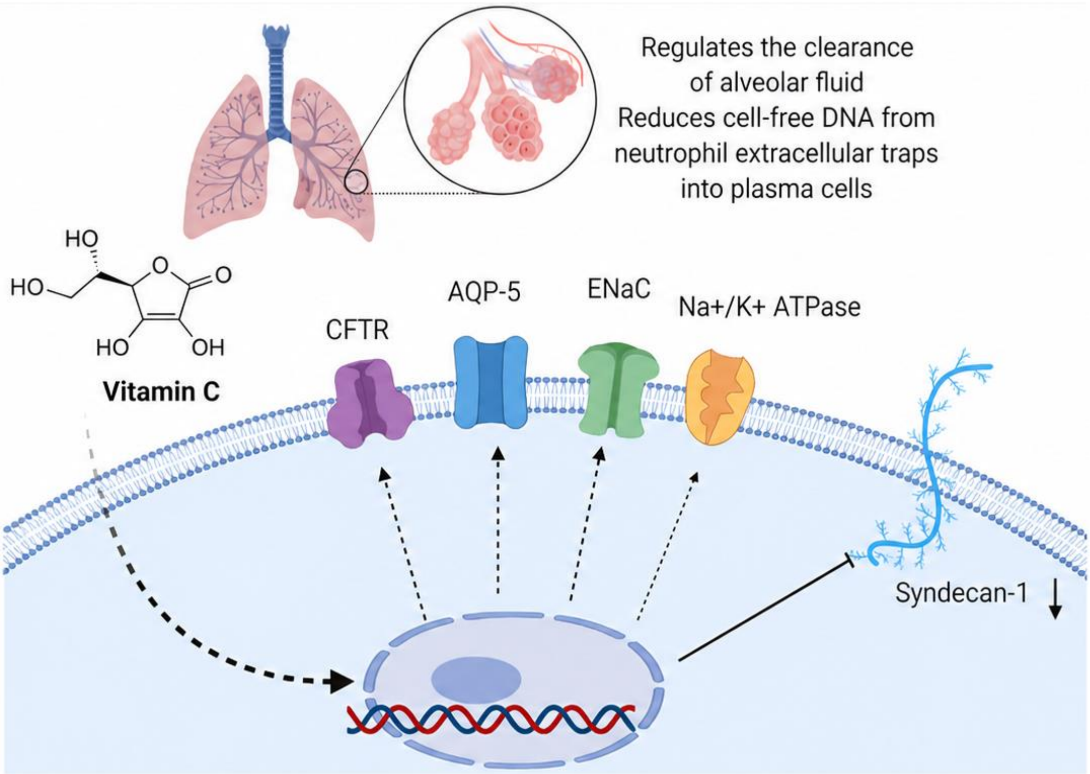
In the study by Bharara et al. (2016), 50 mg/kg of IVAA was administered every 6 hours for 96 hours to treat recurrent ARDS, with satisfactory results and no side effects detected. In another investigation in which HDIVC was administered to patients with severe pneumonia, it was observed that those treated with vitamin C had significantly lower in-hospital mortality. Clinical investigations conducted at Virginia Commonwealth University revealed that high plasma levels of vitamin C act “pleiotropically” to attenuate systemic inflammation and correct sepsis-induced coagulation abnormalities while mitigating vascular injury (CITRIS-ALI clinical trial; identifier NCT02106975). These critically ill patients generally have a reduced concentration of antioxidants. Therefore, a positive effect of vitamin C may be expected (Kim et al., 2018; ClinicalTrials.gov, 2020b).

Thus, to treat pneumonia and hyperinflammation caused by COVID-19, vitamin C should be administered in high doses. Several protocols have recently emerged with different doses and frequencies of administration. The issue is that there is controversy regarding the pro-oxidant effect of vitamin C at high doses, as it has not been demonstrated in vivo, nor is it known at what dose this may occur. Cytokine accumulation generates ROS that can be effectively treated with doses of 30 to 60 g of vitamin C, and at the same time, the relatively high level of vitamin C may promote enhanced chemotaxis of white blood cells (neutrophils, macrophages, lymphocytes, B cells, NK cells) (Hernández et al., 2020; Zeng et al., 2023).

Vitamin C reinforces the maintenance of the alveolar epithelial barrier and increases the transcription of protein channels (transmembrane conductance regulator – CFTR, aquaporin-5 – AQP-5, epithelial sodium channel – ENaC, and sodium-potassium pump – Na^+/K^+ ATPase) that regulate alveolar fluid clearance (Hook; Kuebler, 2025). The use of HDIVC has been implicated in reducing plasma cell-free DNA formed from neutrophil extracellular traps (NETs), which facilitate systemic inflammation in sepsis-induced multiple organ failure. Interestingly, elevated plasma levels of syndecan-1 correlate with increased mortality in severe sepsis and ARDS, and this endothelial proteoglycan can be significantly reduced by HDIVC (**Figure 1**) (Bendib et al., 2019; Kashiouris et al., 2020).

Figure 1

Action of Vitamin C in reducing mortality rates in patients with severe sepsis and ARDS.



Source: Authors

Due to the lack of evidence against COVID-19, recommendations for vitamin C intake are limited; although, previously, doses of 1–2 g/day were considered effective in preventing upper respiratory infections. Since these levels are not attainable through dietary sources, supplementation may be recommended for those at higher risk of respiratory infections. However, doses above 200 mg/day may not benefit healthy individuals; therefore, further research is being developed to prove or disprove the benefits of its use against COVID-19 (Zabetakis et al., 2020).

Taking into account the studies already completed and the progress of those still underway, vitamin C may bring benefits in the treatment of COVID-19; however, uncertainty regarding the vitamin dosage, its form of use, and also its pro-oxidant effect, which may appear at high doses, means that it cannot be stated that vitamin C is conclusively a safe and effective nutrient in combating the current pandemic.

FAKE NEWS, COVID-19, AND VITAMIN C

At present, the amount of information available in the media has increased dramatically, especially in the last ten years, due to the informational explosion "in which information proliferates and circulates in vast quantity and at great speed." With this high level of information available in the digital environment, there is the problem caused by the high production of false news, better known by the term Fake News, and consequently, an increase in misinformation in digital media (Brisola; Romeiro, 2018; Carvalho; Mateus, 2018; Giotakos, 2022).

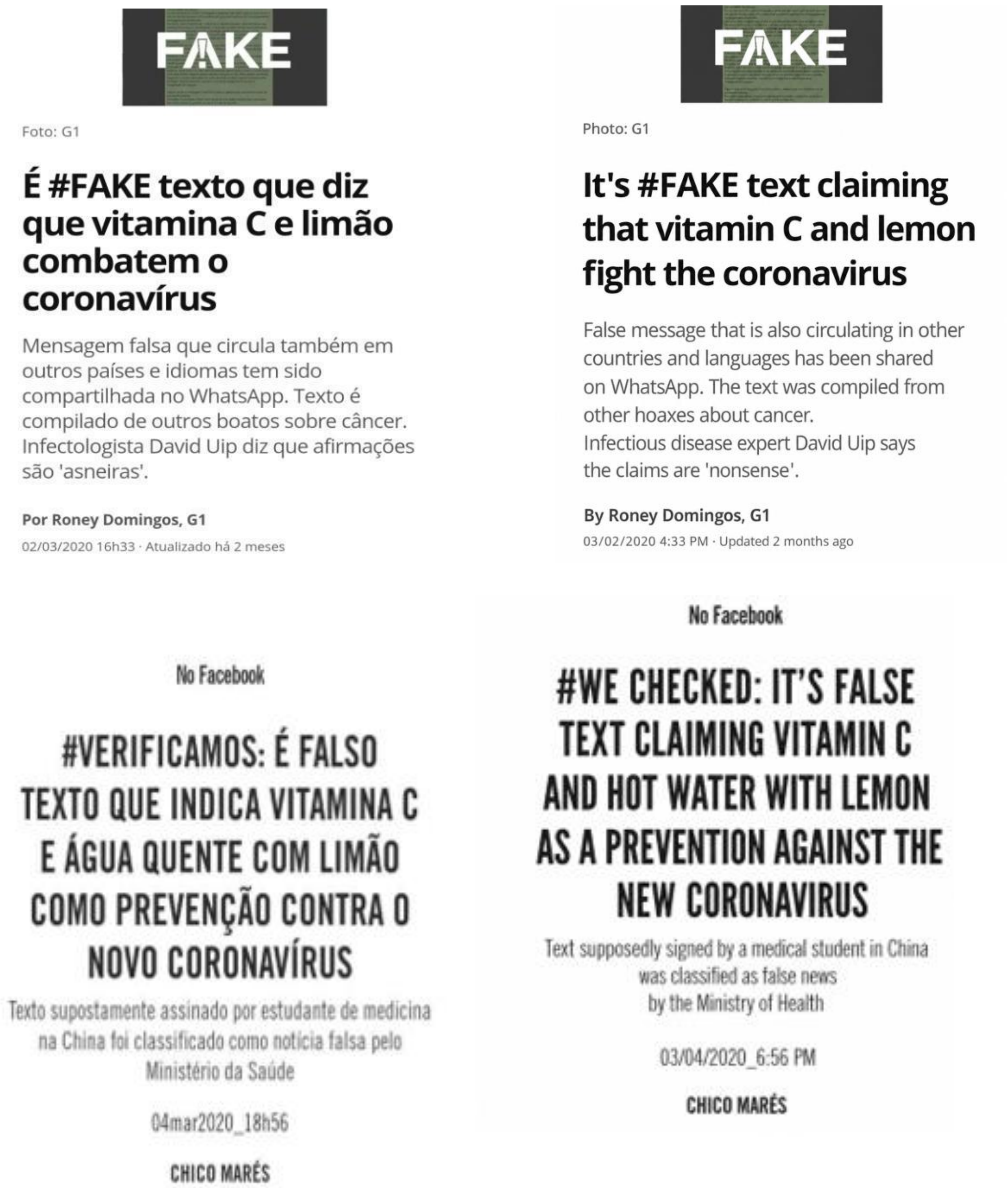
As the SARS-CoV-2 virus spread around the world, a flood of false medical information, rumors, and conspiracy theories unsupported by unfiltered channels has been disseminated, frequently spread through social media and other means of communication (Farhoudinia; Ozturkcan; Kasap, 2024). This infodemic process, which can be defined as an excessive amount of information about a problem, such that the solution becomes more difficult, has become a serious public health problem. In such a rapidly changing situation, with millions of people isolated at home, social media platforms such as Twitter, Facebook, WhatsApp, Instagram, and WeChat have become major sources of (mis)information (Hollowood; Mostrous, 2020; Lai et al., 2020).

For this reason, some institutions, agencies, and fact-checking websites can help examine the reality of news or information, and they are working to combat misinformation and promote facts about COVID-19 disease (UN News, 2020). The Brazilian Ministry of Health, as a way of confronting Fake News about health, has provided a WhatsApp number for receiving messages from the population, an exclusive space to receive viral information, which is verified by technical areas and officially answered as true or false, in a tab on the agency's official page for viewing only Fake News (Brasil, 2020).

Among the various Fake News items circulated during the novel coronavirus pandemic, vitamin C has been involved in many of them, some of which are shown in **Figure 2** and have also already been debunked and clarified.

Figure 2

Images of Fake News related to Vitamin C and COVID-19.



FAKE

Foto: G1

É #FAKE texto que diz que vitamina C e limão combatem o coronavírus

Mensagem falsa que circula também em outros países e idiomas tem sido compartilhada no WhatsApp. Texto é compilado de outros boatos sobre câncer. Infectologista David Uip diz que afirmações são 'asneiras'.

Por Roney Domingos, G1

02/03/2020 16h33 · Atualizado há 2 meses

FAKE

Photo: G1

It's #FAKE text claiming that vitamin C and lemon fight the coronavirus

False message that is also circulating in other countries and languages has been shared on WhatsApp. The text was compiled from other hoaxes about cancer.
Infectious disease expert David Uip says the claims are 'nonsense'.

By Roney Domingos, G1

03/02/2020 4:33 PM · Updated 2 months ago

No Facebook

#VERIFICAMOS: É FALSO TEXTO QUE INDICA VITAMINA C E ÁGUA QUENTE COM LIMÃO COMO PREVENÇÃO CONTRA O NOVO CORONAVÍRUS

Texto supostamente assinado por estudante de medicina na China foi classificado como notícia falsa pelo Ministério da Saúde

04mar2020_18h56

CHICO MARÉS

No Facebook

#WE CHECKED: IT'S FALSE TEXT CLAIMING VITAMIN C AND HOT WATER WITH LEMON AS A PREVENTION AGAINST THE NEW CORONAVIRUS

Text supposedly signed by a medical student in China was classified as false news by the Ministry of Health

03/04/2020_6:56 PM

CHICO MARÉS

Source: Authors. Original version on the left; translated version on the right for clarity.

According to the news items presented in Figure 2 above, it can be observed that it is highly imperative to state that vitamin C, in the form of a simple infusion combined with water and other substances, is capable of preventing or even having an effective action against the novel coronavirus. Thus, it becomes vital to educate the general population about the nature of false news and the negative outcomes of sharing it, because this creates a false feeling in people's minds, making them think they are protected from the disease and promoting greater transmission of it.

FINAL CONSIDERATIONS

Based on all the research carried out regarding the repositioning of Vitamin C for the prevention and/or treatment of COVID-19, it was found that it may present several benefits to the human organism, mainly with regard to its antioxidant potential and its ability to improve immune system functioning, being studied and used as a therapeutic alternative in conditions related to respiratory syndromes, especially in the treatment of COVID-19.

Some studies using HDIVC have shown improvement in reducing hospitalization time and even optimizing oxygenation levels. However, it cannot be stated with complete certainty that it is an effective nutrient against COVID-19, because the data are still uncertain, since the real side effects of its use and the ideal doses to be administered to each individual are still unknown. Therefore, further research advancing on the subject is needed, as is awaiting the studies that are being developed and previously initiated.

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THE BRAZILIAN UNIFIED HEALTH SYSTEM AS A NETWORK-BASED HEALTH CARE MODEL: INTEGRATION, GOVERNANCE, AND QUALITY OF CARE

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Abstract

The Unified Health System (SUS) is established as a network-based health system model grounded in the principles of universality, comprehensiveness, and equity, and structured through the integration of different levels of care. This study aimed to analyze SUS from the perspective of service integration,

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governance, and quality of care, based on a qualitative, descriptive-exploratory literature review. The research was conducted using the SciELO, Latindex, and BDENF databases, in addition to official documents from the Ministry of Health and relevant legislation, considering the time frame from 2022 to 2026. The results highlighted advances in the organization of Health Care Networks, particularly the coordinating role of Primary Health Care and the incorporation of digital technologies as strategies to enhance integration. However, persistent challenges were identified, including fragmentation of care, regional inequalities, the complexity of intergovernmental governance, and difficulties in consolidating quality practices. It was observed that the effectiveness of SUS as a network-based system depends on the articulation of public policies, workforce qualification, and the strengthening of evaluation and social participation mechanisms. It is concluded that, although SUS demonstrates significant potential to ensure comprehensive health care, its consolidation requires continuous investment, innovative management approaches, and the strengthening of integration, governance, and quality of care strategies.

Keywords: Health Care Networks, Health Governance, Health Care Quality, Health Services Integration, Unified Health System.

INTRODUCTION

The consolidation of the Unified Health System (SUS) as a network-based health system model represents one of the most significant milestones of Brazilian public policies, grounded in the principles of universality, comprehensiveness, and equity. Established by the Federal Constitution of 1988, which recognizes health as a right of all and a duty of the State (Brazil, 1988), the SUS was regulated by Laws No. 8,080/1990 and No. 8,142/1990, which established its organizational, operational, and participatory foundations (Brazil, 1990a; Brazil, 1990b). In this context, the system evolved from a fragmented and hospital-centered logic toward a model structured in Health Care Networks (HCNs), guided by service integration and care coordination, according to the guidelines established by Ordinance No. 4,279/2010 (Brazil, 2010).

The organization of the SUS as a network seeks to respond to the complexity of the population's health demands, promoting articulation among different levels of care and ensuring continuity of care. Such a model presupposes the existence of well-defined care flows, effective communication among points of care, and regulatory and governance mechanisms capable of ensuring the comprehensiveness of actions (Conass, 2015). Primary Health Care (PHC), especially since the National Primary Care Policy (PNAB), assumes a central role as the organizer of the network and coordinator of care, being responsible for users' longitudinal follow-up (Brazil, 2017). Complementarily, policies such as the National Health Surveillance Policy (PNVS) expand integration between care and surveillance actions, strengthening the territorial and preventive approach (Brazil, 2018).

However, despite institutional advances, challenges persist regarding the effective integration of services, interfederative governance, and the guarantee of the quality of care provided. Care fragmentation, regional inequality, and limitations in the management of human and technological resources constitute significant obstacles to the consolidation of health care networks (Melo; Silva, 2025; Campos, 2023). Furthermore, the complexity of shared management among the Union, states, and municipalities requires robust coordination and agreement mechanisms capable of aligning interests and promoting system efficiency (Carvalho et al., 2024).

In view of this scenario, the following question is defined as the research problem: in what way has the SUS, structured as a network-based health system, managed to promote service integration, strengthen governance, and ensure the quality of care for the population? This question is fundamental for understanding the advances and limitations of the model, as well as for supporting strategies to improve health management and care.

Thus, the present study aims to analyze the SUS as a network-based health system model, with emphasis on aspects of integration, governance, and quality of care. Specifically, it seeks to discuss the normative and conceptual frameworks that support network organization, identify the main challenges faced in implementing this model, and reflect on the strategies adopted to qualify health care within the Brazilian public system.

