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Pharmaceutical care for patients with leprosy: impact on treatment adherence and pharmacotherapy safety

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Systematic Review

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Abstract

Background

Leprosy (Hansen's disease) remains a major chronic infectious disease with substantial physical disabling potential and enduring social stigma. While multidrug therapy (MDT) is curative, its prolonged course and high frequency of adverse drug reactions severely challenge patient adherence, predisposing individuals to therapeutic failure, clinical relapses, and bacillary drug resistance.

Objective

To critically analyze, through an integrative literature review, the impact of pharmaceutical care on medication adherence and the promotion of pharmacotherapy safety among patients undergoing treatment for leprosy.

Methods

A comprehensive bibliographic search was conducted across SciELO, PubMed/MEDLINE, LILACS, and Google Scholar for studies published between January 1997 and August 2026, combining standardized DeCS/MeSH terms and Boolean operators in English, Portuguese, and Spanish. Following screening and eligibility assessment, seven peer-reviewed studies (original research and reviews) met all criteria and constituted the central analytical corpus.

Results

Adherence to MDT across healthcare services is frequently suboptimal, primarily driven by debilitating adverse drug events (such as hemolysis, methemoglobinemia, severe xerosis, and cutaneous hyperpigmentation), forgetfulness, treatment complexity, and socioeconomic vulnerability. Clinical pharmaceutical interventions—encompassing structured pharmacotherapeutic follow-up (Dáder Method), patient health education, and active pharmacovigilance—demonstrated unequivocal effectiveness. Clinical investigations reported a 100% acceptance rate for pharmaceutical interventions, culminating in the comprehensive resolution of drug-related problems (DRPs) and the effective management of drug toxicity, thereby preventing treatment abandonment.

Conclusion

Integrating pharmacists into primary care multidisciplinary teams strengthens the therapeutic alliance, substantially curtails treatment abandonment, and ensures safe completion of therapy through to microbiological and clinical cure.

1. Introduction

Leprosy remains one of the neglected tropical diseases of greatest epidemiological relevance and socioeconomic impact worldwide [1–3]. Caused by the obligate intracellular bacillus Mycobacterium leprae—and, to a lesser extent, Mycobacterium lepromatosis—the disease exhibits a chronic progression with pronounced cellular tropism for Schwann cells in the peripheral nervous system and cutaneous macrophages [3, 4]. Transmission primarily occurs through the sustained inhalation of oropharyngeal aerosol droplets expelled by untreated bacilliferous patients, particularly under conditions of prolonged domestic cohabitation and overcrowded living arrangements [2, 4]. When diagnostic and therapeutic interventions are delayed, the infection inexorably progresses to degenerative neuritis, muscle atrophy, loss of protective sensation, and irreversible physical deformities of the hands, feet, and face. These sequelae generate severe functional impairments and perpetuate long-standing historical processes of stigmatization and social exclusion [4, 5].

Globally, the World Health Organization (WHO) introduced the Global Leprosy Strategy 2021–2030 ('Towards zero leprosy'), advocating for the interruption of autochthonous transmission, the elimination of new pediatric cases presenting with grade 2 physical disabilities, and the eradication of institutional and community stigma [6, 7]. Despite notable progress over the past four decades, Brazil remains the country with the second-highest annual detection rate of new leprosy cases globally, accounting for more than 90% of the total disease burden in the Americas. Furthermore, hyperendemic clusters persist predominantly across the North, Northeast, and Center-West regions of the country [2, 7].

Clinically, the disease spans a broad immunopathological spectrum determined by the host's cell-mediated immune response, characterized under the Ridley-Jopling classification into indeterminate, tuberculoid, borderline (dimorphous), and lepromatous forms [8]. For operational public health purposes, the Brazilian Ministry of Health and the WHO categorize patients into paucibacillary (PB) or multibacillary (MB) groups based on skin lesion counts, slit-skin smear bacilloscopy findings, and peripheral nerve trunk involvement [2, 6]. Standard curative management relies on multidrug therapy (MDT), provided free of charge through Brazil's Unified Health System (Sistema Único de Saúde – SUS) [2]. Standard MDT synergistically combines three antimicrobial agents with complementary pharmacodynamics: rifampicin (a potent bactericidal agent that inhibits bacterial DNA-dependent RNA polymerase), dapsone (a bacteriostatic competitive inhibitor of dihydropteroate synthase within the folic acid synthesis pathway), and clofazimine (a riminophenazine dye displaying antimycobacterial efficacy alongside potent tissue anti-inflammatory properties) [2, 9, 10].

