The Review Of
DIABETIC
STUDIES OPEN ACCESS

Impact Of Polypharmacy On Oral And Dental Health In Geriatric Patients: A Pharmacological Perspective

Norah Mutiq Nasser Alshahrani[1], Meshari Mutiq Nasser Alshahrani[2], Arwa Abdulrahman Alabdulkader[3], Alanoud Meshari Almeshari[4], Refah Abdullah Alsubaie[5], Fahad Rashed Moqbil Alharbi[6], Khalid Mohammed Ahmad Manhi[7], Hassan Saad Rashid Seayed[8], Anwar Altaher Abdulaziz Bokhari[9], Ahmad Mohmad Saleh Albalwi[10], Alhayli Alhumaidi Alahil Albanaqi[11], Abdullah Musaad Mowaadh Aljohani[12]

[1]Dentist, Erqah Primary Health Care Center, Third Health Cluster, Riyadh, Saudi Arabia
[2]Dentist, Aljazirah Primary Health Care Center, Second Health Cluster, Riyadh, Saudi Arabia
[3]Dentist, Laban West Primary Health Center, Third Health Cluster, Riyadh, Saudi Arabia
[4]Endodontist, King Salman Hospital, First Health Cluster, Riyadh, Saudi Arabia
[5]Dentist, Erqah Health Center, Third Health Cluster, Saudi Arabia
[6]Pharmacy Technician, Ohud Hospital, Madinah Health Cluster, Saudi Arabia
[7]Pharmacy Technician, Ohud Hospital, Madinah Health Cluster, Saudi Arabia
[8]Laban West Primary Health Center, Third Health Cluster, Riyadh, Saudi Arabia
[9]Pharmacy Technician, Ohud Hospital, Madinah Health Cluster, Saudi Arabia
[10]Pharmacy Technician, Kharba Health Center, Tabuk Health Cluster, Saudi Arabia
[11]Pharmacy Technician, Al-Owaiqila General Hospital, Northern Borders Health Cluster, Al-Owaiqila, Saudi Arabia
[12]Dental Assistant, Khorba Primary Health Care Center, Tabuk Health Cluster, Saudi Arabia

Abstract

Background: Polypharmacy is increasingly prevalent among geriatric populations due to the coexistence of multiple chronic diseases. While its systemic consequences are well documented, the impact of polypharmacy on oral and dental health remains underrecognized in clinical practice. Many commonly prescribed medications in older adults exert adverse effects on salivary flow, oral mucosa, periodontal tissues, and bone metabolism, thereby increasing the risk of oral disease and complicating dental management.

Objective: This review aims to critically examine the impact of polypharmacy on oral and dental health in geriatric patients from a pharmacological perspective, emphasizing clinically relevant drug-induced oral conditions and the need for interdisciplinary collaboration between pharmacists and dental professionals.

Methods: A narrative literature review was conducted using major electronic databases, including PubMed, Scopus, and Web of Science. Relevant studies addressing polypharmacy, drug-induced oral adverse effects, and geriatric dental health were identified, analyzed, and synthesized to provide an integrated overview of pharmacological mechanisms and clinical implications.

Results: Evidence indicates that polypharmacy contributes significantly to xerostomia, dental caries, periodontal disease, oral mucosal lesions, and medication-related osteonecrosis of the jaw. Drug classes frequently implicated include antihypertensives, antidepressants, anticholinergics, antidiabetic agents, and antiresorptive therapies. These adverse effects compromise oral function, nutrition, and quality of life, while also increasing the complexity of dental treatment planning.

Conclusion: Polypharmacy represents a major yet modifiable risk factor for poor oral and dental health in geriatric patients. Integrating pharmacological assessment into dental care and fostering pharmacist–dentist collaboration are essential to improve clinical outcomes and support healthy aging.

Keywords: Polypharmacy; Geriatric patients; Oral health; Dental care; Pharmacology; Interprofessional collaboration.