The relevance of this study is justified by the centrality of the SUS in guaranteeing the right to health in Brazil and by the need to strengthen its capacity to respond to the growing and complex demands of the population. In addition, the discussion on integration, governance, and quality of care becomes even more pertinent in a context of technological transformations, such as the incorporation of digital health, which broadens the possibilities of articulation among services and monitoring of health indicators (Haddad; Lima, 2026). In this sense, understanding the functioning of the SUS as a network contributes to the improvement of public policies and to the promotion of a more efficient, problem-solving, and user-centered system.

From a theoretical point of view, the SUS may be understood as a complex system, whose network organization requires the articulation of multiple actors, institutions, and levels of care. The literature indicates that service integration is a key element for the effectiveness of health care networks, as it enables continuity of care and reduces care fragmentation (Melo; Silva, 2025). In this context, care coordination by PHC is fundamental to ensuring orderly access and the problem-solving capacity of health actions.

Governance, in turn, constitutes a structuring axis of the SUS, involving decision-making processes, definition of responsibilities, and control and evaluation mechanisms. Studies emphasize that health governance should be guided by principles of transparency, social participation, and interfederative cooperation, essential elements for the sustainability of the system (Gusmão et al., 2025; Machado, 2024). Community participation, guaranteed by Law No. 8,142/1990, reinforces the democratic character of the SUS and contributes to the construction of policies more aligned with the needs of the population (Brazil, 1990b).

Regarding quality of care, there is growing concern with the implementation of strategies for evaluating and monitoring health services. The National Patient Safety Program (PNSP) and the National

Humanization Policy (PNH) stand out as initiatives aimed at improving the quality of care, promoting safe, humanized, and user-centered practices (Brazil, 2013a; Brazil, 2013b). In addition, the use of performance indicators has been widely discussed as a tool to evaluate the efficiency and effectiveness of services, contributing to evidence-based decision-making (Correa et al., 2025).

Quality management in the SUS is also directly related to institutional capacity and workforce qualification. In this sense, policies aimed at training and valuing health professionals are fundamental to ensuring the effectiveness of actions and the sustainability of the system (Junior; Porto; Silva, 2025). Teaching-service integration, for example, has been identified as a relevant strategy for training professionals aligned with the needs of the SUS and the demands of the population (Rodrigues; Dalbello-Araújo; Lazarini, 2026).

Additionally, health planning constitutes an essential tool for organizing networks and defining priorities, allowing the appropriate allocation of resources and the implementation of more efficient actions (Brazil, 2016). The strengthening of municipal management, as emphasized by Conasems (2023), also plays a crucial role in the operationalization of the SUS, especially in articulating the different points of care and guaranteeing access to services.

Finally, it is emphasized that, despite the advances achieved over more than three decades, the SUS still faces significant challenges to fully consolidate itself as an integrated system, with effective governance and high-quality care. Overcoming these challenges requires the strengthening of public policies, the expansion of health investments, and continued commitment to the principles that guide the system. In this sense, the analysis of the SUS as a network-based health system model contributes to understanding its potentialities and limitations, offering support for the improvement of management and care practices in the context of Brazilian public health.

METHODOLOGY

The present research is characterized as a literature review study, qualitative in nature, with a descriptive-exploratory approach, whose objective consists of analyzing the Unified Health System (SUS) as a network-based health system model, with emphasis on aspects of integration, governance, and quality of care. The choice of this methodological design is justified by the need to gather, systematize, and critically interpret recent scientific and normative production on the topic, enabling a broader understanding of the transformations and challenges of the SUS in the contemporary context.

The investigation was guided by the following guiding question: how has the Unified Health System, structured as a network-based health system, promoted service integration, strengthened governance, and ensured quality of care? This question directed all stages of the methodological path, from the definition of search strategies to the analysis of the selected studies.

Data collection was carried out through a systematized search in the Scientific Electronic Library Online (SciELO), Latindex, and Nursing Database (BDENF), recognized for their relevance in the health field and for indexing national and international scientific productions. Additionally, official documents published by the Ministry of Health were consulted, as well as legislation relevant to the SUS, in order to incorporate into the study updated normative guidelines and legal frameworks that underpin the organization of the Brazilian health system.

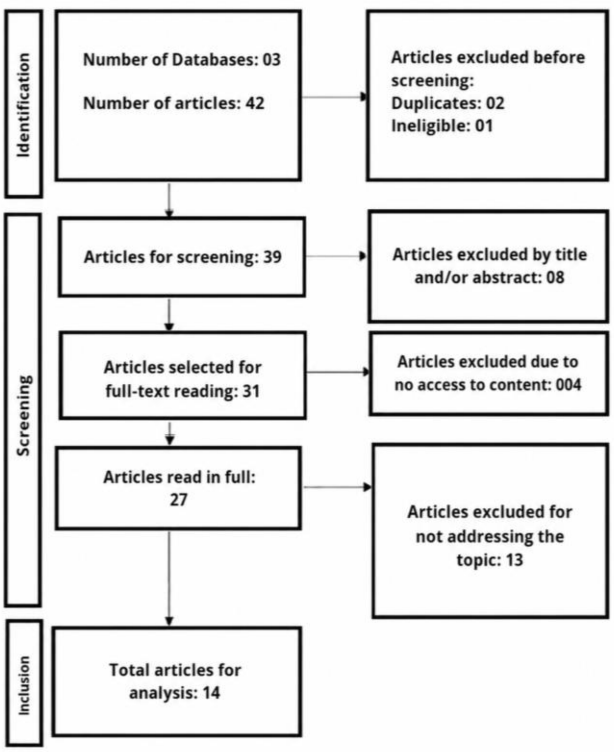
As a time frame, studies published between 2022 and 2026 were considered, with the aim of including recent evidence aligned with current discussions on network organization, governance, and quality of care in the SUS. For the search, controlled and uncontrolled descriptors were used, extracted from the Health Sciences Descriptors (DeCS), combined through Boolean operators (AND and OR), among which the following stand out: “Unified Health System,” “health care networks,” “health governance,” “quality of care,” “health services integration,” “primary health care,” and “public health management.”

The established inclusion criteria were: scientific articles available in full, published in Portuguese, English, or Spanish, between 2022 and 2026, that directly addressed the SUS as a network-based health system or discussed aspects related to integration, governance, and quality of health care. Official documents and current legislation that contributed to understanding the structure and functioning of the SUS were also included. On the other hand, duplicate studies, publications that did not present a direct relationship with the proposed topic, incomplete articles, simple abstracts, editorials, letters to the editor, and productions outside the defined time frame were excluded.

The study selection process occurred in sequential stages, comprising identification, screening, eligibility, and inclusion. Initially, titles and abstracts were read to verify the relevance of the studies, followed by a full reading of those considered potentially relevant. This process enabled the construction of a consistent analytical corpus aligned with the research objectives. The systematization of these stages is represented in Figure 1, which illustrates the flowchart of the study selection process.

Figure 1

Flowchart of the study selection process



Source: Authors (2026)

After selection, the data were organized through study records and thematic analysis, enabling the identification of analytical categories related to the central axes of the research: integration of health care networks, governance mechanisms, and strategies for qualifying care in the SUS. Data analysis was conducted in a critical and interpretive manner, seeking to identify convergences, gaps, and challenges pointed out in the literature, as well as their implications for health management and care.

Thus, the adopted methodology ensures scientific rigor, transparency, and reproducibility for the study, allowing an in-depth and grounded analysis of the SUS as a network-based health system, contributing to the advancement of knowledge in the field of public health and to the improvement of management and care practices in the Brazilian context.

RESULTS AND DISCUSSION

The results of this review demonstrate that the Unified Health System (SUS), as a network-based health system model, presents significant advances with regard to service integration, the consolidation of governance mechanisms, and the qualification of care, although it still faces structural and operational challenges that limit the full effectiveness of these guidelines. The analysis of the selected studies made it possible to identify three central axes of discussion: integration of health care networks, governance and interfederative management, and quality of care.

With regard to service integration, it is observed that the organization of the SUS into Health Care Networks (HCNs) has contributed to overcoming the fragmented model historically present in the system. The articulation among the different levels of care, with emphasis on the coordinating role of Primary Health Care (PHC), has favored continuity of care and expanded access to services (Melo; Silva, 2025). PHC, in this context, assumes a strategic function in organizing the care flow, acting as the preferred gateway and being responsible for users' longitudinal follow-up. However, studies indicate that difficulties still persist in communication among points of care, as well as in the definition of effective care flows, which compromises the comprehensiveness of care (Oliveira et al., 2025).

Additionally, the integration between care actions and health surveillance has been highlighted as an essential element for strengthening HCNs, especially in addressing health problems and promoting health at the territorial level (Brazil, 2018). However, fragmentation between these sectors still represents a challenge, evidencing the need for more robust strategies of intersectoral articulation and information sharing. The incorporation of digital technologies into the SUS emerges as a potential facilitator of this process, by enabling greater integration among services and better management of health data (Haddad; Lima, 2026).

In the governance axis, the results show that the SUS has a consistent normative framework that guides the organization of the system and establishes guidelines for shared management among federative entities. Decentralization, combined with social participation, constitutes one of the pillars of SUS governance, allowing greater adaptation of policies to local needs (Machado, 2024). However, the complexity of interfederative management imposes challenges related to coordination among the Union, states, and municipalities, especially concerning resource allocation, definition of responsibilities, and implementation of public policies (Carvalho et al., 2024).

The literature also highlights that governance in the SUS should be understood as a dynamic process involving not only administrative aspects but also political and social dimensions. In this sense, transparency, accountability, and social participation are fundamental elements for strengthening the system (Gusmão et al., 2025). Nevertheless, it is observed that the effectiveness of these mechanisms remains heterogeneous across the national territory, reflecting regional inequalities and limitations in the institutional capacity of local managers.

Another relevant aspect concerns the management of the health workforce, considered a central element for the consolidation of governance and the quality of care. The shortage of professionals in certain regions, combined with the precariousness of working conditions, directly affects the system’s response capacity (Campos, 2023). In addition, the need for continuous training aligned with SUS guidelines has been identified as a challenge, reinforcing the importance of strategies such as teaching-service integration (Rodrigues; Dalbello-Araújo; Lazarini, 2026).

Regarding the quality of care, the results indicate advances in the implementation of policies and programs aimed at patient safety and the humanization of care. Initiatives such as the National Patient Safety Program and the National Humanization Policy have contributed to the promotion of safer and user-centered practices (Brazil, 2013a; Brazil, 2013b). In addition, the use of quality indicators has been consolidated as an important tool for evaluating the performance of health services, enabling continuous monitoring and the identification of priority areas for intervention (Correa et al., 2025).

However, the literature points out that the implementation of these strategies still faces challenges, such as insufficient resources, resistance to change on the part of professionals and managers, and the absence of an institutional culture focused on evaluation and continuous improvement (Ridolfi et al., 2026). The heterogeneity in the quality of services provided, especially among different regions of the country, evidences the need for more equitable policies and investments directed toward reducing inequalities.

The analysis of the studies also evidences that health planning plays a fundamental role in organizing networks and promoting quality of care. Instruments such as health plans, annual programming, and management reports allow the definition of priorities and rational allocation of resources, contributing to the efficiency of the system (Brazil, 2016). However, the effectiveness of these instruments depends on the technical capacity of managers and the availability of reliable and updated information.

Furthermore, the articulation between public policies and the SUS has been identified as a determining factor for the effectiveness of health actions. Integration with other areas, such as education, social assistance, and sanitation, expands the scope of interventions and contributes to addressing the social determinants of health (Carvalho et al., 2024). In this sense, the SUS reaffirms its intersectoral character, essential for health promotion and the reduction of inequities.

The main findings of this review are summarized in Chart 1, which presents a systematization of the studies analyzed, highlighting authors, objectives, main results, and contributions to the understanding of the SUS as a network-based health system.

Table 1

Summary of the studies included in the review

Author/Year	Objective of the Study	Main Results	Contributions to the Topic
Campos, 2023	To propose guidelines for an integrated national policy for labor management in the SUS	Evidences the need for strategic workforce planning, with emphasis on professional valuation, continuing qualification, and reduction of regional inequalities	Reinforces the centrality of human resources management for the sustainability, governance, and effectiveness of health care networks
Ferreira; Ferreira, 2023	To analyze the historical trajectory and perspectives of the SUS in the context of Brazilian public policies	Identifies relevant institutional advances, but highlights structural obstacles, such as underfunding and inequalities in access to services	Contributes to understanding the SUS as a dynamic system, in a constant process of consolidation and network reorganization
Carvalho *et al.,* 2024	To examine the intersection between public policies and the SUS in the management and provision of health services	Points to the need for greater intersectoral articulation and integration among social policies to ensure greater effectiveness of health actions	Evidences the importance of intersectorality as a structuring element for the consolidation of health care networks
Machado, 2024	To discuss the foundations of democracy and citizenship in strengthening the SUS	Highlights social participation as an essential component of governance, contributing to greater legitimacy and social control of health policies	Reaffirms the democratic character of the SUS and its relevance for building an equitable and participatory system
Correa *et al.,* 2025	To analyze the use of indicators in evaluating the quality of health services in the SUS	Evidences the relevance of performance indicators for measuring efficiency, effectiveness, and quality of care, supporting decision-making	Contributes to strengthening the culture of evaluation and continuous monitoring within the SUS
Gusmão *et al.,* 2025	To discuss the structuring axes of governance, management, and comprehensiveness in the SUS	Identifies governance as a central element in the articulation between management and care, highlighting the importance of interfederative	Integrates the concepts of governance, health care networks, and comprehensiveness as pillars of the health system

		coordination	
Junior; Porto; Silva, 2025	To evaluate the impacts of management models on the health workforce	Evidences weaknesses in labor management, including precariousness and unequal distribution of professionals	Directly relates governance and management models to the quality of care provided
Melo; Silva, 2025	To analyze care coordination, integration, and continuity in the Family Health Strategy	Points to limitations in integration among levels of care, compromising continuity of care and the network's problem-solving capacity	Reinforces the strategic role of Primary Health Care as the organizer of health care networks
Oliveira *et al.,* 2025	To evaluate pathways toward universality and comprehensiveness of services in the SUS	Evidences the persistence of regional inequalities and difficulties in guaranteeing comprehensive care	Contributes to the critical analysis of the challenges in implementing the doctrinal principles of the SUS
Haddad; Lima, 2026	To discuss the incorporation of digital health into the SUS	Points to digital transformation as a strategy for expanding service integration, improving information management, and strengthening decision-making	Highlights the role of digital technologies in the modernization and integration of health care networks
Ridolfi *et al.,* 2026	To analyze the institutional determinants of quality management in the SUS	Evidences challenges related to the implementation of quality practices, including structural and cultural limitations in health institutions	Contributes to the debate on governance and quality of care in the context of health care networks
Rodrigues; Dalbello-Araújo; Lazarini, 2026	To analyze teaching-service integration as a formative strategy in health	Evidences the relevance of training aligned with SUS needs for qualifying care and strengthening the system	Highlights health education as an essential component for the sustainability and effectiveness of networks

Source: Authors (2026)

Finally, the results evidence that, although the SUS has advanced significantly in consolidating a network-based health system model, there are still important challenges to be overcome, especially regarding the effective integration of services, the strengthening of governance, and the guarantee of quality of care. Overcoming these challenges requires the strengthening of public policies, investment in infrastructure and human resources, as well as the promotion of an institutional culture focused on cooperation, innovation, and continuous improvement of health services.

The discussion of the findings of this review allows for a deeper understanding of the Unified Health System (SUS) as a network-based health system model, evidencing both its advances and the persistent challenges concerning service integration, governance, and quality of care. By analyzing recent scientific production, it is observed that the consolidation of Health Care Networks (HCNs) represents a fundamental strategy for organizing the system; however, its effectiveness still depends on multiple structural, organizational, and political factors.

With regard to service integration, Melo and Silva (2025) emphasize that, although the Family Health Strategy has expanded access and strengthened Primary Health Care (PHC) as the coordinator of care, significant weaknesses still exist in the articulation among the different levels of care. This limitation compromises continuity of care and evidences the persistence of fragmented practices. In line with this, Oliveira et al. (2025) argue that comprehensiveness, as a doctrinal principle of the SUS, has still not been achieved homogeneously across the national territory, especially in regions with less infrastructure and management capacity.

This reality reinforces the analysis by Ferreira and Ferreira (2023), who understand the SUS as a system in a constant process of construction, marked by institutional advances, but also by historical challenges, such as underfunding and regional inequalities. In this sense, network organization emerges as a response to the need to overcome fragmentation, requiring not only the definition of care flows but also the strengthening of communication among points of care and the adoption of effective regulatory mechanisms.

The incorporation of digital technologies, as discussed by Haddad and Lima (2026), presents itself as a promising element for service integration, by enabling greater interoperability of information systems and improving care management. However, the authors emphasize that the implementation of these technologies still faces barriers related to infrastructure, professional training, and inequality in access to digital resources, which may expand already existing inequities in the system.

In the field of governance, Gusmão et al. (2025) emphasize that the articulation among management, care, and comprehensiveness constitutes a structuring axis of the SUS, with governance being a central element for the effectiveness of health care networks. The authors highlight that governance should be understood as a process involving interfederative coordination, shared decision-making, and social participation, fundamental aspects to ensure the coherence and sustainability of health policies.