According to the Clinical Protocol and Therapeutic Guidelines (PCDT) for Leprosy established by the Brazilian Ministry of Health, therapy is structured into six supervised monthly doses within up to nine months for PB cases, and 12 supervised monthly doses combined with daily self-administered doses within up to 18 months for MB cases [2, 9]. Although the microbiological efficacy of MDT in eradicating viable bacilli is undisputed, the regimen's complexity and prolonged duration frequently precipitate severe adverse drug reactions [11, 12]. The most widely documented adverse events include hemolytic

anemia and methemoglobinemia triggered by dapsone-induced oxidative stress; jaundice and hepatotoxicity associated with rifampicin; and severe cutaneous xerosis together with reddish to dark-brown skin hyperpigmentation resulting from clofazimine accumulation in lipid-rich tissues and the reticuloendothelial system. These dermatological alterations profoundly impair body image and cause substantial psychological distress [11–13]. In parallel, the clinical course may be punctuated by systemic immune-mediated hypersensitivity phenomena—specifically type 1 (reversal) and type 2 (erythema nodosum leprosum) leprosy reactions—requiring aggressive adjuvant immunosuppressive therapy with high-dose systemic corticosteroids or thalidomide, thereby amplifying overall pharmacological vulnerability [2, 11].

Within this context of chronic duration and marked toxicity, sustaining medication adherence represents the critical crux of clinical management [1, 14]. As defined by the WHO in the seminal report by Sabaté [15] and corroborated by Osterberg and Blaschke [16], adherence to long-term therapies reflects a multidimensional behavioral phenomenon shaped by the interplay of patient-related, disease-related, therapy-related, socioeconomic, and healthcare system-related factors. Non-adherence must not be viewed through a punitive lens of patient culpability, but rather as a relational breakdown within the therapeutic alliance and an incongruence between patient behavior and agreed treatment regimens [17, 18]. Premature treatment discontinuation or irregular medication intake halts tissue sterilization, dramatically escalates the risk of late clinical relapses, and drives the selection and dissemination of drug-resistant M. leprae mutant strains against dapsone and rifampicin, posing a severe public health hazard [2, 14].

Given these complexities, Pharmaceutical Care emerges as an indispensable clinical discipline within Primary Health Care. Originally conceptualized by Hepler and Strand [19] and operationalized by Cipolle, Strand, and Morley [20], pharmaceutical care is defined as the responsible provision of drug therapy to achieve definite therapeutic outcomes that improve a patient's quality of life. Regulated in Brazil by the Federal Council of Pharmacy through Resolution CFF No. 747/2023 for the management of neglected tropical diseases [21], this patient-centered practice encompasses essential clinical services, including pharmacotherapeutic follow-up, medication reconciliation, health education, dosage regimen review, and active pharmacovigilance [21, 22]. The pharmacist's clinical involvement enables early detection of Drug-Related Problems (DRPs), proactive prevention of adverse events, mitigation of drug–drug and drug–nutrient interactions, and resolution of patient concerns, transforming routine drug dispensing into a dedicated opportunity for health education and adherence promotion [22–24].

Despite its demonstrated relevance, national and international literature still reports fragmentation and implementation barriers regarding the integration of pharmacists into the continuum of care for people affected by leprosy. It is therefore crucial to systematically map and synthesize empirical evidence regarding the impact of clinical pharmacy services in addressing treatment absenteeism and therapy discontinuation. Accordingly, this study aimed to critically analyze, based on available scientific literature, the influence of pharmaceutical care on medication adherence and the promotion of pharmacotherapy safety in leprosy.

2. Methods

2.1 Study Design and Conceptual Framework

An integrative literature review was conducted with a descriptive nature and qualitative analytical approach. The integrative methodology was selected because it enables the convergence of diverse empirical designs, including observational studies, scoping reviews, and clinical trials. This synthesis facilitates a comprehensive epistemological evaluation of clinical pharmaceutical services directed toward individuals affected by leprosy across Primary and Secondary Health Care settings.