1. Introduction

1.1 Aging Population and the Burden of Polypharmacy

The global population is aging at an unprecedented rate, leading to significant challenges for healthcare systems worldwide. According to the World Health Organization, the proportion of individuals aged 60 years and older is expected to double by 2050, with the greatest growth occurring in low- and middle-income countries (World Health Organization [WHO], 2023). Aging is commonly associated with multimorbidity, defined as the coexistence of two or more chronic medical conditions, such as cardiovascular disease, diabetes mellitus, neurodegenerative disorders, and osteoporosis. As a result, older adults are frequently exposed to complex medication regimens, a phenomenon known as polypharmacy.

Polypharmacy is most defined as the concurrent use of five or more medications, although definitions vary across studies and clinical settings (Masnoon et al., 2017). Excessive polypharmacy, often described as the use of ten or more medications, is particularly prevalent among frail elderly populations and residents of long-term care facilities. While pharmacotherapy remains essential for disease control and symptom management, polypharmacy is associated with numerous adverse outcomes, including drug–drug interactions, medication non-adherence, falls, cognitive impairment, hospitalization, and mortality (Maher et al., 2014).

Despite growing awareness of these systemic consequences, the oral and dental implications of polypharmacy remain insufficiently addressed. Oral health is a critical component of overall health, especially in geriatric patients, yet it is often overlooked in pharmacological risk assessments. Medications can profoundly influence oral tissues through direct pharmacodynamic effects, alterations in salivary secretion, immune modulation, and changes in bone metabolism, thereby increasing vulnerability to oral disease.

1.2 Oral and Dental Health in Geriatric Patients

Oral and dental health plays a vital role in maintaining nutrition, communication, social interaction, and quality of life in older adults. Common oral health problems in geriatric populations include dental caries, periodontal disease, tooth loss, xerostomia, oral infections, and mucosal disorders (Petersen & Yamamoto, 2005). These conditions are not merely localized issues but are closely linked to systemic health outcomes, such as cardiovascular disease, diabetes control, aspiration pneumonia, and malnutrition.

Physiological aging alone does not inevitably lead to poor oral health; rather, the cumulative effects of chronic disease, functional decline, and medication exposure are major contributors. Reduced manual dexterity, cognitive impairment, and limited access to dental care further exacerbate oral health deterioration in older adults. Importantly, saliva plays a protective role in oral homeostasis by buffering acids, facilitating remineralization, and controlling microbial growth. Any disruption to salivary flow, such as that caused by medication use, can have profound consequences for oral health.

Geriatric patients often prioritize medical care over dental care, and oral symptoms may be underreported or misattributed to aging rather than medication effects. This highlights the need for healthcare

professionals, including pharmacists and dentists, to recognize medication-induced oral adverse effects as preventable and manageable clinical entities.

1.3 Pharmacological Mechanisms Affecting Oral Health

From a pharmacological perspective, many drugs commonly prescribed to older adults exert anticholinergic, sympathomimetic, or cytotoxic effects that directly or indirectly compromise oral tissues. Xerostomia, one of the most frequently reported oral adverse drug reactions, is strongly associated with medications such as antidepressants, antipsychotics, antihypertensives, anticholinergics, and antihistamines (Scully, 2003). Reduced salivary flow not only causes discomfort but also predisposes patients to dental caries, periodontal disease, oral candidiasis, and difficulty wearing dentures.

In addition to salivary dysfunction, certain medications alter immune responses, increasing susceptibility to oral infections and delayed wound healing. Corticosteroids, immunosuppressants, and some antineoplastic agents are known to impair mucosal integrity and host defense mechanisms. Furthermore, long-term use of antiresorptive drugs, such as bisphosphonates and denosumab, has been linked to medication-related osteonecrosis of the jaw, a serious condition with significant implications for dental treatment planning (Ruggiero et al., 2014).

Polypharmacy amplifies these risks through additive or synergistic pharmacological effects. Drug–drug interactions may enhance anticholinergic burden or exacerbate adverse reactions, while complex regimens increase the likelihood of inappropriate prescribing. Consequently, oral health outcomes in geriatric patients cannot be adequately addressed without considering the cumulative pharmacological load.