However, Carvalho et al. (2024) point out that the complexity of interfederative management in the SUS still represents a significant challenge, especially regarding the articulation among public policies and the definition of responsibilities among federative entities. This difficulty may compromise the implementation of integrated actions and reduce the efficiency of the system. In this context, decentralization, although a fundamental principle of the SUS, requires robust coordination and cooperation mechanisms to prevent the fragmentation of policies and services.

Social participation, as discussed by Machado (2024), constitutes one of the pillars of the democratic governance of the SUS, contributing to the legitimacy of decisions and the social control of public policies. However, the author emphasizes that the effectiveness of these mechanisms remains unequal, being influenced by factors such as the organizational capacity of civil society and the degree of institutionalization of participatory spaces.

Another relevant aspect of governance refers to health workforce management. Campos (2023) argues that the absence of an integrated national human resources policy compromises the sustainability of the SUS, especially in view of inequalities in the distribution of professionals and precarious working conditions in certain regions. Complementarily, Junior, Porto, and Silva (2025) evidence that the management models adopted directly affect professionals' motivation and performance, influencing the quality of care provided.

In this sense, teaching-service integration, analyzed by Rodrigues, Dalbello-Araújo, and Lazarini (2026), emerges as a relevant strategy for training professionals aligned with the needs of the SUS, contributing to the strengthening of health care networks and to the improvement of quality of care. The authors highlight that the articulation between educational institutions and health services favors the construction of more integrated and problem-solving practices.

Regarding quality of care, Correa et al. (2025) emphasize the importance of performance indicators as essential tools for evaluating the efficiency and effectiveness of health services. According to the authors, the systematic use of these indicators makes it possible to identify weaknesses, monitor results, and support evidence-based decision-making. However, the implementation of evaluation systems still faces challenges, such as the absence of an institutional culture focused on continuous improvement and the limitation of technical and financial resources.

This perspective is reinforced by Ridolfi et al. (2026), who highlight the institutional determinants of quality management in the SUS, evidencing that factors such as organizational structure, institutional culture, and management capacity directly influence the effectiveness of quality strategies. The authors point out that the consolidation of continuous improvement practices requires investments in training, strengthening of governance, and adoption of more participatory and integrated management models.

Additionally, intersectorality, discussed by Carvalho et al. (2024), emerges as a fundamental element for health promotion and the reduction of inequalities, by enabling articulation among different public policies and social sectors. This approach broadens the scope of SUS actions and contributes to addressing the social determinants of health, reinforcing the need for integration not only among health services, but also among different areas of State action.

Thus, the analysis of the studies evidences that the SUS, as a network-based health system, presents significant potential to promote comprehensive care, provided that challenges related to service integration, governance, and quality of care are overcome. The consolidation of this model requires the strengthening of PHC as the coordinator of care, the expansion of investments in infrastructure and technology, the valorization of the workforce, and the promotion of democratic and participatory governance.

In summary, the discussion indicates that the advancement of the SUS as a network-based health system depends on a continuous effort to articulate policies, services, and actors involved, as well as the adoption of innovative strategies capable of responding to the growing and complex demands of the population. Understanding these elements is fundamental for improving management and care practices, contributing to the construction of a more equitable, efficient health system centered on users' needs.

CONCLUSION

The analysis of the Unified Health System (SUS) as a network-based health system model made it possible to understand its organizational complexity and the advances achieved in consolidating a system guided by the principles of universality, comprehensiveness, and equity. Returning to the objective of this study, which consisted of analyzing the SUS from the perspective of service integration, governance, and quality of care, it is evident that the health care network model has proven to be a relevant strategy for organizing the system, although permeated by structural and operational challenges that affect its effectiveness.

With regard to the guiding question, the results indicate that important advances have occurred, especially in strengthening Primary Health Care as the coordinator of care, in expanding policies aimed at quality of care, and in incorporating digital technologies. However, such advances still occur unevenly across the national territory, being limited by weaknesses in articulation among levels of care, interfederative coordination, and the management of available resources.

The synthesis of the main results demonstrates that service integration, although recognized as a structuring axis of health care networks, still faces obstacles related to care fragmentation, insufficient communication among points of care, and the difficulty of operationalizing effective care flows. In the field of governance, the existence of a robust normative framework was observed, but with limitations in its practical implementation, especially regarding articulation among federative entities and the effectiveness of social participation. With regard to quality of care, advances stand out in the implementation of policies and indicators, although institutional and cultural challenges persist that hinder the consolidation of a culture of evaluation and continuous improvement.

The contributions of this research lie in the systematization and critical analysis of recent scientific production on the SUS as a network-based health system, evidencing the interrelationship among integration, governance, and quality of care as inseparable dimensions for the effectiveness of the system. In addition, the study reinforces the importance of innovative strategies, such as digital health, teaching-service integration, and the strengthening of workforce management, as fundamental elements for improving health care networks and qualifying the care provided to the population.

From a theoretical and practical point of view, the findings of this study contribute to deepening discussions on the organization of the SUS, supporting managers, health professionals, and researchers in formulating policies and strategies aimed at strengthening the system. Understanding the challenges identified, especially those related to regional inequality, service fragmentation, and interfederative governance, makes it possible to guide more effective interventions aligned with the needs of the Brazilian context.

Finally, it is suggested that future research should deepen the empirical analysis of the implementation of health care networks in different regions of the country, considering local specificities and the social determinants of health. In addition, studies are recommended to evaluate the impact of digital technologies on service integration and quality of care, as well as investigations into innovative governance and management models that may contribute to the sustainability of the SUS. In this way, it will be possible to expand knowledge about the system and strengthen its response capacity in the face of the population's growing demands.

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LECANEMAB IN THE EARLY TREATMENT OF ALZHEIMER'S DISEASE: EVIDENCE AND PERSPECTIVES

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Abstract

This chapter aims to analyze recent scientific evidence regarding the use of lecanemab in the early treatment of Alzheimer's disease, focusing on its efficacy, safety, and clinical implications. The methodology consisted of a narrative literature review based on randomized clinical trials, observational

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studies, and reports from regulatory agencies published between 2018 and 2025. The results indicate that lecanemab, a monoclonal antibody targeting beta-amyloid protein, has shown the ability to reduce amyloid plaque burden in the brain and slow cognitive decline in patients at early stages of the disease. Phase III studies demonstrated modest but statistically significant clinical benefits, particularly when administered early. However, adverse events such as amyloid-related imaging abnormalities were reported, requiring careful monitoring. It is concluded that lecanemab represents a significant advancement in disease-modifying therapy for Alzheimer's disease, although challenges related to safety, cost, and accessibility still limit its widespread clinical use.

Keywords: Alzheimer, Beta-amyloid, Early therapy, Lecanemab, Monoclonal antibodies.

INTRODUCTION

Alzheimer's disease is a progressive and irreversible neurodegenerative disorder characterized by cognitive decline, behavioral changes, and functional impairment, being the leading cause of dementia in the elderly worldwide (Alzheimer's Association, 2023). It is estimated that millions of people are affected globally, with a growing trend due to population aging, which reinforces the need for effective therapeutic strategies, especially in the early stages of the disease (WHO, 2021).

From a pathophysiological perspective, the disease is associated with the abnormal accumulation of beta-amyloid and tau proteins in the brain, leading to the formation of senile plaques and neurofibrillary tangles, which contribute to synaptic dysfunction and neuronal death (Hardy; Selkoe, 2002). In this context, the so-called "amyloid hypothesis" has guided the development of disease-modifying therapies, focusing on the removal or reduction of these pathological proteins (Selkoe; Hardy, 2016).

Recently, lecanemab, a humanized monoclonal antibody, has gained prominence as a promising approach in the early treatment of Alzheimer's disease. This drug acts selectively on soluble beta-amyloid protofibrils, promoting their clearance and potentially delaying the clinical progression of the disease

(Van Dyck et al., 2023). Phase III clinical trials, such as the CLARITY AD study, have shown that lecanemab was able to significantly reduce cognitive decline in patients with mild cognitive impairment or mild dementia associated with Alzheimer's disease (Van Dyck et al., 2023).

Despite promising results, the use of lecanemab still raises debates regarding its safety, particularly due to the occurrence of amyloid-related imaging abnormalities (ARIA), in addition to issues involving cost, accessibility, and patient eligibility criteria (Cummings et al., 2023). Moreover, regulatory agencies such as the Food and Drug Administration (FDA) have approved the drug under specific conditions, reinforcing the need for strict monitoring and careful patient selection (FDA, 2023).

Given this scenario, it becomes essential to understand the available scientific evidence regarding lecanemab, as well as its future prospects in the management of Alzheimer's disease. Thus, this chapter aims to discuss the advances, limitations, and clinical implications of the use of this drug in the early treatment of the disease, contributing to the updating of knowledge in the field and to evidence-based practice.

METHODOLOGY

TYPE OF STUDY

This is a qualitative, descriptive study developed through a narrative literature review. This design was chosen because it allows the integration and critical interpretation of different scientific evidence available on the use of lecanemab in the early treatment of Alzheimer's disease, providing a broad and contextualized view of the topic. In addition, the narrative review enables the discussion of clinical, therapeutic, and future perspectives in a more flexible manner, without the methodological restrictions of systematic reviews.

SEARCH STRATEGY

The bibliographic search was carried out in widely recognized electronic health databases, including PubMed/MEDLINE, Scopus, Web of Science, and the Virtual Health Library (VHL). The search period included publications from 2018 to 2025, aiming to encompass recent and updated evidence. Controlled descriptors and keywords in Portuguese and English were used, combined with Boolean operators (AND and OR), such as: "Alzheimer's disease," "lecanemab," "beta-amyloid," "monoclonal antibodies," and "early treatment." The search strategy was adapted according to the specificities of each database, ensuring greater coverage and sensitivity in identifying studies.

INCLUSION AND EXCLUSION CRITERIA

Previously defined criteria were adopted for study selection. Inclusion criteria included:

a) original articles and relevant reviews;

b) randomized clinical trials and observational studies;

c) publications directly addressing the use of lecanemab in early stages of Alzheimer's disease;

d) documents from regulatory agencies and scientific consensus statements;

e) studies published between 2018 and 2025, available in full text.

Exclusion criteria were:

a) duplicate studies across databases;

b) publications without access to the full text;

c) works that did not address the proposed objective;

d) studies focusing on other therapies unrelated to lecanemab;

e) articles outside the established time frame.

STUDY SELECTION PROCESS

The selection of studies occurred in sequential stages. Initially, titles and abstracts were read to identify potentially relevant works. Subsequently, full-text reading of the selected articles was carried out to verify their suitability according to the established criteria. This process allowed refinement of the final sample, ensuring the inclusion of studies with greater scientific relevance and alignment with the research objective.

DATA ANALYSIS AND SYNTHESIS

The data extracted from the selected studies were systematically organized and qualitatively analyzed. The synthesis of information included aspects related to the mechanism of action of lecanemab, its clinical efficacy, safety profile, adverse events, and implications for clinical practice. The analysis was conducted descriptively, seeking to identify convergences, divergences, and gaps in the literature.

ETHICAL ASPECTS

As this study is based on secondary data available in public databases and does not directly involve human subjects, submission to a Research Ethics Committee was not required, in accordance with the guidelines for studies of this nature. However, ethical principles related to scientific integrity and proper citation of sources were observed.

RESULTS AND DISCUSSION

The analysis of the included studies showed a predominance of phase II and III randomized clinical trials, as well as systematic reviews and recent reports from regulatory agencies. Most studies focused on patients with mild cognitive impairment or mild dementia associated with Alzheimer’s disease, considered ideal stages for disease-modifying interventions. There was also a significant increase in publications from 2021 onwards, reflecting advances in therapies targeting beta-amyloid protein.

Table 1

General characteristics of the included studies

Author/Year	Type of study	Sample	Main findings
Van Dyck et al. (2023)	Phase III clinical trial	1795 patients	Reduction in cognitive decline
Swanson et al. (2021)	Phase II clinical trial	856 patients	Reduction of amyloid plaques
Cummings et al. (2023)	Systematic review	—	Evidence of moderate efficacy
FDA (2023)	Regulatory report	—	Approval with restrictions

The results demonstrate that lecanemab presents modest but statistically significant clinical efficacy in slowing cognitive decline in patients at early stages of the disease. The CLARITY AD study showed an approximately 27% reduction in clinical progression, measured by scales such as CDR-SB. In addition, there was a consistent reduction in beta-amyloid plaque burden in the brain, confirmed by imaging exams, reinforcing the hypothesis that early intervention can alter the course of the disease.

Table 2

Main efficacy outcomes

Assessed outcome	Observed result
Cognitive decline	Significant reduction (≈27%)
Beta-amyloid burden	Marked reduction
Clinical progression	Moderate delay
Daily function	Partial preservation

Despite the benefits, concerns related to treatment safety were identified. The main adverse event associated with lecanemab use was the occurrence of amyloid-related imaging abnormalities (ARIA), including brain edema (ARIA-E) and microhemorrhages (ARIA-H). These events were more frequent in individuals carrying the APOE ε4 allele, although in most cases they were mild or asymptomatic.

Table 3

Adverse events associated with lecanemab

Adverse event	Frequency	Severity
ARIA-E (edema)	Moderate	Mild to moderate
ARIA-H (microhemorrhages)	Low to moderate	Variable
Headache	Frequent	Mild
Infusion reactions	Occasional	Mild

The interpretation of the findings indicates that lecanemab represents a relevant advancement in the treatment of Alzheimer's disease, as it acts directly on the disease's pathophysiology, unlike traditional therapies focused only on symptom control. The results are consistent with recent literature, which points to greater efficacy when intervention occurs in early stages, before more advanced neuronal impairment. However, the clinical benefits are still considered modest, raising questions about its cost-benefit ratio, especially in resource-limited settings.

Furthermore, the need for monitoring through imaging exams and the occurrence of adverse events reinforce the importance of careful patient selection. Issues related to accessibility and the high cost of treatment also represent significant challenges for its large-scale implementation. Thus, although promising, the use of lecanemab still requires further investigation, particularly regarding long-term effects and its association with other therapeutic approaches.

CONCLUSION

This chapter aimed to analyze the scientific evidence regarding the use of lecanemab in the early treatment of Alzheimer's disease, focusing on its efficacy, safety, and clinical implications. Based on the literature review, it was possible to identify that the drug represents a relevant advancement in the field of disease-modifying therapies, particularly because it acts directly in reducing beta-amyloid plaques, one of the main pathophysiological markers of the disease.

The main findings showed that lecanemab is capable of promoting a statistically significant slowing of cognitive decline in patients at early stages of the disease, in addition to reducing cerebral amyloid burden. However, the observed clinical benefits are still considered moderate and are accompanied by potential risks, such as amyloid-related imaging abnormalities (ARIA), which require rigorous monitoring and careful patient selection.

As a contribution, this study reinforces the importance of early intervention in the course of Alzheimer's disease and highlights lecanemab as a promising therapeutic alternative in the context of evidence-based medicine. In addition, it expands the understanding of recent advances in disease treatment, assisting healthcare professionals in clinical decision-making.

Finally, future research is suggested to investigate the long-term effects of lecanemab, its efficacy in different population profiles, and its possible association with other therapeutic approaches, such as treatments targeting tau protein. It is also necessary to analyze aspects related to cost-effectiveness and accessibility, especially in public health systems, in order to enable its broader and more equitable implementation.

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MULTIPROFESSIONAL PERFORMANCE IN SEPSIS PROTOCOLS IN EMERGENCY SETTINGS AND ITS IMPLICATIONS FOR MORTALITY REDUCTION AND CARE QUALIFICATION

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Abstract

Sepsis is one of the leading causes of hospital mortality worldwide, especially in emergency departments, urgent care services and intensive care units. Early recognition and rapid implementation of evidence-based care protocols are decisive factors for reducing mortality and improving the quality of care

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provided to critically ill patients. This chapter aimed to discuss multiprofessional performance in sepsis protocols in emergency settings and its implications for mortality reduction and care qualification. This is a narrative literature review based on international guidelines, scientific articles and institutional documents related to sepsis management. It was observed that the integration between nursing, medicine, physiotherapy, clinical pharmacy and other healthcare professionals favors early recognition of organ dysfunction, greater adherence to therapeutic bundles, reduced time to antibiotic administration and strengthening of patient safety. In addition, strategies related to continuing education, interprofessional communication and technological incorporation demonstrated positive impacts on care quality and hospital clinical outcomes. It is concluded that multiprofessional performance is an essential element for the effectiveness of sepsis protocols and for the consolidation of safer, more effective and humanized healthcare practices.

Keywords: Sepsis, Emergency, Multiprofessional team, Patient safety, Hospital mortality.

INTRODUCTION

Sepsis corresponds to a highly complex clinical syndrome, defined as a potentially fatal organ dysfunction resulting from a dysregulated host response to an infectious process (Singer et al., 2016). This condition currently represents one of the leading causes of hospital morbidity and mortality worldwide, especially in urgent care services, emergency departments, and intensive care units, constituting an important challenge for contemporary health systems. Its pathophysiology involves inflammatory, immunological, hemodynamic, and metabolic alterations capable of triggering progressive impairment of multiple organs and systems, frequently culminating in septic shock, multiple organ failure, and death.

In addition to its high clinical severity, sepsis has a significant epidemiological, economic, and social impact. Data from the World Health Organization (2023) indicate that millions of individuals develop sepsis annually, with substantial mortality associated with the syndrome, particularly in middleand low-income countries. In these settings, factors such as structural inequalities, limitations in access to health services, organizational weaknesses, and difficulties in implementing care protocols contribute to the worsening of clinical outcomes and to increased mortality rates. In the hospital environment, septic patients frequently require prolonged hospitalizations, intensive use of technological resources, advanced life support, and continuous multiprofessional follow-up, which results in a significant financial and operational burden for health services (Machado et al., 2017; World Health Organization, 2023).