2.2 Search Strategy and Information Sources

A comprehensive bibliographic search was executed across four indexed multidisciplinary databases: Scientific Electronic Library Online (SciELO), Medical Literature Analysis and Retrieval System Online (MEDLINE/PubMed), Latin American and Caribbean Health Sciences Literature (LILACS), and Google Scholar. The search window spanned publications indexed between January 1997 and August 2026. The search strategy combined controlled vocabularies from Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH), as well as specific natural-language keywords, linked using the Boolean operators 'AND' and 'OR' across English, Portuguese, and Spanish: 'Pharmaceutical Care' (Atenção Farmacêutica / Atención Farmacéutica), 'Leprosy' (Hanseníase / Lepra), 'Medication Therapy Management' (Acompanhamento Farmacoterapêutico / Seguimiento Farmacoterapéutico), 'Medication Adherence' (Adesão ao Tratamento / Cumplimiento de la Medicación), and 'Drug Therapy, Combination' (Poliquimioterapia).

2.3 Eligibility Criteria

Inclusion criteria were defined as: (a) original empirical research articles, systematic reviews, or scoping reviews published in full in peer-reviewed scientific journals; (b) studies available in open-access format; (c) publications written in English, Portuguese, or Spanish; and (d) studies addressing clinical pharmaceutical services, determinants of MDT adherence, adverse drug reaction management, or patient safety in leprosy. Exclusion criteria comprised: articles without full text available, editorials, letters to the editor, book reviews, duplicate records, conference abstracts, undergraduate course completion monographs, master's dissertations, and doctoral theses. This strategy ensured the inclusion of findings validated through independent academic peer review.

2.4 Selection Process and Data Extraction

Study selection proceeded in sequential stages. The primary search identified 6,040 bibliographic records (5,550 in Google Scholar and 490 in SciELO). Titles and abstracts were systematically screened to remove duplicates and thematically irrelevant citations, leaving 345 potentially eligible records for full-text review. After detailed textual assessment, seven scientific papers met all predefined eligibility criteria and constituted the central analytical corpus. The quantitative distribution of study identification and selection is detailed in Table 1.

Table 1
Quantitative synthesis of bibliographic search and document selection across consulted databases.

Database	Identified Studies	Articles After Screening	Selected Articles
Google Scholar	5,550	343	05
SciELO	490	02	02
Total	**6,040**	**345**	**07**

For standardized data extraction, a structured analytical instrument was developed covering: authors, year of publication, article title, journal, methodological design and study population, clinical pharmaceutical services or interventions evaluated, and primary clinical and operational outcomes concerning adherence and pharmacotherapy safety. Methodological frameworks for pharmacotherapeutic follow-up (Dáder Method) [25] and the Pharmaceutical Care Network Europe (PCNE) classification for Drug-Related Problems (DRPs) [26] served as the interpretative matrix for data synthesized in Table 2.

Table 2
Synthesis matrix and characterization of selected studies included in the review corpus.

Authors / Year	Journal	Study Design / Population	Pharmaceutical Interventions / Services	Primary Outcomes on Adherence and Pharmacotherapy
Silva (2015) [23]	Hansenol Int	Prospective clinical study; n = 25 patients in Primary Health Center (UBS)	Pharmacotherapeutic follow-up via Dáder Method, DRP identification, and dosage adjustment guidance.	100% of users presented active DRPs; 50 structured pharmaceutical interventions were successfully performed, resolving all complaints and achieving 100% adherence to MDT.
Guerra, Pontes & Randau (2022) [27]	Rev Ciênc Méd Biol	Descriptive cross-sectional study; n = 41 patients in a municipal polyclinic	Clinical pharmaceutical care, individualized consultations, and management of adverse reactions and complaints.	High patient satisfaction with pharmaceutical guidance; bureaucratic hurdles and periodic dispensing stockouts identified as major barriers to access.
Silva et al. (2023) [28]	J Assist Farm Farmacoecon	National scoping review in Brazil's Unified Health System (SUS)	Mapping pharmaceutical services: health education, pharmacotherapy review, and specialized clinical dispensing.	Demonstrated positive impact on health-related quality of life and substantial reduction in retreatment costs caused by therapeutic failure.
Coimbra & Nascimento (2025) [29]	Rev Amazônia Sci Health	Descriptive study of clinical care workflow	Integration of pharmacists into clinical workflows, supervision of monthly doses, and drug interaction screening.	Demonstrated the urgency of institutionalizing pharmaceutical consultations to strengthen the therapeutic alliance and suppress absenteeism.
Oliveira et al. (2021) [30]	Rev Baiana Saúde Pública	Descriptive cross-sectional study; n = 63 patients	Measurement of MDT adherence using validated scales and evaluation of conditioning factors.	Only 49.2% (n = 31) of patients were classified as strictly adherent, revealing severe pharmacotherapeutic vulnerability in the absence of continuous monitoring.