1.4 Clinical Relevance for Dental Practice

For dental professionals, managing geriatric patients with polypharmacy presents unique challenges. Comprehensive medication history taking is essential to identify drugs that may influence oral health, bleeding risk, bone metabolism, and responses to dental materials or local anesthetics. Failure to recognize medication-related oral conditions may result in misdiagnosis, ineffective treatment, or preventable complications. Dental procedures themselves may be affected by pharmacotherapy. Anticoagulants and antiplatelet agents increase bleeding risk, while drug interactions with commonly prescribed dental antibiotics and analgesics can lead to adverse systemic effects. Therefore, understanding the pharmacological profile of geriatric patients is fundamental to safe and effective dental care.

1.5 Role of Pharmacists in Oral Health Promotion

Pharmacists are uniquely positioned to identify medication-related oral adverse effects and contribute to preventive oral healthcare. Through medication therapy management, pharmacists can assess anticholinergic burden, recommend alternative therapies, and support deprescribing initiatives aimed at minimizing harm. Collaboration with dental professionals allows for timely referral, shared decision-making, and optimization of both systemic and oral health outcomes. Despite this potential, pharmacist involvement in oral health remains limited in many healthcare systems. Integrating oral health considerations into pharmacological care models represents an important opportunity to improve geriatric healthcare delivery.

1.6 Rationale and Aim of the Review

Although previous studies have explored individual drug-related oral adverse effects, there is a lack of comprehensive reviews that synthesize the impact of polypharmacy on oral and dental health from a pharmacological perspective while addressing its implications for both pharmacy and dental practice. This gap limits the development of integrated care strategies for geriatric patients. Therefore, this review aims to critically evaluate existing literature on the impact of polypharmacy on oral and dental health in geriatric

patients, elucidate underlying pharmacological mechanisms, and highlight the importance of interdisciplinary collaboration between pharmacists and dental professionals to improve patient outcomes.

3. Methods

This narrative literature review was conducted to examine the impact of polypharmacy on oral and dental health in geriatric patients from a pharmacological and dental perspective. A comprehensive and structured literature search was performed across multiple electronic databases. Reference lists of selected articles were manually screened to identify additional relevant studies. Inclusion criteria encompassed original research articles, systematic and narrative reviews, clinical guidelines, and consensus statements that addressed medication use in older adults and its effects on oral or dental health. Studies focusing on individuals aged 60 years or older were prioritized, reflecting commonly accepted definitions of geriatric populations. Articles were included if they discussed pharmacological mechanisms, clinical oral manifestations, dental treatment considerations, or pharmacist- and dentist-led interventions related to medication use. Exclusion criteria included studies limited to pediatric or non-geriatric populations, case reports without broader clinical relevance, non-human studies, editorials without empirical or clinical content, and publications not available in full text. Data extraction focused on study characteristics, patient population, medication classes involved, reported oral and dental outcomes, underlying pharmacological mechanisms, and implications for clinical practice. Rather than performing quantitative synthesis, findings were narratively analyzed and thematically organized to allow integration of pharmacological and dental perspectives. This approach was chosen to accommodate the heterogeneity of study designs and outcome measures and to facilitate the development of a conceptual framework linking polypharmacy with oral and dental health outcomes in geriatric patients. Emphasis was placed on identifying recurring patterns, clinically relevant drug classes, and opportunities for interdisciplinary collaboration between pharmacists and dental professionals.