In recent decades, sepsis has come to be recognized as a time-dependent emergency, in which the interval between clinical recognition and the implementation of therapeutic measures exerts a direct influence on the patient's prognosis. Classic studies have demonstrated that delays in the adequate administration of antimicrobials are significantly associated with a progressive increase in hospital mortality among patients with septic shock, reinforcing the need for rapid and systematized interventions (Kumar et al., 2006). In this context, structured clinical protocols have become part of institutional strategies aimed at patient safety, standardization of care pathways, and qualification of care for critically ill patients.

From this movement, the Surviving Sepsis Campaign consolidated international recommendations grounded in robust scientific evidence, promoting greater organization of care and reducing therapeutic variability in sepsis management (Evans et al., 2021). Among the main recommended interventions are early recognition of organ dysfunction, measurement of serum lactate, collection of blood cultures before antibiotic therapy, rapid administration of broad-spectrum antimicrobials, adequate fluid resuscitation, and continuous monitoring of tissue perfusion. The systematic implementation of these measures has demonstrated a significant impact on reducing hospital mortality and improving care indicators related to intensive care (Rhodes et al., 2017).

However, the effectiveness of sepsis protocols does not depend exclusively on the existence of clinical guidelines, but also on the organizational capacity of institutions and the integration among the different professionals involved in care. The management of septic patients requires simultaneous interventions, continuous clinical monitoring, rapid decision-making, and effective interprofessional communication, making coordinated action among nursing, medicine, physiotherapy, clinical pharmacy, laboratory services, and other care sectors indispensable. In this scenario, the multiprofessional approach constitutes a central element for early recognition of clinical deterioration, timely implementation of therapeutic measures, and strengthening of patient safety.

Given the epidemiological magnitude of sepsis and the need for rapid, organized, and resolutive care responses, it is essential to discuss multiprofessional practice in sepsis protocols in hospital emergency settings and its implications for mortality reduction, care qualification, and strengthening of patient safety. In addition, understanding the challenges related to the implementation of these protocols contributes to the consolidation of more efficient, humanized care practices aligned with contemporary principles of care for critically ill patients.

METHODOLOGY

This is a narrative literature review, developed from the analysis of scientific articles, international consensuses, and institutional documents related to sepsis and multiprofessional practice in urgent and emergency care services. Publications indexed in the PubMed, SciELO, and Google Scholar databases were consulted, prioritizing studies published between 2016 and 2025. Documents from the Surviving Sepsis Campaign and the Latin American Sepsis Institute were also used.

The material was analyzed descriptively and critically, seeking to identify evidence related to the role of nursing, medicine, physiotherapy, and clinical pharmacy in the sepsis protocol, as well as its implications for reducing hospital mortality and qualifying care.

RESULTS AND DISCUSSION

Nursing plays a strategic and central role in the early recognition of sepsis due to its continuous presence with the patient and its capacity for systematic and longitudinal clinical monitoring. In many hospital contexts, especially in urgent care, emergency, and intensive care units, the nurse is the first professional to identify clinical alterations suggestive of hemodynamic deterioration and organ dysfunction. Signs such as arterial hypotension, persistent tachycardia, fever or hypothermia, tachypnea, oliguria, reduced peripheral oxygen saturation, and changes in mental status are often initially detected by the nursing team, enabling early activation of institutional sepsis protocols and rapid mobilization of the multiprofessional team (Machado et al., 2017; Evans et al., 2021).

In this context, the Systematization of Nursing Care (SNC) assumes fundamental relevance for organizing care and strengthening clinical reasoning. The use of the nursing process enables continuous assessment of compromised basic human needs, identification of care priorities, and implementation of interventions based on scientific evidence. In addition, the SNC contributes to standardizing care, improving communication among professionals, and strengthening the safety of critically ill patients. Nursing also participates directly in the collection of laboratory tests, administration of antimicrobials, hemodynamic monitoring, rigorous fluid balance control, and fluid resuscitation, favoring adherence to the therapeutic bundles recommended by the international guidelines of the Surviving Sepsis Campaign (Evans et al., 2021; Rhodes et al., 2017).

The early implementation of therapeutic measures proves decisive for reducing mortality associated with sepsis. Studies show that delays in clinical recognition and in the initiation of antibiotic therapy are directly related to the worsening of organ dysfunction and to increased hospital mortality rates. Thus, the nursing team's ability to recognize subtle signs of clinical deterioration becomes essential for the effectiveness of care protocols and for reducing response time in hospital emergency settings (Kumar et al., 2006; Machado et al., 2017).

Medical practice in sepsis management involves diagnostic definition, stratification of clinical severity, and therapeutic decision-making based on clinical and laboratory parameters. Prognostic tools such as the Sequential Organ Failure Assessment (SOFA) and quick SOFA (qSOFA) have become widely used after the publication of the Sepsis-3 consensus, assisting in the early identification of patients at higher risk of unfavorable progression. The use of these instruments allows greater sensitivity in identifying organ dysfunction and supports faster and more targeted interventions, contributing to the reduction of complications associated with septic shock and multiple organ failure (Singer et al., 2016; Evans et al., 2021).

Early antibiotic therapy remains one of the main strategies for reducing mortality associated with sepsis, especially when administered within the first hour after clinical recognition of the septic condition. However, the inappropriate choice of antimicrobial agent or therapeutic delay may contribute to failure in infection control, progression to septic shock, and increased microbial resistance. In this scenario, integration among the medical team, nursing staff, and clinical pharmacy becomes indispensable for rationalizing antimicrobial therapy and ensuring greater care safety (Kumar et al., 2006; Rhodes et al., 2017).

Physiotherapy has growing relevance in the multiprofessional management of septic patients, especially in individuals with acute respiratory failure and acute respiratory distress syndrome (ARDS). The physiotherapist acts directly in ventilatory support, adjustment of mechanical ventilation parameters, bronchial hygiene, early mobilization, and prevention of complications associated with prolonged immobility. These interventions contribute significantly to reducing mechanical ventilation time, preventing muscle weakness acquired in the intensive care unit, and improving functionality after hospital discharge, strengthening the comprehensive approach to care for critically ill patients (Rhodes et al., 2017; Evans et al., 2021).

Clinical pharmacy plays a fundamental role in medication safety and in rationalizing the use of antimicrobials during sepsis management. The clinical pharmacist participates in the evaluation of medical prescriptions, dose adjustment according to renal and hepatic function, identification of drug interactions, and therapeutic monitoring. Furthermore, the pharmacist acts in antimicrobial stewardship strategies, which are essential for controlling bacterial resistance and promoting the rational use of antibiotics in the hospital environment. The integrated work of clinical pharmacy and the care team favors the reduction of adverse events, therapeutic optimization, and strengthening of the quality of care provided to septic patients (Evans et al., 2021; World Health Organization, 2023).

Another central aspect in the effectiveness of sepsis protocols concerns multiprofessional communication. Communication failures represent an important factor associated with therapeutic delays, care errors, and compromised patient safety. In this context, strategies such as multiprofessional rounds, care checklists, standardized protocols, and electronic alert systems favor greater integration among professionals and increased institutional adherence to therapeutic bundles. Effective communication strengthens continuity of care, reduces care variability, and contributes to the construction of an organizational culture oriented toward patient safety and care quality (Rhodes et al., 2017; Machado et al., 2017).

Continuing education in health constitutes an indispensable strategy for strengthening professional competencies related to sepsis management. The periodic implementation of training programs, clinical audits, realistic simulations, and interdisciplinary capacity-building activities favors early recognition of organ dysfunction and improves the effectiveness of therapeutic interventions. In addition, institutional continuing education programs contribute to the scientific updating of teams and to the strengthening of evidence-based practices, reducing care inconsistencies and promoting continuous improvement of clinical and care indicators (Evans et al., 2021; World Health Organization, 2023).

Brazilian studies demonstrate that hospitals that implement managed sepsis protocols associated with multiprofessional practice show a significant reduction in hospital mortality, a decrease in length of stay, and improvement in care indicators. In addition, the incorporation of digital technologies and computerized early warning systems enables the rapid identification of clinical and laboratory alterations suggestive of sepsis, contributing to reduced door-to-antibiotic time and greater standardization of care. However, the effectiveness of these technologies depends directly on team training and on the existence of an institutional culture committed to patient safety and quality of care (Machado et al., 2017; Evans et al., 2021).

CONCLUSION

Multiprofessional practice in sepsis protocols constitutes an essential element for reducing hospital mortality, qualifying care, and strengthening patient safety in urgent care, emergency, and intensive care services. The pathophysiological complexity of sepsis requires rapid, coordinated interventions grounded in scientific evidence, making effective integration among nursing, medicine, physiotherapy, clinical pharmacy, laboratory services, and other professionals involved in the care of critically ill patients indispensable. Collaborative practice favors early recognition of organ dysfunction, greater adherence to therapeutic bundles, reduced time to administration of antibiotic therapy, and optimization of hemodynamic and ventilatory support measures, factors directly associated with improved clinical outcomes and reduced hospital mortality rates.

In addition to impacts related to survival, the implementation of managed sepsis protocols contributes significantly to the standardization of care pathways, reduction of clinical variability, and strengthening of the institutional safety culture. In this context, strategies related to continuing education in health, qualified interprofessional communication, clinical auditing, and incorporation of digital technologies demonstrate important potential for the continuous improvement of care indicators and the consolidation of practices based on scientific evidence.

Nursing stands out in this process due to its capacity for continuous monitoring, early recognition of clinical deterioration, and articulation among the different professionals of the team. In parallel, medical practice guides therapeutic decision-making, while physiotherapists and pharmacists contribute to adequate ventilatory support, rationalization of antimicrobial use, and prevention of complications associated with intensive care. Thus, comprehensive care for septic patients depends directly on the construction of collaborative practices and the consolidation of organizational models centered on interdisciplinarity and clinical resolutiveness.

Additionally, it is essential to understand that sepsis management goes beyond exclusively biomedical aspects, also involving ethical, humanistic, and organizational dimensions of health care. The reception of critically ill patients and their families, clear communication between the team and service users, and care centered on human dignity represent fundamental components of comprehensive and humanized care. Thus, strengthening multiprofessional practices in sepsis protocols should be understood not only as a strategy for reducing mortality, but also as an instrument for qualifying care, rationalizing hospital resources, and promoting care excellence in contemporary health systems.

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DEPRESSION IN PATIENTS WITH ADVANCED CANCER: CHALLENGES AND INTERDISCIPLINARY MANAGEMENT

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Abstract

Depression in patients with advanced cancer is a highly prevalent yet frequently underdiagnosed condition, with significant impacts on quality of life, treatment adherence, and disease progression. This study aims to analyze the main challenges involved in the recognition and management of depression in patients with advanced-stage cancer, emphasizing the importance of an interdisciplinary approach to

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comprehensive care. This is a narrative literature review based on national and international scientific articles indexed in PubMed, SciELO, and Google Scholar databases, published between 2015 and 2025. The findings indicate that depressive symptoms are often masked by clinical manifestations of cancer itself or by treatment side effects, making early diagnosis difficult. In addition, factors such as stigma, emotional vulnerability, lack of systematic screening, and limited access to psychological care contribute to underreporting. Evidence also shows that integrated care involving oncology, nursing, psychology, psychiatry, and palliative care significantly improves symptom management and patients' overall well-being. It is concluded that addressing depression in advanced cancer requires continuous assessment, use of validated screening tools, and structured interdisciplinary intervention, promoting humanized and holistic care.

Keywords: Advanced cancer, Depression, Interdisciplinary care, Oncology, Palliative care.

INTRODUCTION

Depression in patients with advanced cancer constitutes an important public health problem, frequently associated with intense psychological suffering, worsening quality of life, and reduced adherence to oncological treatments. Advanced-stage cancer affects not only the body but also triggers significant emotional impacts, such as fear of death, hopelessness, chronic pain, and loss of autonomy, factors that contribute to the development of depressive disorders. In this context, the identification and adequate management of depression become essential for comprehensive and humanized care.

In view of this, the research problem guiding this study is: what are the main challenges in the recognition and management of depression in patients with advanced cancer, and how can interdisciplinary action contribute to more effective care?

The general objective is to analyze the challenges related to depression in patients with advanced cancer, emphasizing the importance of interdisciplinary management. The specific objectives are: to identify the prevalence and characteristics of depression in this group of patients; to describe the main obstacles to early diagnosis; and to discuss the relevance of joint action among health professionals in the treatment of these cases.

The justification for this study is based on the high prevalence of psychological distress among oncology patients and on the need to strengthen comprehensive care strategies that integrate mental health and oncological treatment. The literature indicates that depression, when untreated, can worsen the clinical prognosis and increase the suffering of the patient and their family, making it essential to discuss more effective and integrated interventions.

According to authors such as Holland and Breitbart (2010), psycho-oncology emphasizes that emotional aspects are directly linked to the progression of cancer, making the work of multiprofessional teams indispensable. In addition, the World Health Organization (WHO, 2022) reinforces that palliative care must include psychological support as a fundamental component of care for oncology patients.

Thus, understanding depression in advanced cancer from an interdisciplinary perspective is fundamental to promoting quality of life, dignity, and comprehensive patient care.

METHODOLOGY

TYPE OF STUDY

The present study consists of a narrative literature review, qualitative in nature, with a descriptive and exploratory approach. This type of methodological design was chosen because it allows a broad, interpretative, and critical analysis of the existing scientific production on depression in patients with advanced cancer, enabling the integration of different theoretical and practical perspectives. Narrative review is especially appropriate when seeking to understand complex health phenomena, such as psychological suffering in the oncological context, and its interfaces with interdisciplinary care.

SEARCH STRATEGY AND STUDY SELECTION

The search for articles was conducted systematically in scientific databases widely recognized in the health field: PubMed, SciELO, and Google Scholar. These platforms were selected because they gather relevant national and international publications on oncology, mental health, and palliative care.

Controlled and uncontrolled descriptors in Portuguese and English were used, such as: *"câncer avançado"*, *"depressão"*, *"saúde mental em oncologia"*, *"cuidados paliativos"*, *"psychological distress"*, *"advanced cancer"* and *"interdisciplinary care"*. The terms were combined with Boolean operators (AND, OR, and NOT), aiming to broaden the sensitivity and specificity of the search.

In addition, an initial exploratory reading of titles and abstracts was carried out to screen potentially relevant studies, followed by full reading of the selected articles for final analysis.

INCLUSION CRITERIA

The study included articles that met the following criteria:

- Publications from 2015 to 2025, ensuring scientific updating;
- Original articles, systematic reviews, integrative reviews, and observational studies available in full;
- Studies published in Portuguese, English, or Spanish;
- Research that directly addressed depression in patients with advanced cancer or in palliative care;
- Works that discussed interdisciplinary management strategies or a multiprofessional approach;
- Studies with clinical relevance for practice in oncology and mental health.

EXCLUSION CRITERIA

The following were excluded:

- Duplicate articles across the databases;
- Studies that did not have a direct relationship with the central theme of the research;
- Simple abstracts, proceedings without full text, editorials, letters to the editor, and personal opinions;
- Publications outside the established time frame;
- Studies with low methodological consistency or without clarity in the description of results.

DATA ANALYSIS PROCEDURES

Data analysis was carried out through critical, interpretative, and comparative reading of the selected studies. The information was organized into previously defined thematic categories, allowing the identification of recurring patterns and gaps in scientific knowledge.

The main categories analyzed were:

- Prevalence and manifestations of depression in advanced oncology patients;
- Difficulties in diagnosis and underreporting of depressive symptoms;
- Impacts of depression on clinical progression and quality of life;
- Role of the interdisciplinary team in the management of psychological suffering;
- Therapeutic strategies and integrated palliative care.

This organization enabled a critical synthesis of the findings and a broader understanding of the object of study.

ETHICAL ASPECTS

Because this is research based exclusively on a literature review, there was no direct involvement with human beings or collection of primary data, which exempts submission to the Research Ethics Committee, in accordance with the guidelines of CNS Resolution No. 510/2016. However, the ethical principles of scientific research were rigorously respected, including the correct citation of authors, the integrity of information, and the responsible use of consulted sources, avoiding any form of plagiarism or distortion of original data.

RESULTS AND DISCUSSION

The analysis of the studies included in this review shows that depression in patients with advanced cancer is a condition of high clinical relevance, frequently underdiagnosed and associated with significant impacts on patients' quality of life and prognosis. The prevalence reported in the literature ranges from 20% to 60%, and may be even higher in palliative care contexts, in which disease progression, chronic pain, and functional dependence intensify emotional suffering.

One of the main findings concerns the difficulty of diagnosing depression in this group of patients, especially due to the overlap of symptoms between advanced cancer and depressive disorder. Symptoms such as intense fatigue, insomnia, anorexia, weight loss, and apathy are common in both conditions, which contributes to underreporting and delays in appropriate treatment. In addition, institutional and cultural factors, such as the absence of systematic mental health screening and the stigma associated with psychiatric disorders, also hinder early recognition of the depressive condition.

The literature also indicates that depression in patients with advanced cancer is multifactorial, being associated with biological, psychological, and social aspects. Among the main risk factors are chronic pain, progressive loss of autonomy, social isolation, fragility of family bonds, perception of the finitude of life, and adverse effects of oncological treatments. These elements act in an interconnected manner, intensifying the patient's psychological and emotional suffering. The impacts of depression are broad and directly affect the patient's clinical progression and well-being. Reduced adherence to treatment, worsening quality of life, increased perception of pain, and greater risk of social isolation are observed. In some cases, depression may even be associated with a poorer clinical prognosis, reinforcing the need for early and structured interventions.