Authors / Year	Journal	Study Design / Population	Pharmaceutical Interventions / Services	Primary Outcomes on Adherence and Pharmacotherapy
Cruz & Franchi (2025) [31]	Rev Bras Enferm	Analytical cross-sectional study; n = 40 treatment default cases	Identification of causes and determinant factors of MDT abandonment.	Default rates ranged from 3.12% to 8.3%; lack of perceived early improvement, diagnostic divergence, and medication toxicity motivated treatment cessation.
Cavalcante, Larocca & Chaves (2020) [32]	Rev Esc Enferm USP	Exploratory mixed-methods study	Leprosy care management and organization of the secondary healthcare network.	Identified disarticulation in reference/counter-reference workflows, community social stigma, and institutional access barriers.

3. Results

The thematic categorization of the selected scientific literature enabled the synthesis of findings across four central operational and clinical axes: (a) the magnitude of low adherence and drivers of treatment default; (b) the prevalence of Drug-Related Problems (DRPs) and MDT toxicity profiles; (c) documented clinical pharmaceutical interventions and services; and (d) healthcare workflow organization and interprofessional collaboration.

3.1 Magnitude of Suboptimal Adherence and Drivers of Treatment Default

Epidemiological findings documented marked vulnerability regarding medication compliance and care continuity. In the cross-sectional study by Oliveira et al. [30], conducted in Bahia State among 63 individuals undergoing MDT, more than half of the sample (50.8%) exhibited low therapeutic adherence, with only 49.2% (n = 31) categorized as strictly adherent. The primary non-adherent behaviors involved intentional or inadvertent omissions of self-administered daily doses of dapsone and clofazimine, as well as recurrent delays in attending healthcare facilities for the monthly supervised dose of rifampicin.

Corroborating this critical panorama, Cruz and Franchi [31] analyzed the etiology of MDT abandonment in Palmas, Tocantins State, reporting annual default rates reaching 8.3%. Patients' self-reported justifications for stopping treatment centered on the lack of rapid visible regression of dermatological lesions following initial blister packs, distrust in the diagnosis stemming from conflicting prior medical opinions, and the onset of debilitating adverse effects that had not been adequately explained by the healthcare team prior to therapy initiation [31].

3.2 Prevalence of Drug-Related Problems (DRPs) and MDT Toxicity Profile

Regarding pharmacotherapy safety, the interventional clinical study conducted by Silva [23] in a Primary Health Center in São Paulo State with 25 leprosy patients revealed that 100% of participants experienced at least one active DRP during their therapeutic regimen. All enrolled patients faced operational difficulties regarding dosage schedules, timing of administration, and incompatibilities with dietary routines or pre-existing comorbidities.

The pharmacist performed 50 structured clinical interventions using the Dáder Method, averaging 2.0 interventions per patient [23]. Of these, 56% involved specific guidance on ingesting medications alongside lipid-rich meals—a strategy designed to optimize clofazimine bioavailability while minimizing dapsone-induced epigastric distress—whereas 44% encompassed non-pharmacological preventive measures, including photoprotection, intensive skin hydration, and physical limb protection to prevent trauma in anesthetic areas. The acceptance rate for pharmaceutical recommendations reached 100%, leading to the complete resolution of identified DRPs and verified treatment adherence across all 25 patients until discharge upon cure [23].

3.3 Documented Clinical Pharmaceutical Interventions and Patient Support

In secondary care, Guerra, Pontes, and Randau [27] evaluated 41 leprosy patients attending a municipal polyclinic in Recife, Pernambuco State. The most common complaints and adverse events reported included musculoskeletal pain and fatigue (frequently associated with leprosy reactions), limb numbness and paresthesia, diffuse skin hyperpigmentation, and fever. All patients who received clinical pharmaceutical consultations reported that personalized dosage instructions and therapeutic counseling were pivotal in sustaining motivation and mitigating drug toxicity.

However, 34% of respondents highlighted institutional access barriers within the dispensing process, such as periodic drug stockouts and administrative bureaucracy surrounding the distribution of MDT blister packs and adjuvant therapies (prednisone and thalidomide) [27].

3.4 Healthcare System Organization and Multiprofessional Coordination

At the macro-systemic level, the scoping review by Silva et al. [28] indicated that clinical pharmacy services within Brazil's SUS concentrate on health education for medication literacy, systematic pharmacotherapy review to screen for potential drug–drug interactions, specialized clinical dispensing, and longitudinal pharmacotherapeutic follow-up. The authors emphasized that qualified pharmaceutical care curbs public healthcare costs associated with hospitalizations, re-treatments, and the surgical management of secondary physical disabilities [28].