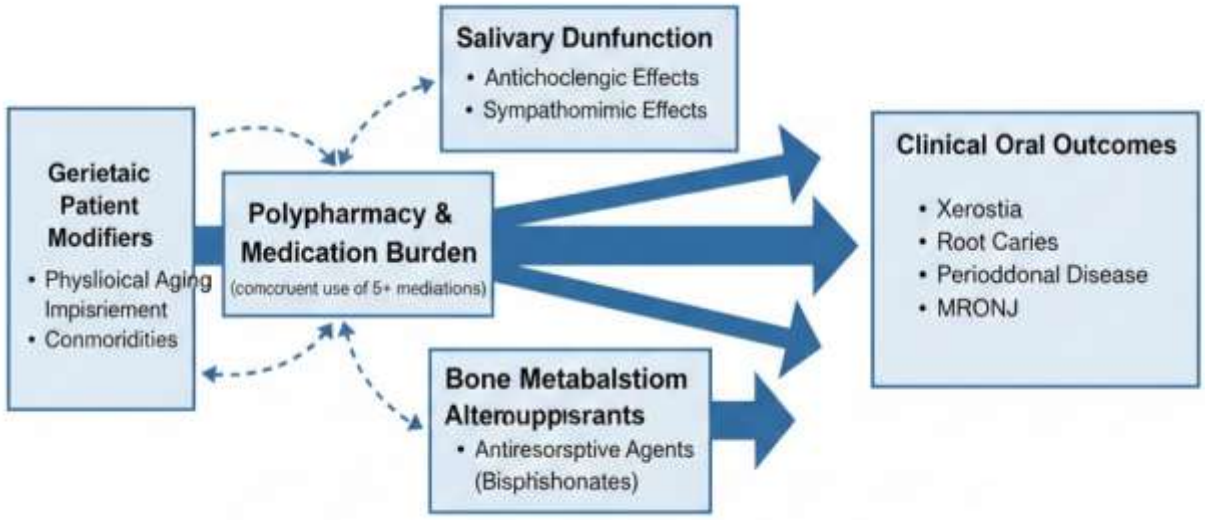
4. Pharmacologically Mediated Pathways Linking Polypharmacy to Oral and Dental Health in Geriatric Patients

Polypharmacy in geriatric patients represents a complex clinical phenomenon that extends beyond the simple accumulation of medications. Its impact on oral and dental health is mediated through multiple, interrelated biological, behavioral, and healthcare system factors. Existing literature often addresses individual drug-related oral adverse effects in isolation, without adequately capturing the cumulative and interactive nature of multiple medications or the roles of different healthcare professionals. To address this gap, a conceptual framework is proposed to illustrate the pathways through which polypharmacy influences oral and dental health outcomes and to highlight points of intervention for pharmacists and dental practitioners. This framework is grounded in pharmacological science, geriatric medicine, and dental clinical practice. It conceptualizes oral health deterioration in geriatric patients as the result of overlapping pharmacodynamic and pharmacokinetic mechanisms, patient-related vulnerabilities, and fragmented healthcare delivery. By integrating these domains, the framework provides a comprehensive model for understanding, preventing, and managing medication-related oral health problems. The proposed framework consists of five interconnected domains: (1) polypharmacy and medication burden, (2) pharmacological mechanisms affecting oral tissues, (3) geriatric patient modifiers, (4) oral and dental clinical outcomes, and (5) interprofessional intervention points. Each domain contributes independently and synergistically to oral health outcomes in older adults.

Figure 1. The Multi-Domain Conceptual Framework

4.2.1 Polypharmacy and Medication Burden

At the center of the framework is polypharmacy, defined as the concurrent use of multiple medications for chronic disease management. In geriatric patients, polypharmacy often arises from multimorbidity,



fragmented care, and guideline-driven prescribing that may not adequately account for cumulative drug burden. From a pharmacological standpoint, polypharmacy increases the likelihood of additive adverse effects, drug–drug interactions, and inappropriate prescribing, all of which can influence oral health.

Table 1. Common Drug Classes in Geriatrics and Their Oral Adverse Effects

Drug Class	Examples	Oral Adverse Effects	Pharmacological Mechanism	Clinical Implications for Dental Care
Antihypertensives	Beta-blockers, Diuretics, Calcium channel blockers (e.g., nifedipine)	Xerostomia, Gingival hyperplasia (CCBs), Altered taste	Reduced salivary flow, gingival fibroblast proliferation	Increased risk of caries and periodontal disease; challenges in plaque control due to gingival overgrowth

Psychotropics	Tricyclic antidepressants, SSRIs, Antipsychotics	Xerostomia, Dysgeusia, Oral candidiasis	Anticholinergic effects, immunosuppression	Increased caries risk, mucosal infections, impaired oral hygiene
Anticholinergics	Oxybutynin, Atropine, Antihistamines	Severe xerostomia, mucosal dryness, burning sensation	Inhibition of parasympathetic stimulation of salivary glands	Difficulty in denture wear, higher risk of mucosal trauma and infections
Antidiabetic agents	Insulin, Metformin, Sulfonylureas	Altered taste, increased risk of periodontal disease	Metabolic control affecting inflammation and healing	Need for stringent periodontal monitoring and glycemic control
Antiresorptive agents	Bisphosphonates, Denosumab	Medication-related osteonecrosis of the jaw (MRONJ)	Inhibition of bone remodeling and turnover	High risk during invasive dental procedures; requires multidisciplinary planning
Anticoagulants/Antiplatelets	Warfarin, DOACs (e.g., apixaban)	Increased bleeding risk during dental procedures	Impaired coagulation pathways	Careful surgical planning, potential modification of anticoagulant therapy