Table 1

Factors associated with depression in patients with advanced cancer

Factors	Description	Consequences
Chronic pain	Frequent symptom in the advanced stage of the disease	Intensification of emotional suffering
Loss of autonomy	Reduction of the patient's functional capacity	Feelings of dependence and uselessness
Social isolation	Reduction of family and social interaction	Worsening of depressive symptoms
Terminality of the disease	Awareness of the finitude of life	Anxiety, fear, and hopelessness
Effects of treatment	Chemotherapy, radiotherapy, and medications	Fatigue, physical and emotional changes

Table 2

Barriers to the diagnosis of depression in oncology

Category	Identified barriers	Impacts on care
Clinical	Symptom overlap with cancer	Diagnostic difficulty
Institutional	Absence of systematic psychological screening	Late diagnosis
Professional	Predominant focus on the biomedical model	Undervaluation of mental health
Social	Stigma related to depression	Resistance to psychological treatment
Care-related	Lack of integration among services	Fragmentation of care

Table 3

Contributions of the interdisciplinary approach

Professional	**Role**	**Benefits in care**
Oncology	Disease control and therapeutic definition	Clinical stabilization
Nursing	Continuous monitoring of the patient	Early identification of emotional changes
Psychology	Psychotherapeutic intervention	Reduction of psychological suffering
Psychiatry	Diagnosis and pharmacological treatment	Control of depressive symptoms
Palliative care	Comprehensive care and comfort	Improvement in quality of life

Based on these findings, it is observed that depression in patients with advanced cancer cannot be understood in isolation, but rather as the result of a complex interaction among physical, emotional, and social factors. The literature reinforces that an exclusively biomedical model of care is insufficient to meet the needs of these patients, requiring the implementation of integrated and interdisciplinary strategies.

In this sense, the interdisciplinary approach stands out as a fundamental element in the management of depression, allowing articulation among different areas of knowledge and health practices. The integration of oncology, nursing, psychology, psychiatry, and palliative care enables a broader view of the patient, favoring earlier, individualized, and humanized interventions.

Therefore, the results reinforce the need to incorporate psychological screening routines into oncology services, as well as to strengthen the training of health teams for the recognition and appropriate management of depressive symptoms, thereby promoting comprehensive and patient-centered care.

CONCLUSION

The present study aimed to analyze the challenges related to depression in patients with advanced cancer, with emphasis on recognition, management, and the importance of the interdisciplinary approach. Based on the literature review, it was possible to understand more broadly how psychological suffering manifests in this group of patients and which factors hinder its identification and appropriate treatment.

The main results show that depression in patients with advanced cancer has a high prevalence and is frequently underdiagnosed due to the overlap of symptoms with the oncological disease itself. In addition, factors such as chronic pain, loss of autonomy, social isolation, and awareness of terminality contribute significantly to the worsening of the depressive condition. It was also observed that the absence of systematic psychological screening and the stigma related to mental health represent important barriers to early diagnosis and adequate management.

Another relevant finding is that the interdisciplinary approach proves essential for improving care, allowing integrated action among oncology, nursing, psychology, psychiatry, and palliative care. This integration contributes to the early identification of symptoms, reduction of psychological suffering, and promotion of greater quality of life for oncology patients.

As a contribution, this study reinforces the importance of the humanization of care in oncology, highlighting the need to incorporate mental health as a fundamental part of advanced cancer treatment, going beyond the exclusively biomedical model.

Finally, it is suggested that future research should deepen the investigation of standardized protocols for screening depression in oncology services, as well as intervention studies that evaluate the effectiveness of interdisciplinary strategies in improving the psychological and clinical outcomes of these patients.

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ONE HEALTH: INTERFACES BETWEEN HUMAN, ANIMAL AND ENVIRONMENTAL HEALTH IN THE CONTEXT OF GLOBAL SUSTAINABILITY

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Abstract

The One Health approach is an interdisciplinary model that recognizes the interdependence between human, animal, and environmental health, proposing integrated actions to promote global health and sustainability. In this context, this study aimed to analyze the interfaces among these three dimensions, discussing the impacts of interactions between humans, animals, and the environment on collective health and the promotion of sustainable practices. This is an integrative literature review with a qualitative, exploratory, and descriptive approach, conducted between April and May 2026. The studies were searched in the databases Periódicos CAPES, SciELO, ScienceDirect, SpringerLink, Wiley Online Library, and PubMed. Descriptors related to One Health, sustainability, zoonoses, planetary health, and health surveillance were used, combined with the Boolean operators AND and OR. After applying the inclusion and exclusion criteria, 17 scientific articles composed the final sample. The results showed that environmental imbalances, climate change, biodiversity loss, and the intensification of interactions between humans and animals favor the emergence of zoonoses and public health problems. It was also observed that integrated surveillance and intersectoral policies constitute essential strategies for preventing health crises and strengthening global sustainability. Therefore, the One Health approach represents an important instrument for promoting global health, requiring interdisciplinary actions, stronger governance, and integration among different social and scientific sectors.

Keywords: Biodiversity, Epidemiological surveillance, Global sustainability, Health governance, Zoonoses.

INTRODUCTION

The intensification of environmental changes, the increase in zoonotic diseases, food insecurity, and the impacts of climate change highlight the need for integrated approaches to the promotion of global health. In this context, the concept of One Health gains prominence by recognizing that human, animal, and environmental health are deeply interconnected, requiring multidisciplinary actions and collective strategies aimed at sustainability and the prevention of health risks (Pitt; Gunn, 2024).

The One Health perspective has been strengthened in recent decades in the face of global health emergencies, such as the COVID-19 pandemic, as well as the advance of emerging infectious diseases and environmental degradation. Studies indicate that the unbalanced relationship among human beings, animals, and ecosystems directly contributes to the emergence of public health crises, demonstrating that contemporary challenges go beyond the traditional boundaries of the health sciences (Zinsstag et al., 2023).

In addition to disease prevention, the One Health approach is also associated with the promotion of sustainable development, the preservation of biodiversity, and the strengthening of public policies on health surveillance and governance. Integration among different sectors and areas of knowledge enables more efficient responses to complex problems involving biological, social, economic, and environmental factors (Zhou et al., 2024).

In this context, it becomes relevant to understand how the interfaces among human, animal, and environmental health can contribute to the construction of more resilient and sustainable societies. Despite the growth of scientific discussions on the topic, challenges still remain regarding the practical implementation of One Health, especially with respect to coordination among institutions, the formulation of integrated policies, and the strengthening of preventive actions (Faijue et al., 2024).

The undertaking of this study is justified by the growing need to broaden scientific discussions on sustainable and integrated health practices, considering that environmental and health impacts directly affect populations' quality of life. Furthermore, the One Health approach has the potential to strengthen preventive actions, surveillance systems, and public policies capable of minimizing epidemiological and environmental risks (Hayman et al., 2023).

From this perspective, it is argued that One Health represents a paradigm shift in the understanding of global health, as it proposes an expanded and integrated view of the relationships between living beings and the environment (Antó, 2024). In addition, the integration of Planetary Health, EcoHealth, and One Health broadens understanding of environmental impacts on collective health, strengthening strategies aimed at sustainability and global well-being (Talukder et al., 2024). In this sense, the expansion of the One Health concept demonstrates the need for permanent interdisciplinary actions to confront contemporary health and environmental challenges (Mumford et al., 2022).

In view of this, this study aims to analyze the interfaces among human, animal, and environmental health in the context of global sustainability based on the One Health approach. Specifically, it seeks to understand the conceptual foundations of One Health, discuss the impacts of interactions among the environment, human beings, and animals on collective health, and identify challenges and possibilities for implementing integrated health promotion strategies.

METHODOLOGY

This is an integrative literature review, with a qualitative approach and an exploratory and descriptive character, conducted between April and May 2026, with the objective of analyzing the interfaces among human, animal, and environmental health in the context of global sustainability, based on the One Health approach. The research sought to understand how integration among different areas of knowledge contributes to the promotion of collective health, disease prevention, and the strengthening of sustainable practices at the global level.

The methodological path was developed based on the methodological assumptions of Gil (2019), encompassing the stages of defining the research problem, delimiting the objectives, establishing the inclusion and exclusion criteria, searching for and selecting studies, analytically reading the material, organizing the information, and critically synthesizing the results.

The guiding question of the review was defined as follows: how do interactions among human, animal, and environmental health contribute to the promotion of global sustainability and to the strengthening of One Health strategies?

The search for studies was carried out between April and May 2026 in the databases Periódicos da CAPES, Scientific Electronic Library Online (SciELO), ScienceDirect, SpringerLink, Wiley Online Library, and PubMed, in addition to national and international scientific journals.

For the search strategy, descriptors and free terms in English and Portuguese were used, such as: (One Health), (Saúde Única), (global health), (saúde global), (environmental health), (saúde ambiental), (zoonoses), (sustainability), (sustentabilidade), (planetary health), (saúde planetária), (EcoHealth), (health surveillance), (vigilância em saúde), (health governance), (governança em saúde), and (emerging diseases), combined through the Boolean operators AND and OR

The following inclusion criteria were adopted: scientific articles available in full, published between 2021 and 2026, in Portuguese, English, and Spanish, that addressed the relationships among human, animal, and environmental health in the context of global sustainability and the One Health approach. As exclusion criteria, duplicate studies, simple abstracts, narrative reviews, editorials, dissertations, theses, and publications that did not directly answer the guiding research question were considered.

The initial search identified 312 studies. After applying the time frame and verifying full-text availability, 74 studies were excluded due to unavailability or inadequacy in relation to the inclusion criteria. Subsequently, 46 duplicate studies were removed, leaving 192 studies for title and abstract analysis. At this stage, 129 studies were excluded because they did not present a direct relationship with the proposed topic, resulting in 63 studies eligible for full-text reading.

After full reading and application of the eligibility criteria, 46 studies were excluded because they did not consistently address the interfaces among human, animal, and environmental health, or because they presented relevant methodological limitations. Thus, 17 scientific articles were selected to compose the final sample of this integrative review.

Data analysis was performed through thematic content analysis, according to Bardin (2011), encompassing the stages of pre-analysis, exploration of the material, thematic categorization, and interpretation of the results.

RESULTS AND DISCUSSION

The analysis of the seventeen selected studies identified that the One Health approach has been consolidated as a fundamental strategy for addressing contemporary health, environmental, and social challenges. The synthesis of the main studies included in this review is presented in Table 1.

Table 1

Synthesis of the selected studies

Author/Year	Study objective	Main results
Antó (2024)	To discuss the relationship between human health and planetary health	It showed that processes of environmental degradation, climate change, and biodiversity loss exert direct impacts on collective health indicators, contributing to the expansion of social inequalities, food insecurity, health vulnerabilities, and the worsening of environment-related diseases.
Bertoni (2021)	To relate sustainability, human health, and animal health	It demonstrated that global sustainability depends on balanced integration among human health, animal health, and environmental preservation, emphasizing that sustainable practices simultaneously favor collective well-being, health security, and ecosystem conservation.
Brown *et al*. (2024)	To analyze trends and the expansion of the One Health concept	They identified significant growth in scientific production related to One Health, showing that the approach has been consolidated as an essential strategy for addressing emerging diseases, environmental crises, and global public health challenges.
Cataldo *et al*. (2023)	To discuss gender issues in the One Health approach	They emphasized that gender inequalities and socioeconomic vulnerabilities directly influence the impacts of health and environmental crises, making it indispensable to formulate inclusive and intersectoral policies aimed at protecting the most vulnerable populations.
Danasekaran (2024)	To present One Health as a global health strategy	It showed that public health harms have multifactorial determinants related to

		environmental, economic, social, and biological aspects, reinforcing the need for integrated approaches to disease prevention and control.
Dar *et al*. (2026)	To relate sustainability and One Health	They proposed an integrated conceptual model between sustainability and One Health, highlighting that interdisciplinary actions strengthen the resilience of health systems, reduce global vulnerabilities, and favor long-term preventive strategies.
Edward *et al.* (2024)	To discuss practical applications of One Health	They showed that integration among human, animal, and environmental health favors more effective responses to zoonoses, contributing to the strengthening of epidemiological surveillance, the promotion of collective health, and the prevention of global health crises.
Faijue *et al.* (2024)	To analyze governance mechanisms in One Health	They identified institutional weaknesses related to the lack of coordination among governmental sectors, operational limitations, and difficulties in implementing integrated governance structures aimed at One Health.
Hayman *et al.* (2023)	To assess integrated surveillance systems	They demonstrated that integrated surveillance systems enable the early identification of epidemiological threats, expansion of preventive capacity, and strengthening of rapid responses to infectious and zoonotic outbreaks.
Milazzo *et al.* (2025)	To investigate the implementation of One Health	They showed that the practical implementation of the approach occurs unevenly among countries, being limited by insufficient investment, fragile public policies, a shortage of professional training, and institutional barriers.
Mumford *et al*. (2022)	To discuss the evolution and expansion of One Health	They argued that the expansion of One Health represents an urgent need in the face of contemporary environmental transformations, highlighting that interdisciplinary practices strengthen more resilient and sustainable health systems.
Pitt and Gunn (2024)	To present the conceptual foundations of One Health	They highlighted that climate change, disorderly urbanization, environmental degradation, and increased interactions between humans and animals expand epidemiological risks, requiring integrated strategies to protect global health.
Redford *et al*. (2022)	To relate human health and environmental preservation	They showed that ecosystem conservation constitutes an indispensable strategy for maintaining human health, preventing ecological imbalances, and reducing the circulation of emerging infectious agents.

Talukder *et al*. (2024)	To compare One Health, EcoHealth, and Planetary Health	They identified conceptual convergences among the approaches by recognizing that human, animal, and environmental health are interdependent dimensions, requiring integrated strategies aimed at sustainability and ecological balance.
Weatherly *et al*. (2023)	To investigate environmental impacts on mental health	They demonstrated that environmental degradation, extreme climate events, and biodiversity loss are associated with psychological distress, social insecurity, and the worsening of mental disorders in exposed populations.
Zhou *et al.* (2024)	To discuss theory and ethics in One Health governance	They emphasized that the effectiveness of One Health depends on continuous interinstitutional cooperation, data sharing, the strengthening of surveillance networks, and the incorporation of ethical principles into global health decisions.
Zinsstag *et al.* (2023)	To assess evidence on One Health and global security	They demonstrated that environmental imbalances, intensification of human activities, and changes in ecosystems favor the emergence of zoonoses and increase the risk of health emergencies with global reach.

Source: Prepared by the authors (2026)

ONE HEALTH AND THE INTEGRATION AMONG HUMAN, ANIMAL, AND ENVIRONMENTAL HEALTH

The One Health approach begins from the understanding that human health cannot be analyzed in isolation from animals and the environment. This model proposes integrated action among different areas of knowledge to address health problems that have multiple causes and consequences. As discussed by Pitt and Gunn (2024), the intensification of climate change, disorderly urbanization, and environmental degradation has increased the need for broader strategies to protect collective health.

Scientific evidence demonstrates that environmental imbalances favor the emergence and spread of infectious diseases, especially zoonoses. Zinsstag et al. (2023) emphasize that recent epidemics have shown how environmental impacts and inappropriate interaction between humans and animals can generate global public health crises. Thus, understanding these relationships has become essential to preventing new epidemiological outbreaks and strengthening global health security.

In addition to disease control, One Health also contributes to strengthening global sustainability. Bertoni (2021) states that environmental preservation, animal welfare, and human health should be treated as complementary dimensions of the same process. This understanding broadens the role of public policies, which cease to act only in the treatment of diseases and begin to include preventive actions related to environmental conservation and populations' quality of life.

From this perspective, Antó (2024) emphasizes that the health of the planet directly influences human health indicators. Problems such as pollution, water insecurity, and biodiversity loss affect not only ecosystems but also increase social inequalities and health vulnerabilities. Thus, environmental sustainability comes to be understood as an indispensable element for the promotion of collective health.

Talukder et al. (2024) reinforce that the concepts of Planetary Health, EcoHealth, and One Health have convergent objectives by defending more balanced relationships between society and the environment. Although they present distinct approaches, these perspectives share concern regarding environmental impacts on human health and advocate integrated strategies to confront contemporary ecological and health crises.

Brown et al. (2024) add that the expansion of the One Health concept occurred mainly due to the increase in global challenges related to environmental changes and emerging diseases. According to the authors, the growth of research in the field demonstrates that integration among sectors has become a practical necessity and not merely a theoretical proposal. This shows that complex problems require equally integrated and interdisciplinary responses.

HEALTH SURVEILLANCE, ZOONOSIS PREVENTION, AND SUSTAINABILITY

Integrated surveillance represents one of the main pillars of the One Health approach. The prevention of zoonotic diseases depends on coordination among environmental monitoring, animal health, and human health, allowing faster and more efficient responses to epidemiological threats. Hayman et al.

(2023) explain that shared surveillance systems favor the early identification of risks and strengthen the capacity to contain infectious outbreaks.

The COVID-19 pandemic reinforced the importance of these preventive strategies. Edward et al. (2024) discuss that the advance of zoonoses is directly associated with intensified human contact with degraded natural environments and wild species. In this scenario, preventive measures become more effective than actions centered exclusively on treating diseases after their dissemination.

Danasekaran (2024) highlights that One Health offers a broader approach to addressing global health problems by integrating biological, environmental, and social factors. This view makes it possible to understand that many health harms do not have an exclusively clinical origin, being also related to the environmental, economic, and structural conditions of populations.