Furthermore, Coimbra and Nascimento [29] analyzed care workflows, noting that pharmaceutical practice must transcend logistical and administrative drug dispensing. The pharmacist must occupy a strategic clinical post during triage, actively supervising monthly doses and screening for interactions with antihypertensives, oral hypoglycemic agents, and psychotropics commonly prescribed to individuals with comorbidities [29]. Finally, Cavalcante, Larocca, and Chaves [32] demonstrated in Southern Brazil that treatment discontinuation is deeply intertwined with social inequities, community stigma, transportation deficits, and communication breakdowns between primary care clinics and specialized referral centers, reinforcing the imperative for integrated multiprofessional care.

4. Discussion

The convergence of evidence compiled in this integrative review reinforces the understanding that adherence to multidrug therapy in leprosy transcends mechanical compliance with a prescription; it represents an intricate biopsychosocial phenomenon [1, 15, 16]. Long-term therapeutic regimens involving complex polypharmacy and medications with narrow clinical comfort margins require continuous technical and humanized support to avert default and therapeutic failure [16, 30, 31].

4.1 Pharmacological Toxicity as a Catalyst for Treatment Default

The intrinsic pharmacological toxicity of MDT stands out as one of the most prominent catalysts for treatment default [11, 12]. Studies by Celestino et al. [11], Goulart et al. [12], and Mota et al. [13] confirm that adverse drug reactions affect the vast majority of patients undergoing therapy. Dapsone causes dose-dependent erythrocyte oxidative stress modulated by glucose-6-phosphate dehydrogenase (G6PD) activity, culminating in varying degrees of hemolytic anemia, asthenia, muscle weakness, and, in rare instances, fatal dapsone hypersensitivity syndrome (DRESS syndrome) [11, 12].

Clofazimine, due to its extreme lipophilicity and pharmacokinetic accumulation within subcutaneous adipose tissue and the reticuloendothelial system, produces generalized ichthyosis and prominent reddish-brown skin hyperpigmentation in up to 90% of patients, in addition to obstructive gastrointestinal symptoms at elevated doses [11, 13]. In a sociocultural context where leprosy already carries centuries of deep-seated stigma, dramatic changes in skin pigmentation expose patients to visible disfigurement and intense community scrutiny. This psychological burden frequently drives individuals toward social isolation and deliberate treatment abandonment [1, 13, 33].

4.2 Clinical Impact of Pharmaceutical Care and the Dáder Method

In this challenging setting, Pharmaceutical Care functions as a vital protective clinical buffer [19, 22]. By implementing structured pharmacotherapeutic follow-up—such as the established Dáder Method [23, 25]

—pharmacists forge a confidential, longitudinal bond of trust with the patient. Early identification of DRPs enables clinicians to resolve adverse symptoms before they trigger treatment abandonment [23].

As demonstrated empirically by Silva [23] and Guerra, Pontes, and Randau [27], simple, zero-cost clinical interventions—such as instructing patients to take clofazimine and dapsone with main meals, and demystifying the benign, reddish-orange discoloration of urine, sweat, and tears caused by rifampicin—effectively alleviate unfounded anxieties and prevent unnecessary therapy interruptions [23, 27].

4.3 International Evidence and Historical Benchmarks

The value of specialized clinical pharmacy services in leprosy is further supported by international historical benchmarks. Since the pioneering outpatient trials by Fischer, West, and Worobec [37] and Danziger et al. [38] evaluating dapsone compliance monitoring, direct pharmacist-led supervision has been shown to elevate medication compliance from baseline rates of 46% to sustained levels exceeding 80% and 94% over time. Similarly, Kannan et al. [39] demonstrated in India that active over-the-counter pharmacovigilance combined with visual educational aids significantly attenuated the severity of peripheral neuropathies and gastrointestinal complaints associated with MDT.

4.4 Management of Leprosy Reactions, Polypharmacy, and Thalidomide Safety

An additional complicating factor in leprosy management is the frequent occurrence of leprosy reactions (types 1 and 2), which necessitate aggressive adjuvant immunosuppressive therapy [2, 11]. Managing erythema nodosum leprosum with thalidomide and prednisone exposes patients to cumulative risks of axonal peripheral polyneuropathy, intense sedation, severe constipation, thromboembolic events, and catastrophic teratogenicity [2, 41].