Medication burden is not solely determined by the number of drugs but also by their pharmacological properties, dosing regimens, duration of therapy, and anticholinergic load. Drugs commonly prescribed in older adults—including antihypertensives, antidepressants, antipsychotics, antidiabetic agents, and

antiresorptive therapies—are repeatedly implicated in oral adverse drug reactions. The framework emphasizes that oral health risks increase as medication burden intensifies, particularly when drugs with overlapping oral adverse effect profiles are combined.

4.2.2 Pharmacological Mechanisms Affecting Oral and Dental Structures

The second domain focuses on pharmacological mechanisms through which medications affect oral tissues. These mechanisms operate at multiple biological levels and form the core link between polypharmacy and clinical oral disease. One of the most prominent mechanisms is salivary gland dysfunction. Many medications exert anticholinergic or sympathomimetic effects that reduce salivary secretion, leading to xerostomia and hyposalivation. Saliva plays a critical role in maintaining oral homeostasis by buffering acids, facilitating remineralization, and controlling microbial growth. Pharmacologically induced salivary dysfunction therefore represents a key pathway through which polypharmacy contributes to dental caries, periodontal disease, oral infections, and denture intolerance.

Another major mechanism involves immune modulation and mucosal integrity. Corticosteroids, immunosuppressive agents, and certain antineoplastic drugs impair local immune defenses, increasing susceptibility to oral candidiasis, delayed wound healing, and mucosal ulceration. Additionally, some medications induce hypersensitivity reactions or lichenoid lesions affecting the oral mucosa, which may be misdiagnosed without careful medication review.

Table 2. Oral and Dental Conditions Associated with Polypharmacy in Geriatric Patients

Condition	Clinical Features	Contributing Drug Effects	Impact on Oral Health and Function
Xerostomia / Hyposalivation	Dry mouth, burning sensation, difficulty swallowing	Anticholinergics, diuretics, psychotropics	Increased risk of caries, mucosal infections, denture intolerance
Dental Caries	Cavitations, especially root caries	Xerostomia-induced acid erosion, sugar-containing medications	Tooth loss, impaired mastication, nutrition
Periodontal Disease	Gingival inflammation, pocket formation, bone loss	Gingival overgrowth (CCBs), immunosuppression (corticosteroids)	Tooth mobility, tooth loss, systemic inflammation
Gingival Overgrowth	Excessive gingival tissue, inflammation	Calcium channel blockers, phenytoin	Difficulty in plaque control, increased infection risk
Oral Mucosal Lesions	Ulcers, candidiasis, lichenoid reactions	Immunosuppressants, xerostomia-inducing drugs	Pain, infection, impaired oral function
Medication-Related Osteonecrosis of the Jaw (MRONJ)	Exposed necrotic bone, pain, infection	Bisphosphonates, denosumab	Compromised healing post dental surgery, chronic morbidity

Bone metabolism represents a third critical pharmacological pathway, particularly relevant to dental practice. Antiresorptive drugs, such as bisphosphonates and denosumab, alter bone remodeling and have been associated with medication-related osteonecrosis of the jaw. This condition has significant implications for invasive dental procedures and requires close collaboration between prescribers, pharmacists, and dentists. Finally, pharmacokinetic changes in geriatric patients, including reduced renal

and hepatic clearance, can amplify drug exposure and prolong adverse effects. These age-related changes further intensify the oral impact of polypharmacy and underscore the need for individualized medication assessment.