Environmental sustainability also exerts a direct influence on disease prevention and the maintenance of collective health. Redford et al. (2022) argue that the preservation of ecosystems should be understood as a fundamental strategy for protecting human life. Environmental destruction favors ecological imbalances capable of increasing the circulation of pathogens and compromising essential resources for the survival of populations.

Another relevant aspect involves environmental and social impacts on mental health. Weatherly et al. (2023) identified that changes in ecosystems, biodiversity loss, and extreme environmental events can cause psychological distress, social insecurity, and the worsening of mental disorders. This demonstrates that the effects of environmental crises go beyond infectious diseases, also affecting the emotional and social well-being of populations.

Cataldo et al. (2023) add that One Health actions need to consider social inequalities and gender issues so that preventive strategies are more effective. Vulnerable populations tend to suffer more intense impacts in the face of environmental and health crises, highlighting the need for inclusive and intersectoral policies.

GOVERNANCE, INSTITUTIONAL CHALLENGES, AND IMPLEMENTATION OF ONE HEALTH

The implementation of the One Health approach still faces challenges related to governance and institutional coordination. Faijue et al. (2024) observe that many countries face difficulties in building integrated structures capable of bringing together the human health, veterinary, and environmental sectors. The absence of coordination among institutions limits the effectiveness of preventive actions and compromises rapid responses to health emergencies.

The challenges also involve ethical, political, and operational issues. Zhou et al. (2024) explain that One Health governance requires continuous cooperation among different areas of knowledge, as well as investments in planning, data sharing, and strengthening surveillance networks. Without institutional integration, strategies become fragmented and less efficient.

Milazzo et al. (2025) highlight that the practical implementation of One Health still occurs unevenly in different regions of the world. Although there is scientific recognition of the importance of the model, difficulties related to financing, professional training, and the development of integrated public policies persist. This demonstrates that the consolidation of the approach depends on both scientific advances and governmental and institutional support.

Dar et al. (2026) argue that sustainability and One Health should be understood jointly, as both have objectives aimed at preserving life and reducing global vulnerabilities. The authors argue that the strengthening of integrated actions can contribute to more resilient health systems that are better prepared to face future crises.

Mumford et al. (2022) state that the expansion of the One Health approach represents an urgent need in the face of current environmental and social transformations. According to the authors, the strengthening of interdisciplinary practices favors broader and more sustainable responses to problems that simultaneously affect human beings, animals, and ecosystems.

CONCLUSION

It is evident that the One Health approach represents a fundamental strategy for confronting contemporary health, environmental, and social challenges. The analysis of the literature showed that human, animal, and environmental health have an interdependent relationship, demonstrating that impacts caused to ecosystems directly affect populations' quality of life and the occurrence of harms to collective health. Thus, it became evident that the promotion of global health depends on the adoption of integrated, sustainable, and interdisciplinary practices.

The objectives proposed in this research were achieved by enabling an understanding of the conceptual foundations of One Health, as well as a discussion of the interactions among human beings, animals, and the environment in the context of global sustainability. The studies analyzed demonstrated that factors such as climate change, environmental degradation, disorderly urbanization, and biodiversity loss favor the emergence of zoonoses, increase epidemiological risks, and expand social and health vulnerabilities. In addition, it was verified that environmental preservation constitutes an indispensable element for maintaining collective health and preventing global health crises.

The relevance of integrated health surveillance was highlighted as a strategic tool for the early identification of epidemiological threats and the strengthening of preventive actions. Integration among human, veterinary, and environmental health proved essential for containing infectious outbreaks and reducing the impacts of emerging diseases.

The results also revealed important challenges related to the practical implementation of One Health. Institutional fragmentation, funding limitations, insufficient professional training, and difficulties in intersectoral coordination still represent obstacles to the consolidation of integrated strategies in different countries and health systems. In this context, it was found that strengthening governance, data sharing, and surveillance networks constitutes an essential measure for expanding the effectiveness of One Health actions.

Furthermore, it was observed that the integration of the concepts of Planetary Health, EcoHealth, and One Health broadens understanding of the consequences of human actions on ecosystems and on population health. This perspective reinforces the need to develop sustainable policies aimed at environmental preservation, the reduction of social inequalities, and the promotion of balance between society and nature.

Finally, future research is suggested to evaluate the effectiveness of public policies grounded in the One Health approach, especially in developing countries and socially vulnerable regions. Studies investigating the impacts of intersectoral strategies on zoonosis prevention, epidemiological surveillance, and the promotion of environmental sustainability may contribute to improving global health actions. In this way, the expansion of scientific knowledge on One Health may favor more efficient responses to contemporary health and environmental crises.

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CONTEMPORARY VACCINE HESITANCY IN THE FACE OF THE ADVANCE OF VACCINE-PREVENTABLE DISEASES: IMPACTS OF SCIENTIFIC MISINFORMATION, DIGITAL MEDIA, AND THE LOSS OF PUBLIC TRUST ON HERD IMMUNITY AND GLOBAL HEALTH

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Abstract

Contemporary vaccine hesitancy has become a major challenge for global public health, particularly in light of the resurgence of vaccine-preventable diseases that were previously under control. This study aimed to analyze the impacts of scientific misinformation, the influence of digital media, and the decline in public trust on vaccine adherence and its consequences for herd immunity and global health. The methodology consisted of a narrative literature review based on studies by recognized authors in the fields

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of immunization, health communication, and social behavior, published in national and international scientific databases. The results demonstrated that the rapid spread of false information through digital environments, combined with anti-vaccine content and limited scientific literacy, significantly contributes to increasing vaccine insecurity. Furthermore, sociocultural, political, and institutional factors influence risk perception and public trust in immunization programs. It is concluded that vaccine hesitancy is a multifactorial phenomenon that compromises vaccination coverage, promotes the reemergence of vaccine-preventable diseases, and threatens collective protection. Integrated strategies based on health education, accessible scientific communication, and strengthening social trust are essential for preserving global public health.

Keywords: Herd immunity, Digital media, Scientific misinformation, Vaccine hesitancy, Vaccine-preventable diseases.

INTRODUCTION

Vaccination is recognized as one of the most effective public health interventions, being responsible for the significant reduction of morbidity and mortality related to infectious diseases and for the eradication or control of several illnesses throughout history. Large-scale immunization programs have enabled substantial advances in the life expectancy and quality of life of populations, consolidating vaccines as fundamental tools for individual and collective protection. However, in recent decades, there has been an increase in a complex phenomenon known as vaccine hesitancy, characterized by delay in or refusal of vaccination even when services are available (Macdonald, 2015).

Contemporary vaccine hesitancy has become a highly relevant public health problem due to the increased circulation of false information, the rapid dissemination of content lacking scientific basis in digital environments, and the weakening of social trust in scientific and governmental institutions. The expansion of social networks has broadened access to information, but it has also favored the spread of misleading content that influences perceptions, beliefs, and behaviors related to vaccination. According to the World Health Organization, vaccine hesitancy was included among the main threats to global health because of its potential impact on vaccination coverage and the reemergence of previously controlled diseases (WHO, 2019).

In this context, the following research problem is defined: in what way does scientific misinformation, associated with digital media and the loss of public trust, influence contemporary vaccine hesitancy and contribute to the advance of vaccine-preventable diseases and the weakening of herd immunity?

The general objective of this study is to analyze the impacts of scientific misinformation, digital media, and the loss of public trust on contemporary vaccine hesitancy and its repercussions for herd immunity and global health. As specific objectives, the study seeks to understand the factors associated with the increase in vaccine hesitancy; investigate the influence of digital platforms on the spread of disinformative content; identify the impacts of reduced vaccination coverage; and discuss strategies to strengthen social trust and promote adherence to vaccines.

The relevance of this study is justified by the growing reduction in vaccination coverage rates observed in several countries, including Brazil, associated with the reemergence of vaccine-preventable diseases such as measles and pertussis. Studies indicate that maintaining high vaccination coverage is essential for preserving herd immunity and protecting more vulnerable individuals (Fine; Eames; Heymann, 2011). In this sense, understanding the determinants of vaccine hesitancy is indispensable for supporting more effective public policies and educational strategies.

From a theoretical perspective, vaccine hesitancy is understood as a multifactorial phenomenon influenced by factors related to trust, convenience, and risk perception, known as the “3Cs” model — confidence, complacency, and convenience (Macdonald, 2015). In addition, authors such as Larson et al. (2014) emphasize that public confidence in vaccines is strongly influenced by cultural, political, and communicational aspects. At the same time, the phenomenon of the “infodemic,” characterized by an excess of information, including incorrect or false content, has become a contemporary challenge for public health, making it difficult to identify reliable scientific evidence and contributing to the expansion of vaccine insecurity (Zarocostas, 2020).

Thus, discussing vaccine hesitancy in the current scenario of intense circulation of digital information is essential for understanding the impacts of misinformation on collective health and for strengthening strategies aimed at promoting trust in science and in immunization programs.

METHODOLOGY

RESEARCH DESIGN

The present study is characterized as research with a qualitative approach, descriptive and exploratory in nature, developed through a narrative review of the scientific literature. This type of methodology enables a broader understanding of complex and multifactorial phenomena, allowing the integration of knowledge produced in different contexts and theoretical perspectives. According to Gil (2019), exploratory research aims to provide greater familiarity with a given problem, contributing to its understanding and analytical deepening. The choice of a narrative review is justified by the need to analyze contemporary vaccine hesitancy across different dimensions — scientific, social, cultural, and communicational — considering the complexity of the interactions among misinformation, digital media, public trust, and collective health.

Procedures for searching and selecting studies

Data collection was carried out through a bibliographic survey in national and international scientific databases widely recognized in the health field, including the Scientific Electronic Library Online (SciELO), Latin American and Caribbean Literature in Health Sciences (LILACS), PubMed, and the Virtual Health Library (VHL). Descriptors indexed in the Health Sciences Descriptors (DeCS) and in Medical Subject Headings (MeSH) were used, combined through the Boolean operators AND and OR.

The main terms used were: "vaccine hesitancy," "scientific misinformation," "digital media," "immunization," "vaccination," "herd immunity," and "global health," in addition to their corresponding versions in Portuguese: "hesitação vacinal," "desinformação científica," "mídias digitais," "imunização," "imunidade coletiva," and "saúde global." As inclusion criteria, scientific articles, institutional documents, systematic reviews, and studies published in Portuguese, English, and Spanish were selected, provided they were fully available and related to the proposed topic. Publications from the last ten years were preferably included, as well as classic studies considered fundamental to the theoretical discussion of the topic. As exclusion criteria, duplicate studies, publications without direct relevance to the object of study, and materials lacking scientific support were eliminated.

ANALYSIS TECHNIQUES AND INSTRUMENTS

The instrument used to obtain information was a bibliographic analysis protocol containing: identification of the authors, year of publication, study objective, methodology applied, main results, and contributions to the understanding of vaccine hesitancy.

Subsequently, an exploratory, selective, and analytical reading of the collected material was carried out. According to Marconi and Lakatos (2021), bibliographic analysis makes it possible to critically examine different perspectives on a given phenomenon, promoting the systematization of existing scientific knowledge. The data obtained were organized into thematic categories, including: factors associated with vaccine hesitancy; influence of digital media; scientific misinformation; impacts on herd immunity; and repercussions for global health.

METHODOLOGICAL FOUNDATION AND DISCUSSION

The choice of a qualitative approach is grounded in the need to understand subjective and sociocultural elements that interfere with decision-making related to vaccination. According to Minayo

(2014), qualitative research works with meanings, values, beliefs, and interpretations present in social relations, being particularly relevant to studies in collective health.

The literature demonstrates that vaccine hesitancy cannot be explained exclusively by biomedical factors, since it involves behavioral, political, and communicational aspects. MacDonald (2015) emphasizes that confidence in vaccines constitutes one of the main determinants of vaccine adherence, while Larson et al. (2014) show that cultural factors and the circulation of information directly influence public perception regarding the safety and efficacy of vaccines. In addition, the growth of digital platforms has transformed the way the population accesses health-related content. According to Zarocostas (2020), the so-called “infodemic” has intensified the spread of false information, making it more difficult to identify reliable scientific evidence. Thus, the methodology adopted enables a critical and comprehensive analysis of the factors involved in contemporary vaccine hesitancy, favoring the understanding of current challenges for global public health.

RESULTS AND DISCUSSION

The analysis of the literature showed that contemporary vaccine hesitancy constitutes a complex, multifactorial phenomenon strongly influenced by sociocultural, political, and communicational factors. The studies reviewed demonstrated that the reduction of trust in health institutions, the circulation of false information, and the growth of digital media have significantly modified the population’s relationship with immunization programs. Unlike previous periods, when low vaccine adherence was often associated with limited access to health services, it is currently observed that part of the resistance to vaccination is related to subjective risk perception and the credibility attributed to information sources.

According to MacDonald (2015), vaccine hesitancy is not limited to the simple refusal of vaccines, but includes delays, doubts, and intermediate behaviors influenced by diverse factors. The “3Cs” model — confidence, complacency, and convenience — has become an international reference for understanding the determinants of vaccine adherence. Confidence refers to credibility in vaccines and in the institutions responsible for them; complacency relates to a low perception of disease risks; and convenience is associated with the accessibility of services.

In this context, it was found that the “confidence” component has shown significant weaknesses in the contemporary scenario marked by the intense circulation of digital information. Studies indicate that the growth of anti-vaccine content and the spread of fake news increase uncertainty and contribute to decisions based on personal perceptions to the detriment of scientific evidence (Larson et al., 2014).

Table 1

Main factors associated with vaccine hesitancy identified in the literature

Identified factors	Description	Possible impacts
Scientific misinformation	Dissemination of false content or content without scientific evidence	Reduction of trust and increase in insecurity
Digital media	Accelerated sharing of information and fake news	Expansion of anti-vaccine discourses
Low risk perception	Belief that vaccine-preventable diseases have been eradicated	Decrease in vaccine adherence
Sociocultural aspects	Religious, political, and cultural influences	Resistance to vaccination
Reduced institutional trust	Discredit toward governments and health systems	Decline in vaccination coverage

Source: Prepared by the author (2026).

The findings demonstrated that scientific misinformation stands out as one of the most relevant factors in strengthening vaccine hesitancy. The expansion of digital platforms has promoted greater democratization of access to information; however, at the same time, it has facilitated the circulation of content without scientific validation. In recent years, social networks have come to play a central role in shaping opinions related to health.

According to Zarocostas (2020), the phenomenon known as the “infodemic” corresponds to the excess of available information, including incorrect, contradictory, or false content, making it difficult to identify reliable evidence. During health crises, such as the COVID-19 pandemic, this process became even more evident, producing significant impacts on public perception of vaccine safety.

In addition, studies show that false information has greater potential for dissemination in digital environments due to its emotional appeal, sensationalism, and ability to generate engagement. Consequently, individuals repeatedly exposed to disinformative content may develop greater mistrust of vaccines and scientific institutions.

Table 2

Main impacts of misinformation on vaccination

Aspects analyzed	Observed consequences
Circulation of fake news	Dissemination of fear and insecurity
Anti-vaccine content	Reduction of vaccination intention
Pseudoscientific information	Confusion between evidence and opinions
Excess of information	Difficulty identifying reliable sources
Digital polarization	Reinforcement of resistant beliefs and behaviors

Source: Prepared by the author (2026).

Another aspect observed concerns the relationship between reduced vaccination coverage and the reemergence of vaccine-preventable diseases. Studies show that high vaccination rates are fundamental for maintaining herd immunity, a mechanism responsible for the indirect protection of unvaccinated or more vulnerable individuals (Fine; Eames; Heymann, 2011).

When vaccination coverage decreases, population groups become susceptible to the circulation of previously controlled infectious agents. This situation has been observed in different countries, including Brazil, especially in recent episodes involving an increase in measles cases.

Table 3

Relationship between declining vaccination coverage and public health consequences

Observed situation	Consequence for collective health
Reduction in vaccination coverage	Weakening of herd immunity
Increase in vaccine hesitancy	Greater number of susceptible individuals
Return of vaccine-preventable diseases	Growth of epidemiological outbreaks
Reduction of social trust	Difficulty in future campaigns
Circulation of misinformation	Compromise of preventive actions

Source: Prepared by the author (2026).

The analysis also revealed that public trust represents a central element in vaccine acceptance. Larson et al. (2014) argue that trust is built through historical, cultural, and institutional factors and is directly influenced by the relationship among society, science, and public policies. When this relationship weakens, there is an increase in doubts related to the safety, efficacy, and necessity of vaccination.

Another relevant factor refers to the change in the epidemiological profile of vaccine-preventable diseases. The historical success of immunization programs significantly reduced the incidence of several diseases, leading part of the population to underestimate their risks. This phenomenon is described by MacDonald (2015) as vaccine complacency, a situation in which reduced perception of disease severity decreases motivation for vaccine adherence.

The discussion of the results makes it possible to understand that vaccine hesitancy goes beyond exclusively biomedical factors. Psychological, social, technological, and political aspects act in an integrated manner, requiring equally multidimensional responses. Strategies centered only on making vaccines available prove insufficient in the face of the complexity of the problem.

Thus, the results analyzed suggest the need to strengthen scientific literacy, expand health communication policies, and develop digital strategies capable of combating misinformation. In addition, the reconstruction of social and institutional trust emerges as an indispensable element for preserving herd immunity and reducing risks associated with the advance of vaccine-preventable diseases.

CONCLUSION

The present research aimed to analyze the impacts of scientific misinformation, digital media, and the loss of public trust on contemporary vaccine hesitancy, as well as to understand its repercussions for herd immunity and global health. Specifically, it sought to identify the factors associated with the increase in vaccine hesitancy, investigate the influence of digital platforms on the dissemination of disinformative content, analyze the impacts of reduced vaccination coverage, and discuss strategies aimed at strengthening social trust in vaccination.