Pharmacotherapeutic follow-up studies focusing on thalidomide, such as those by Vasconcelos et al. [41] and Ramos, Galete, and Polisel [40], demonstrate that clinical pharmacists identify numerous DRPs stemming from polypharmacy and harmful drug interactions (e.g., dapsone with rifampicin, or prednisone with nonsteroidal anti-inflammatory drugs). Pharmacists establish essential preventive protocols and enforce rigorous teratogenicity surveillance across primary and specialized care [41, 42].

4.5 Behavioral Dimensions and Neural Protection

Behavioral insights described by Leite and Vasconcellos [17] and Moraes, Rolim, and Costa Jr. [18] emphasize that adherence requires shared responsibility between the user and the care team. As highlighted by Cruz and Franchi [31], Rolim et al. [33], and Lira, Silva, and Gonçalves [34], initial symptomatic improvement during the first months of MDT frequently instills a deceptive perception of cure, encouraging premature default. Concurrently, as cautioned by Pinheiro et al. [35] and Nardi, Paschoal, and Zanetta [36], abrupt treatment cessation permits insidious, ongoing neurological damage to proceed unchecked, accelerating irreversible deformities.

Targeted health education delivered by pharmacists at each monthly dispensing encounter reinforces that the visual clearing of skin patches does not equate to the eradication of deep bacillary reservoirs within peripheral nerve fibers. This dialogic education fosters genuine awareness regarding the non-negotiable necessity of completing full therapeutic courses to achieve definitive bacteriological cure [2, 28, 35].

4.6 Multidisciplinary Primary Care and Regional Challenges in the Amazon

Finally, available literature underscores that Pharmaceutical Care achieves maximum effectiveness when seamlessly integrated into the multidisciplinary primary care network of the SUS [21, 22, 43]. Leprosy is historically concentrated in socially and geographically vulnerable territories—particularly within the Brazilian Amazon, as documented by Salgado et al. [45] and Santos et al. [44]—requiring rapid communication among physicians, nurses, pharmacists, and community health agents. Pharmaceutical consultations integrated into primary triage, supported by contemporary telehealth tools [46], ensure timely detection of severe adverse reactions and drug interactions, enabling immediate collaborative interventions that safeguard cure outcomes [21, 22, 29].

5. Conclusion

This integrative review demonstrates that non-adherence and treatment abandonment in leprosy constitute severe, multifaceted public health challenges, driven by multidrug therapy toxicity, visible aesthetic alterations, patient forgetfulness, and structural socioeconomic vulnerabilities.

Addressing the stated objective, the evidence concludes that Pharmaceutical Care exerts an indispensable, positive, and transformative influence on treatment adherence and pharmacotherapy safety in leprosy. Through structured clinical pharmacy services—including pharmacotherapeutic follow-up via the Dáder Method, early detection and resolution of Drug-Related Problems (DRPs), health education focused on medication literacy, and active pharmacovigilance—the pharmacist acts as a key mediator in mitigating pharmacological toxicity and consolidating the therapeutic alliance between patients and the healthcare system.

To permanently embed this potential within public health frameworks such as Brazil's Unified Health System (SUS), it is imperative to move beyond viewing pharmacies as passive logistical dispensaries. Pharmaceutical consultations should be formally protocolled as a mandatory clinical component of dermatoneurological monitoring and monthly supervised MDT administration. Large-scale clinical implementation studies are recommended across primary care networks to establish standardized pharmaceutical guidelines, directly supporting international targets for leprosy elimination.

Declarations

Ethics approval and consent to participate:

Not applicable. This manuscript is an integrative review of publicly available, previously published scientific literature and did not involve direct clinical experimentation, biological specimen collection, or direct interaction with human subjects or animal models by the authors.

Consent for publication:

Not applicable. The manuscript does not contain any individual person's identifiable personal data, clinical photographs, or institutional individual identifiers.

Competing interests:

The authors declare that they have no competing financial, personal, commercial, or academic interests related to the conception, execution, or publication of this work.

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Authors' contributions:

E.F.G.: Conceptualization, literature search, study selection, data extraction, formal analysis, and drafting the original manuscript. I.N.A.R.: Conceptualization, methodological validation, critical review, and editing of the manuscript. S.S.J.F.: Conceptualization, study design, methodology, project administration, supervision, critical review and editing, formal validation, and corresponding author responsibilities. All authors critically reviewed and approved the final manuscript for preprint submission.

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Availability of data and materials:

All data generated or analyzed during this study are fully integrated and synthesized within this published article (Tables 1 and 2) and its referenced primary sources. Additional extraction matrices are available from the corresponding author upon reasonable request.

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