4.2.3 Geriatric Patient Modifiers

The third domain recognizes that geriatric patients are not a homogeneous group and that individual vulnerabilities modify the impact of polypharmacy on oral health. Age-related physiological changes, such as reduced salivary gland reserve, thinning of oral mucosa, and diminished regenerative capacity, increase susceptibility to drug-induced damage. Comorbid conditions, including diabetes mellitus, cardiovascular disease, and neurodegenerative disorders, further compromise oral health and interact with pharmacological effects.

Functional and cognitive impairments also play a critical role. Reduced manual dexterity may limit effective oral hygiene practices, while cognitive decline can impair medication adherence and symptom reporting. These factors may mask early signs of drug-induced oral disease, delaying diagnosis and intervention. Socioeconomic factors, access to dental care, and health literacy further influence outcomes and contribute to disparities in geriatric oral health.

4.2.4 Oral and Dental Clinical Outcomes

The fourth domain encompasses the spectrum of oral and dental conditions resulting from the interaction of polypharmacy, pharmacological mechanisms, and patient modifiers. Xerostomia and hyposalivation represent the most common and clinically significant outcomes, often serving as precursors to more severe disease. Reduced salivary flow increases the risk of dental caries, particularly root caries, which are highly prevalent in older adults. Periodontal disease is another major outcome, influenced by immune modulation, altered microbial ecology, and reduced oral hygiene capacity. Polypharmacy-associated periodontal deterioration contributes not only to tooth loss but also to systemic inflammation, highlighting the bidirectional relationship between oral and general health. Oral mucosal lesions, including candidiasis, ulcerations, and lichenoid reactions, further compromise oral comfort and function. From a dental perspective, these outcomes complicate treatment planning and increase the risk of adverse events during dental procedures. Bleeding risk, impaired healing, and altered responses to local anesthetics and antibiotics necessitate careful pharmacological evaluation before dental interventions.

4.2.5 Interprofessional Intervention Points

The final domain of the framework identifies opportunities for intervention by pharmacists and dental professionals. Pharmacists play a critical role in identifying high-risk medication regimens, assessing anticholinergic burden, and recommending deprescribing or therapeutic substitutions to reduce oral adverse effects. Medication therapy management programs provide an ideal platform for integrating oral health considerations into pharmacological care.

Dental professionals, in turn, serve as frontline observers of medication-related oral changes and are uniquely positioned to detect early signs of drug-induced disease. Incorporating comprehensive medication histories into dental assessments allows dentists to identify potential pharmacological contributors to oral pathology and to coordinate care with pharmacists and prescribers. The framework emphasizes that optimal management of polypharmacy-related oral health issues requires bidirectional communication and shared decision-making. Interprofessional collaboration enhances patient safety, improves treatment outcomes, and aligns with contemporary models of geriatric care that prioritize holistic, patient-centered approaches.

4.3 Implications of the Framework for Research and Practice

This conceptual framework offers a structured approach for understanding the multifaceted relationship between polypharmacy and oral health in geriatric patients. For researchers, it provides a foundation for designing studies that examine cumulative medication effects rather than isolated drug exposures. For clinicians, it highlights the importance of integrating pharmacological assessment into oral healthcare and reinforces the value of pharmacist–dentist collaboration. By bridging pharmacy and dentistry, the framework supports the development of interdisciplinary clinical guidelines, educational initiatives, and healthcare policies aimed at improving oral health outcomes in aging populations. Ultimately, addressing polypharmacy as a modifiable risk factor represents a critical step toward promoting healthy aging and preserving oral function and quality of life in geriatric patients.

5. Drug Classes Implicated in Oral and Dental Disorders

Polypharmacy in geriatric patients exposes oral tissues to a wide range of pharmacological effects, many of which are cumulative and synergistic. Several drug classes commonly prescribed to older adults are strongly associated with oral and dental disorders through mechanisms involving salivary dysfunction, immune modulation, vascular changes, and altered bone metabolism. Understanding these drug classes is essential for both pharmacists and dental professionals to identify at-risk patients and implement preventive or corrective strategies.