The results showed that vaccine hesitancy constitutes a multifactorial phenomenon, influenced by social, cultural, political, and communicational aspects. It was observed that the widespread dissemination of false information and pseudoscientific content in digital environments plays a significant role in the formation of mistaken perceptions regarding vaccine safety and efficacy. In addition, it was found that reduced trust in scientific and governmental institutions and in health systems represents a determining factor in the increase of vaccine insecurity.

The findings also demonstrated that declining vaccination coverage favors the weakening of herd immunity and increases the risk of reemergence of previously controlled vaccine-preventable diseases. The literature analyzed revealed that maintaining high vaccination rates is essential for individual and collective protection, especially among more vulnerable groups, such as children, older adults, and immunosuppressed individuals.

As a scientific contribution, this study enabled the integration of different theoretical perspectives related to vaccine hesitancy, offering a broader understanding of the mechanisms that influence the population’s decision-making regarding vaccination. The research reinforces the need for interdisciplinary approaches capable of articulating knowledge from public health, communication, education, and the social sciences in order to confront this contemporary challenge.

Furthermore, the results highlight the importance of strengthening public policies aimed at health education, the promotion of scientific literacy, and the development of more accessible and effective communication strategies. Investments in educational campaigns based on scientific evidence and adapted to new digital dynamics can contribute significantly to increasing public trust and vaccine adherence.

Finally, it is suggested that future research investigate the impact of social media algorithms on the spread of health misinformation, as well as the effectiveness of digital interventions in addressing vaccine hesitancy. The development of field studies and quantitative research is also recommended in order to analyze regional, cultural, and socioeconomic differences related to vaccination behavior, broadening the understanding of the determinants of this phenomenon and supporting more targeted strategies for the promotion of global health.

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POLYENDOCRINE METABOLIC OVARIAN SYNDROME (PMOS): A GLOBAL CONSENSUS PROCESS AND SCIENTIFIC REDEFINITION

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Abstract

The present study is characterized as a narrative literature review, of a descriptive, analytical, and interpretative nature, whose objective was to discuss and problematize the available scientific knowledge regarding the redefinition of Polycystic Ovary Syndrome (PCOS) into Polyendocrine Metabolic Ovarian Syndrome (PMOS). Considering the high global prevalence of the condition and its clinical, metabolic, reproductive, and psychosocial impacts, the study sought to understand how the change in nomenclature may contribute to greater diagnostic accuracy, reduction of stigma, and improvement of care practices. To this end, sources were selected from recognized scientific databases, including articles, systematic reviews, international guidelines, technical reports, and complementary documents, prioritizing studies published between 2022 and 2026. The analysis allowed the identification of recurring categories, such as diagnostic criteria, clinical and metabolic outcomes, therapeutic strategies, and social participation in the consensus process. Convergence was observed regarding the need for more inclusive criteria, while divergences emerged in therapeutic approaches, highlighting both the use of pharmacological agents and bariatric surgery. The discussion revealed practical implications for clinical practice and theoretical implications for research, emphasizing the importance of interdisciplinarity and the integration between science and society. It is concluded that the redefinition of PCOS to PMOS represents a significant advancement, but still requires multicenter studies, economic analyses in different contexts, and greater community involvement, establishing itself as a fertile field for future investigations and for the consolidation of a global scientific consensus.

Keywords: Scientific evidence, Pathophysiology, Clinical management, Quality of life, Women's health.

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INTRODUCTION

Polycystic Ovary Syndrome (PCOS), recently redefined as Polyendocrine Metabolic Ovarian Syndrome (PMOS), constitutes one of the most prevalent endocrine conditions among women of reproductive age, with an estimated impact on more than 170 million people worldwide (Endocrine Society, 2026). It is a multifactorial disorder that transcends the gynecological sphere, involving metabolic, cardiovascular, inflammatory, and psychosocial aspects (Joham; Teede, 2022; Su; Chen; Sun, 2025). The scientific and social relevance of the topic is evidenced both by its high global prevalence (Neven et al., 2026) and by its associated economic and public health burden (Riestenberg et al., 2022). In this context, the terminological and conceptual redefinition of the syndrome emerges as a scientific milestone, seeking greater diagnostic accuracy and improved patient-centered care (Teede et al., 2026; Norman; Morman; Teede, 2023).

The central problem motivating this review lies in the need to understand how the transition from the nomenclature PCOS to PMOS may contribute to improving diagnosis, clinical management, and the social perception of the condition. Recent studies indicate that the traditional terminology generates confusion, stigmatization, and limitations in clinical practice (Cohut, 2026; Teede et al., 2025). In addition, the heterogeneity of phenotypes, influenced by ethnic and environmental factors (Bizuneh et al., 2025), reinforces the urgency of more robust and inclusive diagnostic criteria, such as those discussed in systematic reviews on hirsutism (Bizuneh et al., 2025) and ultrasonography (Pea et al., 2024).

The importance of this research is justified by the need to integrate recent scientific evidence into a narrative and critical body of work capable of offering a comprehensive and interpretative view of the syndrome. The choice of a narrative and critical review methodology makes it possible not only to gather and synthesize studies published in high-impact journals (Joham et al., 2022; Goldberg et al., 2024; Tay et al., 2024), but also to analyze technical documents (Mousa; Tay; Teede, 2023), experience reports, and international guidelines (Teede et al., 2023; Peña et al., 2025). This approach favors the construction of a solid theoretical overview that articulates clinical, epidemiological, and social data, while also considering community participation and patient involvement in processes of scientific redefinition (Ng et al., 2025).

Recent advances in understanding the pathophysiology of the syndrome, including its association with adiposity at different stages of life (Dobbie et al., 2023), the impacts of bariatric surgery on ovulation and fertility (Li et al., 2025; Samarasinghe et al., 2024), and the genomic implications identified in multi-ancestry analyses (Zhao et al., 2025), reinforce the need for an integrated approach. Furthermore, the development of anti-obesity pharmacological therapies (Goldberg et al., 2024) and the updating of international recommendations (Teede et al., 2023) demonstrate the dynamic and interdisciplinary nature of research on PCOS/PMOS.

Given this scenario, the general objectives of this article are to investigate the scientific, clinical, and social impacts of redefining PCOS as PMOS, analyzing how this change may improve diagnostic accuracy, therapeutic applicability, and the global perception of the condition. The specific objectives are: (i) to map the historical and conceptual evolution of the syndrome; (ii) to compare traditional diagnostic criteria and new parameters; (iii) to analyze evidence on clinical and metabolic outcomes; (iv) to assess the economic and social impact; (v) to examine the participation of patients and scientific communities in the redefinition process; and (vi) to synthesize practical recommendations for clinical application and future research. Thus, the article seeks to offer a relevant contribution to the international scientific debate, grounded in a broad literature review and critical analysis of the available literature.

THEORETICAL FRAMEWORK

Polycystic Ovary Syndrome (PCOS), recently renamed Polyendocrine Metabolic Ovarian Syndrome (PMOS), is recognized as a complex condition involving multiple endocrine and metabolic systems. Traditionally, PCOS has been characterized by clinical criteria such as hyperandrogenism, menstrual irregularity, and the presence of ovarian cysts (Joham et al., 2022; Piltonen et al., 2026).

However, recent studies demonstrate that the syndrome transcends reproductive aspects, being associated with obesity, insulin resistance, chronic inflammation, and increased cardiovascular risk (Su; Chen; Sun, 2025; Tay et al., 2024). This conceptual expansion underpins the proposal for terminological redefinition, seeking greater scientific accuracy and improved patient-centered care (Teede et al., 2026; Endocrine Society, 2026).

The international literature presents significant contributions from researchers such as Teede, Joham, and Norman, who discuss PCOS as a metabolic condition with global impact (Joham; Teede, 2022; Norman; Morman; Teede, 2023). Systematic reviews and meta-analyses reinforce the association of the syndrome with adverse pregnancy outcomes (Bahri Khomami et al., 2024), adiposity at different stages of life (Dobbie et al., 2023), and global prevalence (Neven et al., 2026). In addition, Bizuneh et al. (2025) highlight the importance of ethnic variation in diagnostic criteria, while Pea et al. (2024) discuss the accuracy of ultrasonographic parameters. These studies converge on the need for updated international guidelines, such as those developed by Mousa; Tay; Teede (2023) and Teede et al. (2023), which consolidate evidence-based recommendations.

Diagnostic and therapeutic approaches vary across different theoretical perspectives. While some authors emphasize the relevance of hormonal and ultrasonographic criteria (Bizuneh et al., 2025; Pea et al., 2024), others advocate an expanded view that includes metabolic and cardiovascular factors (Tay et al., 2024; Joham et al., 2022). In the therapeutic field, there are divergences between the use of anti-obesity pharmacological agents (Goldberg et al., 2024) and the indication of bariatric surgery as a strategy for restoring ovulation (Li et al., 2025; Samarasinghe et al., 2024). This plurality of approaches highlights the complexity of the syndrome and the need for integration among different areas of knowledge.

Despite advances, relevant gaps persist. The traditional nomenclature still generates stigmatization and confusion among patients and health professionals (Cohut, 2026; Teede et al., 2025). The heterogeneity of phenotypes, influenced by genetic and environmental factors (Zhao et al., 2025), makes diagnostic standardization difficult. In addition, the economic impact of the syndrome, although already documented (Riestenberg et al., 2022), lacks comparative studies in different socioeconomic contexts. Another underexplored point concerns the active participation of patients and scientific communities in the redefinition process, a topic addressed by Ng et al. (2025), but still incipient on a global scale. These controversies reinforce the relevance of a critical and narrative review that integrates multiple perspectives.

METHODOLOGY

The present study is characterized as a narrative literature review, of a descriptive, analytical, and interpretative nature. The choice of this type of review is based on the need to gather, integrate, and problematize the available scientific knowledge regarding Polyendocrine Metabolic Ovarian Syndrome (PMOS), allowing for a broad and critical approach. This methodological strategy enables not only the systematization of the existing literature, but also the identification of gaps, controversies, and opportunities for scientific deepening, ensuring the relevance and applicability of the results.

The selection of sources followed explicit inclusion and exclusion criteria, ensuring transparency and reproducibility. Internationally recognized scientific databases were consulted, such as PubMed, Scopus, Web of Science, and Google Scholar, as well as institutional portals and technical documents from medical and scientific societies. The search included controlled and uncontrolled descriptors related to PCOS and PMOS, combined through Boolean operators (AND, OR, NOT, NEAR, and SAME), in order to ensure breadth and precision. The analyzed period was concentrated between 2022 and 2026, prioritizing recent and updated studies, without disregarding classic works of historical relevance for understanding the syndrome.

The types of documents included were diverse, encompassing scientific articles published in indexed journals, systematic reviews and meta-analyses, international guidelines, technical reports, dissertations, theses, book chapters, official documents from medical societies, as well as complementary materials such as news items, social media posts, videos, and experience reports. This breadth of sources allowed the construction of a comprehensive overview, encompassing both formal scientific production and social and institutional manifestations on the topic.

In the analysis stage, the studies underwent a process of screening and methodological evaluation, considering criteria of relevance, scientific consistency, and quality of evidence. Potential biases, methodological limitations, and the consistency of the results presented were examined. The analysis prioritized the identification of convergences and divergences among the studies, highlighting points of consensus, controversies, and areas that remain underexplored. This process enabled the construction of a critical and integrated view capable of reflecting the complexity of the syndrome and its multiple dimensions.

Finally, the synthesis of the information was developed in a structured and interpretative manner, articulating the different approaches found in the literature. The result consisted of a critical narrative that highlights practical implications, theoretical contributions, and directions for future research. Thus, the adopted methodology ensures not only the systematization of existing scientific production, but also the generation of reflections capable of supporting advances in clinical practice, the formulation of public policies, and the development of new studies on PMOS.

RESULTS AND DISCUSSION

RESULTS

The literature review conducted made it possible to identify a significant set of findings that demonstrate the complexity of Polyendocrine Metabolic Ovarian Syndrome (PMOS) and the need for its scientific redefinition. The studies analyzed indicate that the condition has a high worldwide prevalence, with significant regional and ethnic variations (Neven et al., 2026; Bizuneh et al., 2025). In addition, there is consensus that the syndrome is not restricted to the reproductive sphere, but involves multiple endocrine and metabolic systems, with cardiovascular, inflammatory, and psychosocial repercussions (Joham et al., 2022; Su; Chen; Sun, 2025; Tay et al., 2024).

In the diagnostic field, the results reveal divergences among clinical, hormonal, and ultrasonographic criteria. While Bizuneh et al. (2025) highlight the importance of accuracy in androgen measurement, Pea et al. (2024) discuss limitations and advances in ultrasonographic parameters. The heterogeneity of phenotypes, influenced by genetic and environmental factors (Zhao et al., 2025), reinforces the need for more inclusive criteria adapted to different populations. This discussion is expanded by Norman; Morman; Teede (2023), who problematize the inadequacy of the traditional nomenclature, pointing to the relevance of the proposed redefinition (Teede et al., 2026; Endocrine Society, 2026).

Regarding clinical and metabolic outcomes, the literature evidences the association of the syndrome with obesity, insulin resistance, and increased cardiovascular risk (Joham; Teede, 2022; Tay et al., 2024). Longitudinal studies and Mendelian randomization studies confirm the relationship between adiposity at different stages of life and a higher risk of developing the condition (Dobbie et al., 2023). In the reproductive sphere, Bahri Khomami et al. (2024) demonstrate negative impacts on pregnancy, while Piltonen et al. (2026) discuss the presence of ovarian cysts as a relevant clinical marker. These findings reinforce the need for an integrated approach that encompasses both metabolic and reproductive aspects.

With regard to therapeutic strategies, the results point to significant advances. The use of anti-obesity pharmacological agents appears promising in improving clinical parameters (Goldberg et al., 2024), while bariatric surgery has demonstrated a positive impact on the restoration of ovulation and fertility (Li et al., 2025; Samarasinghe et al., 2024). Updated international guidelines (Mousa; Tay; Teede, 2023; Teede et al., 2023; Peña et al., 2025) consolidate practical recommendations that integrate clinical evidence and patient perspectives, highlighting the importance of community participation in the redefinition process (Ng et al., 2025; Teede et al., 2025).

Finally, the results reveal relevant trends and patterns. There is a clear movement toward the conceptual and terminological redefinition of the syndrome, seeking greater diagnostic accuracy and reduction of social stigma (Cohut, 2026; Teede et al., 2026). There is also a growing effort to integrate different areas of knowledge—endocrinology, gynecology, cardiology, genetics, and public health—in order to understand the syndrome in its entirety. However, gaps persist regarding the economic impact in different contexts (Riestenberg et al., 2022) and the need for multicenter studies that assess the applicability of the new diagnostic criteria in diverse populations. These points reinforce the relevance of the present investigation and the contribution of the narrative review to scientific and clinical advancement concerning PMOS.

DISCUSSION

The critical interpretation of the results obtained shows that the proposed objectives were achieved, since it was possible to map the conceptual evolution of Polycystic Ovary Syndrome (PCOS) up to its redefinition as Polyendocrine Metabolic Ovarian Syndrome (PMOS). The reviewed literature demonstrates that the change in nomenclature is not merely semantic, but reflects an attempt to broaden the understanding of the condition by incorporating metabolic, endocrine, and psychosocial aspects (Teede et al., 2026; Endocrine Society, 2026). This redefinition directly aligns with the general objectives of the study, as it seeks greater diagnostic accuracy and reduction of social stigma, while also favoring integration among different areas of health care.

When comparing the findings with previous studies, convergence is observed regarding the need for more robust and inclusive diagnostic criteria. Systematic reviews on hirsutism and ultrasonography (Bizuneh et al., 2025; Pea et al., 2024) confirm the heterogeneity of phenotypes, while multi-ancestry genomic analyses (Zhao et al., 2025) reinforce the influence of genetic and environmental factors. On the other hand, there are divergences regarding therapeutic strategies: while Goldberg et al. (2024) highlight the potential of anti-obesity pharmacological agents, Li et al. (2025) and Samarasinghe et al. (2024) emphasize the benefits of bariatric surgery. This plurality of approaches reveals the complexity of the syndrome and the need for integrated strategies.

The practical and theoretical implications of the results are broad. From a clinical standpoint, the redefinition of PCOS as PMOS may contribute to more accurate diagnoses, reducing errors and expanding the applicability of international guidelines (Mousa; Tay; Teede, 2023; Teede et al., 2023). In the theoretical field, the change in nomenclature opens space for new lines of investigation, especially concerning the metabolic and cardiovascular impacts of the syndrome (Joham et al., 2022; Tay et al., 2024). In addition, the participation of patients and scientific communities in the redefinition process (Ng et al., 2025; Teede et al., 2025) represents a methodological advance, by incorporating social and cultural perspectives into the construction of scientific knowledge.

However, it is necessary to recognize the limitations of the narrative review. Despite its breadth and critical character, this type of methodology involves a certain degree of subjectivity in the selection and interpretation of sources, which may influence how the results are presented. The absence of systematic evaluation protocols, such as those used in systematic reviews and meta-analyses, may limit the reproducibility and generalization of the findings. In addition, although the review included a broad diversity of documents, gaps still persist regarding the economic impact in different contexts (Riestenberg et al., 2022) and the applicability of the new diagnostic criteria in specific populations.