5.1 Cardiovascular Medications

Cardiovascular drugs are among the most frequently prescribed medications in geriatric populations due to the high prevalence of hypertension, ischemic heart disease, heart failure, and arrhythmias. Antihypertensive agents, including beta-blockers, calcium channel blockers, angiotensin-converting enzyme inhibitors, and diuretics, have been widely associated with oral adverse effects. Xerostomia is a common complaint, particularly with diuretics and beta-blockers, resulting from reduced salivary gland perfusion and autonomic modulation. Calcium channel blockers, such as nifedipine and amlodipine, are well known to induce gingival overgrowth. This condition complicates oral hygiene, increases plaque accumulation, and predisposes patients to periodontal disease. From a dental perspective, drug-induced gingival enlargement requires careful differential diagnosis and may necessitate both pharmacological review and periodontal intervention. Pharmacists play a critical role in identifying causative agents and recommending alternative therapies when appropriate. Anticoagulants and antiplatelet agents, while not directly causing oral pathology, significantly influence dental management by increasing bleeding risk during invasive procedures. The widespread use of direct oral anticoagulants in older adults has introduced new considerations for dental treatment planning, emphasizing the need for interdisciplinary communication.

5.2 Psychotropic Medications

Psychotropic medications, including antidepressants, antipsychotics, anxiolytics, and mood stabilizers, are frequently prescribed to manage depression, anxiety, dementia-related behavioral symptoms, and other psychiatric conditions in older adults. These drugs are among the most significant contributors to oral adverse drug reactions. Antidepressants, particularly tricyclic antidepressants and selective serotonin reuptake inhibitors, exert anticholinergic or serotonergic effects that reduce salivary flow. Xerostomia associated with antidepressant use is strongly linked to increased dental caries, oral discomfort, dysphagia, and impaired denture retention. Antipsychotic medications further exacerbate these effects and may cause extrapyramidal symptoms that interfere with oral hygiene practices. From a pharmacological standpoint, psychotropic drugs contribute substantially to overall anticholinergic burden, a key determinant of oral dryness and mucosal vulnerability. Dental practitioners often encounter the consequences of these effects without direct awareness of their pharmacological origins, underscoring the importance of comprehensive medication review.

5.3 Antidiabetic Agents

Diabetes mellitus is highly prevalent among geriatric patients, leading to widespread use of antidiabetic medications, including insulin, metformin, sulfonylureas, and newer agents such as sodium–glucose cotransporter-2 inhibitors. While glycemic control itself plays a central role in oral health, pharmacotherapy may also influence oral outcomes. Certain antidiabetic drugs contribute indirectly to oral disease by altering salivary composition and increasing susceptibility to infections. Poor glycemic control, often exacerbated by complex medication regimens, is associated with periodontal disease progression, delayed wound healing, and increased risk of oral candidiasis. Dental professionals must consider both the pharmacological and metabolic context when managing diabetic geriatric patients. Pharmacists contribute by optimizing medication regimens, promoting adherence, and minimizing drug-related complications that may worsen oral health outcomes.

5.4 Anticholinergics and Antihistamines

Anticholinergic medications are widely used in older adults to manage conditions such as overactive bladder, Parkinson's disease, chronic obstructive pulmonary disease, and gastrointestinal disorders. Antihistamines are also commonly prescribed for allergic conditions and insomnia. These drugs represent one of the strongest pharmacological risk factors for xerostomia. By inhibiting parasympathetic stimulation of salivary glands, anticholinergics significantly reduce salivary secretion, leading to severe oral dryness, mucosal fragility, taste disturbances, and difficulty speaking or swallowing. Chronic xerostomia accelerates the development of dental caries and periodontal disease and increases the risk of oral infections. The cumulative anticholinergic burden resulting from polypharmacy is particularly relevant in geriatric patients, making this drug class a primary target for pharmacist-led medication review and deprescribing efforts.

5.5 Antiresorptive and Bone-Modifying Agents

Bisphosphonates and other antiresorptive agents are commonly prescribed for osteoporosis and metastatic bone disease in older adults. These drugs profoundly affect bone remodeling and are associated with medication-related osteonecrosis of the jaw, a serious condition characterized by exposed necrotic bone and impaired healing following dental procedures. From a dental standpoint, patients receiving antiresorptive therapy require careful risk assessment prior to extractions or implant placement. Pharmacists play a crucial role in identifying at-risk patients, educating them about oral health maintenance, and coordinating care with dental professionals.