Thus, the discussion shows that, although the redefinition of PCOS as PMOS represents a significant advancement, there are still challenges to be overcome. The integration of different scientific perspectives, together with the strengthening of social participation and the conduct of multicenter studies, constitutes a promising path toward consolidating international consensus and expanding the clinical applicability of the new nomenclature. In this way, the results interpreted here not only confirm the relevance of the redefinition, but also point to future directions for scientific and practical deepening regarding the syndrome.

CONCLUSION

The present narrative literature review made it possible to revisit the initially proposed objectives, synthesizing the main contributions of recent literature on Polyendocrine Metabolic Ovarian Syndrome (PMOS). The study showed that the redefinition of the former Polycystic Ovary Syndrome (PCOS) is not limited to a terminological change, but represents a scientific and clinical advancement by incorporating metabolic, endocrine, and psychosocial dimensions that broaden the understanding of the condition. Thus, it was possible to critically discuss diagnostic criteria, clinical outcomes, and therapeutic strategies, as well as to highlight the relevance of social and community participation in the international consensus process.

Among the main contributions, the identification of recurring patterns in the literature stands out, such as the association of the syndrome with obesity, insulin resistance, and cardiovascular risk, as well as negative impacts on fertility and pregnancy. The heterogeneity of phenotypes, influenced by genetic, environmental, and ethnic factors, was also evidenced, reinforcing the need for more inclusive diagnostic criteria adapted to different populations. Furthermore, therapeutic advances were discussed, such as the use of anti-obesity pharmacological agents and bariatric surgery, which demonstrate promising results in clinical and reproductive improvement.

The relevance of this study to the field lies in its capacity to integrate multiple scientific and social perspectives, offering a critical and comprehensive view of PMOS. By bringing together evidence from different fields—endocrinology, gynecology, cardiology, genetics, and public health—the review contributes to consolidating the understanding of the syndrome as a multifaceted condition that requires interdisciplinary approaches. In addition, by problematizing the traditional nomenclature and highlighting the importance of redefinition, the study reinforces the need to reduce stigma and expand the clinical applicability of international guidelines.

However, it is important to recognize that the narrative review presents limitations, especially due to the subjectivity involved in the selection and interpretation of sources. Although a structured and transparent protocol was adopted, the absence of systematic evaluation criteria may restrict the reproducibility of the results. Even so, the breadth of the analysis and the diversity of documents consulted confer robustness to the conclusions, allowing the construction of a critical and interpretative overview.

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SEPSIS, BIOFILM, AND CATHETER-RELATED INFECTIONS: CONTEMPORARY CHALLENGES IN THE INTENSIVE CARE UNIT

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Abstract

Sepsis remains one of the leading causes of morbidity and mortality in Intensive Care Units (ICUs), often associated with infections related to invasive devices, particularly central venous catheters. In this context, microbial biofilm formation represents an important clinical challenge due to its ability to protect microorganisms against antimicrobial agents and host defense mechanisms. This study aimed to analyze

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contemporary challenges related to sepsis, biofilm formation, and catheter-associated infections in critically ill patients admitted to ICUs. This is a narrative literature review conducted using scientific articles published in national and international databases, including PubMed, SciELO, and the Virtual Health Library (VHL), selecting studies relevant to the topic. The results demonstrated that biofilms are a determining factor in the persistence of infections, increased microbial resistance, and development of severe septic conditions. Furthermore, factors such as prolonged catheter use, failures in healthcare protocols, and inappropriate antimicrobial use contribute to worsening the problem. It was concluded that the rigorous implementation of preventive measures, combined with continuous professional education and infection control strategies, is essential to reduce complications and improve critically ill patient safety.

Keywords: Biofilm, Catheter-associated infections, Hospital infection, Intensive Care Unit, Sepsis.

INTRODUCTION

Sepsis is one of the main causes of morbidity and mortality in hospital settings, especially in Intensive Care Units (ICUs), where critically ill patients are more vulnerable to the development of severe infections. Characterized by a dysregulated host response to an infectious process, sepsis represents a major public health problem due to its high incidence, rapid clinical progression, and significant impact on mortality rates (Singer et al., 2016). In this scenario, the use of invasive devices, particularly central venous catheters, although essential for hemodynamic monitoring, medication administration, and therapeutic support, is frequently associated with an increased risk of healthcare-associated infections (Mermel, 2000).

Among the mechanisms that favor the development of these infections, the formation of microbial biofilms on catheter surfaces stands out. Biofilms consist of structured communities of microorganisms surrounded by an extracellular matrix produced by the infectious agents themselves, providing greater adhesion capacity, persistence, and resistance to antimicrobials. This phenomenon represents one of the greatest contemporary challenges in intensive care practice, since it hinders pathogen eradication, favors persistent infections, and may trigger severe septic conditions (Donlan; Costerton, 2002).

In this context, the following problem arises: how does biofilm formation on catheters contribute to the development of sepsis, and what are the main challenges faced by multidisciplinary teams in the prevention and control of these infections in patients admitted to ICUs? The complexity of this relationship highlights the need to deepen scientific discussions on the factors involved, considering the clinical and epidemiological impact of infections associated with invasive devices.

The general objective of this study is to analyze the contemporary challenges related to sepsis, biofilm formation, and catheter-associated infections in Intensive Care Units. Its specific objectives are to understand the mechanisms of biofilm formation on invasive devices; identify factors associated with the development of catheter-related infections; discuss the relationship between biofilms and the worsening of septic conditions; and analyze preventive strategies used in the hospital environment to reduce these complications.

The conduct of this study is justified by the clinical and scientific relevance of the topic, considering that catheter-associated infections represent an important cause of prolonged hospitalization, increased hospital costs, and higher mortality rates. In addition, the growth of microbial resistance and the complexity of therapeutic management make it necessary to expand knowledge that can support safer and more effective care practices.

The discussion of preventive measures and control strategies is also essential to strengthen patient safety and contribute to the quality of care provided in critical care units (Vincent et al., 2009).

In the theoretical field, different studies have discussed the relationship between biofilms and infections associated with medical devices. Hall-Stoodley, Costerton, and Stoodley (2004) emphasize that biofilms constitute an important microbial survival strategy, favoring resistance to host defense mechanisms and antimicrobial treatment. Donlan (2001) emphasizes that the surfaces of invasive devices represent favorable environments for bacterial adhesion and the development of persistent microbial communities. At the same time, Singer et al. (2016), based on the updated Sepsis-3 definitions, reinforce that sepsis results from a dysregulated organic response to infectious processes and may rapidly progress to severe dysfunctions and a high risk of death. In this sense, understanding the interaction among biofilms, catheters, and sepsis becomes fundamental for the development of more effective prevention and clinical management strategies.

METHODOLOGY

RESEARCH TYPE

The present study is characterized as qualitative, descriptive, and exploratory research, developed through a narrative literature review. This type of investigation enables the expansion of knowledge about a given phenomenon, allowing the critical and interpretive analysis of existing scientific production on the topic investigated. According to Gil (2019), bibliographic research is developed based on already published materials and constitutes an important instrument for theoretical understanding and deepening regarding different scientific problems.

The choice of a narrative review is justified by the possibility of integrating different perspectives and studies on sepsis, biofilms, and catheter-related infections, allowing a broad approach to the contemporary challenges present in Intensive Care Units. According to Lakatos and Marconi (2021), research of this nature favors the critical analysis and organization of knowledge produced in different scientific contexts.

METHODOLOGICAL PROCEDURES

The research was developed based on a bibliographic survey conducted in national and international databases widely used in the health field, including the Virtual Health Library (VHL), PubMed, Scientific Electronic Library Online (SciELO), and Latin American and Caribbean Literature in

Health Sciences (LILACS). The use of these databases allows access to relevant and scientifically recognized studies on the topic investigated.

For the search for articles, descriptors in Portuguese and English were used, combined with the Boolean operators “AND” and “OR,” aiming to increase the sensitivity of the search. The descriptors used included: “sepsis,” “biofilm,” “catheters,” “hospital infection,” “intensive care unit,” “sepsis,” “biofilm,” “catheter-related infections,” and “intensive care unit.”

According to Souza, Silva, and Carvalho (2010), the use of systematized strategies in bibliographic searches contributes to greater methodological rigor and better organization of the studies analyzed. Thus, the prior definition of descriptors and databases consulted contributed to ensuring greater reliability in the process of selecting scientific material.

Inclusion and exclusion criteria

Criteria were established for the selection of studies with the aim of ensuring greater scientific relevance and alignment with the proposed topic. As inclusion criteria, full articles available free of charge were selected, published in Portuguese, English, and Spanish between 2016 and 2026, considering studies related to sepsis, microbial biofilms, catheter-associated infections, and intensive care assistance.

Duplicate studies, simple abstracts, incomplete works, editorials, letters to the editor, dissertations, theses, and articles that did not have a direct relationship with the proposed topic were excluded.

The definition of clear eligibility criteria represents a fundamental step in scientific reviews, reducing biases and strengthening the quality of the results found (Galvão; Pereira, 2014).

INSTRUMENTS AND DATA ANALYSIS TECHNIQUE

After selecting the studies, an exploratory, selective, and analytical reading of the identified materials was performed. Subsequently, the data were organized in an instrument developed by the authors containing information regarding the study title, author, year of publication, objectives, methodology used, and main results found.

The analysis was conducted through a descriptive and interpretive approach, seeking to identify convergences, divergences, and central aspects discussed in the scientific literature regarding the relationship among biofilms, catheters, and sepsis in critically ill patients.

According to Minayo (2014), qualitative analysis makes it possible to understand the meanings, contexts, and interpretations of the phenomena studied, favoring an in-depth reading of the data produced.

GROUNDED DISCUSSION OF THE METHODOLOGY

The choice of a narrative review made it possible to broadly understand the factors associated with the development of sepsis related to invasive devices and the formation of microbial biofilms in intensive care settings. Studies indicate that patients admitted to ICUs are more susceptible to infections due to the frequent use of invasive devices and clinical severity, making the continuous investigation of preventive strategies essential (Vincent et al., 2009).

In addition, research developed by Donlan and Costerton (2002) demonstrates that biofilms present on medical devices favor infectious persistence and antimicrobial resistance, which reinforces the importance of scientific production aimed at understanding these mechanisms. In this sense, the methodology adopted made it possible to gather evidence capable of supporting critical reflections on the challenges faced by healthcare teams in the prevention and control of these complications in intensive care.

RESULTS AND DISCUSSION

The analysis of the literature showed that sepsis related to invasive devices remains an important cause of morbidity and mortality in patients admitted to Intensive Care Units (ICUs). Among the various factors involved, central venous catheter-related infections and the formation of microbial biofilms stand out, currently recognized as important mechanisms of infectious persistence and therapeutic resistance. The selected studies demonstrated that biofilm formation on the surfaces of medical devices favors bacterial adhesion, persistent colonization, and the protection of microorganisms against antimicrobial agents and the host's immune mechanisms (Donlan; Costerton, 2002).

The literature analyzed indicates that critically ill patients admitted to ICUs have a greater predisposition to the development of these infections due to the association of multiple factors, including immunosuppression, prolonged use of invasive devices, frequent performance of procedures, and the need for complex therapies. According to Vincent et al. (2009), the high prevalence of infections in critical care units is related to the clinical severity of patients and the intensive use of healthcare technologies.

To better organize the results found in the literature, Table 1 was prepared, containing a synthesis of relevant studies used in the construction of this chapter.

Table 1

Main studies related to sepsis, biofilms, and catheter-associated infections

Author/Year	Objective	Main results
Donlan and Costerton (2002)	To investigate mechanisms of biofilm formation	Demonstrated that biofilms increase antimicrobial resistance and infectious persistence
Hall-Stoodley, Costerton, and Stoodley (2004)	To analyze biofilms in infectious diseases	Showed that biofilms function as a microbial survival strategy
Mermel (2000)	To investigate catheter-associated infections	Identified factors related to increased risk of infection

Singer et al. (2016)	To update clinical definitions of sepsis	Defined sepsis as a dysregulated host response to infection
Vincent et al. (2009)	To assess the prevalence of infections in ICUs	Demonstrated the high incidence and clinical impact of infections in critically ill patients

Source: Prepared by the authors (2026).

The results demonstrate that biofilm formation represents one of the main factors responsible for the difficulty in treating catheter-related infections. Unlike bacteria in a planktonic state, microorganisms organized in biofilms present phenotypic changes that significantly reduce the effectiveness of antimicrobials. In addition, the extracellular matrix produced by the microorganisms themselves acts as a physical and chemical barrier, hindering the penetration of medications (Hall-Stoodley; Costerton; Stoodley, 2004).

Several pathogens frequently found in catheter-related infections have a high capacity for biofilm formation. Among the main microorganisms identified are *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Pseudomonas aeruginosa*, *Candida albicans*, and species of *Enterococcus*. These species have specific mechanisms of cellular adhesion and extracellular matrix production, favoring persistent colonization on artificial surfaces.

Table 2 presents the main microorganisms associated with biofilms on catheters and their clinical characteristics described in the literature.

Table 2

Main microorganisms associated with biofilm formation on catheters

Microorganism	Main characteristic	Clinical impact
Staphylococcus aureus	High adhesion to surfaces	Greater risk of severe sepsis
Staphylococcus epidermidis	Strong biofilm production	Persistent infections
Pseudomonas aeruginosa	High antimicrobial resistance	Greater therapeutic difficulty
Candida albicans	Formation of fungal biofilms	Invasive infections
Enterococcus spp.	High adaptive capacity	Clinical persistence

Source: Adapted from Donlan (2001); Hall-Stoodley et al. (2004).

The findings reinforce that catheter colonization occurs through different routes, including migration of microorganisms present on the patient's skin, contamination of the hospital environment, and inadequate handling of the device during care procedures. Mermel (2000) highlights that prolonged catheter dwell time constitutes an important risk factor for the development of healthcare-associated infections.

In addition, microbial resistance was found to represent a growing concern in intensive care environments. The inappropriate and indiscriminate use of antimicrobials contributes significantly to the selection of multidrug-resistant microorganisms, making treatments more difficult and increasing hospital costs. Recent studies demonstrate that biofilms can increase bacterial resistance by up to hundreds of times compared with free cells, making therapeutic protocols more complex (Donlan; Costerton, 2002).

Another aspect identified refers to the clinical consequences associated with sepsis resulting from catheter-related infections. Among the main outcomes found in the literature are increased length of hospital stay, prolonged need for mechanical ventilation, higher rates of organ failure, and increased mortality. Singer et al. (2016) emphasize that sepsis results from a dysregulated inflammatory response of the organism to infection and may rapidly progress to septic shock and multiple organ dysfunction. Based on the studies analyzed, it was observed that prevention remains the most effective strategy for reducing these complications. Institutional protocols known as prevention bundles include rigorous hand hygiene, aseptic technique during device insertion, daily assessment of the need for catheter maintenance, and early removal whenever possible. Such measures have a significant impact on reducing infection rates (Mermel, 2000).

In addition to conventional strategies, recent studies also discuss technological advances involving antimicrobial surfaces, catheters impregnated with antiseptic agents, and research related to the development of substances capable of interfering with biofilm formation. These resources show promising potential, although challenges remain regarding cost, safety, and large-scale clinical applicability.

Therefore, the results found show that the interaction among biofilms, catheters, and sepsis represents a complex and multifactorial phenomenon. Understanding these mechanisms is essential for the development of more effective preventive strategies, the reduction of infectious complications, and the strengthening of patient safety in critical care environments.

CONCLUSION

The present study aimed to analyze contemporary challenges related to sepsis, biofilm formation, and catheter-associated infections in patients admitted to Intensive Care Units, seeking to understand the mechanisms involved in biofilm formation, identify factors associated with the development of infections related to invasive devices, discuss their relationship with the worsening of septic conditions, and analyze preventive strategies used in the hospital environment. Based on the proposed objectives, it was possible to understand the complexity of this problem and its relevance to healthcare assistance.

The results showed that catheter-related infections remain among the main challenges faced in critical care units, especially due to the ability of microorganisms to form biofilms on the surfaces of invasive devices. The studies analyzed demonstrated that biofilms constitute important mechanisms of microbial survival, favoring antimicrobial resistance, infectious persistence, and therapeutic difficulty. This condition directly contributes to an increased risk of sepsis, clinical worsening of patients, prolonged hospital stay, and higher morbidity and mortality rates (Donlan; Costerton, 2002).

It was also observed that several factors contribute to the development of these complications, including prolonged catheter dwell time, failures in care protocols, inadequate handling of invasive devices, and indiscriminate use of antimicrobials. Such factors reinforce the need to adopt rigorous preventive measures, since patients admitted to ICUs present greater clinical and immunological vulnerability (Mermel, 2000).

The literature analyzed also demonstrated that preventive strategies, such as appropriate hand hygiene, use of aseptic techniques during catheter insertion and maintenance, implementation of institutional protocols, and ongoing training of multidisciplinary teams, have a significant impact on reducing healthcare-associated infections. In addition, scientific advances related to the development of antimicrobial technologies and new materials for invasive devices demonstrate promising potential in addressing this problem.

As a scientific contribution, this research expands discussions on the relationship among sepsis, biofilms, and catheter-related infections, gathering relevant evidence capable of supporting actions aimed at patient safety and the qualification of intensive care. The systematization of this information may assist professionals and researchers in understanding the factors involved and strengthening safer and more effective clinical practices.

Finally, it is suggested that future research should expand investigations into new technologies capable of preventing biofilm formation on medical devices, as well as clinical studies directed toward the development of innovative therapies for the prevention and treatment of these infections. Further research is also recommended on microbiological behavior in intensive care environments and on the impact of care protocols in reducing cases of catheter-associated sepsis. In this way, it is expected to contribute to scientific advances and the continuous improvement of care provided to critically ill patients.

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