6. Major Oral and Dental Conditions Associated with Polypharmacy

The interaction between polypharmacy and geriatric physiology gives rise to a broad spectrum of oral and dental conditions that significantly impair function, comfort, and quality of life. These conditions often coexist and progress synergistically, reflecting the cumulative impact of multiple medications on oral tissues.

6.1 Xerostomia and Hyposalivation

Xerostomia is the most prevalent oral condition associated with polypharmacy and represents a central pathway linking medication use to oral disease. Reduced salivary flow compromises the protective functions of saliva, leading to acid accumulation, microbial overgrowth, and mucosal irritation. Geriatric patients frequently report burning sensations, altered taste, difficulty swallowing, and impaired speech. Clinically, xerostomia is associated with rapid progression of dental caries, particularly root caries, and increased incidence of oral candidiasis. Pharmacological assessment is essential to identify contributing medications and implement targeted interventions.

6.2 Dental Caries and Tooth Loss

Polypharmacy-related salivary dysfunction significantly increases the risk of dental caries. Older adults are particularly susceptible to root caries due to gingival recession and exposed dentin. Sugar-containing liquid medications further exacerbate this risk.

Untreated caries often leads to tooth loss, which negatively affects mastication, nutrition, and social interaction. From a public health perspective, medication-induced caries represent a preventable cause of oral morbidity in aging populations.

6.3 Periodontal Disease

Periodontal disease is highly prevalent among geriatric patients and is influenced by both pharmacological and behavioral factors. Medications that impair immune function, alter inflammatory responses, or induce gingival overgrowth contribute to periodontal deterioration. Polypharmacy also indirectly affects periodontal health by reducing oral hygiene capacity and increasing plaque accumulation. Periodontal disease, in turn, exacerbates systemic inflammation, highlighting the bidirectional relationship between oral and general health.

6.4 Oral Mucosal Lesions and Infections

Polypharmacy increases susceptibility to oral mucosal lesions, including candidiasis, aphthous ulcers, and drug-induced lichenoid reactions. Immunosuppressive therapies and xerostomia play central roles in the development of these conditions. From a dental perspective, distinguishing drug-induced lesions from malignant or autoimmune conditions is critical. Pharmacists assist by identifying offending agents and advising on medication adjustments.

7. Clinical Implications for Dental Practice

The growing prevalence of polypharmacy among geriatric patients has profound implications for dental practice. Dental professionals must adopt a pharmacologically informed approach to patient assessment, diagnosis, and treatment planning to ensure safe and effective care.

7.1 Comprehensive Medication History and Risk Assessment

A detailed medication history is a cornerstone of geriatric dental care. Dentists must assess not only the number of medications but also their pharmacological properties, potential interactions, and cumulative adverse effects. Collaboration with pharmacists enhances the accuracy and clinical relevance of this assessment.

7.2 Treatment Planning and Procedure Modification

Polypharmacy influences bleeding risk, healing capacity, and responses to local anesthetics and antibiotics. Dental procedures may require modification, including altered dosing, timing adjustments, or preventive measures to reduce complications.

7.3 Prevention and Patient Education

Preventive strategies are essential to mitigate the oral impact of polypharmacy. These include enhanced oral hygiene protocols, salivary substitutes, fluoride therapy, and patient education. Dentists and pharmacists jointly contribute to educating patients about medication-related oral risks.

7.4 Interprofessional Collaboration

Effective management of polypharmacy-related oral conditions requires coordinated care. Regular communication between dentists, pharmacists, and physicians supports medication optimization, early detection of adverse effects, and improved patient outcomes.

Table 3: Pharmacist-Led Interventions to Mitigate Oral Drug-Related Adverse Effects

Intervention	Description	Targeted Oral Effects	Expected Outcomes
Medication Review and Deprescribing	Systematic assessment of medication necessity and optimization	Reduction of xerostomia and mucosal toxicity	Decreased oral dryness, improved salivary flow, lower caries risk
Anticholinergic Burden Assessment	Identification and minimization of cumulative anticholinergic effects	Xerostomia, mucosal discomfort	Improved oral comfort and hygiene capability
Patient Education	Informing patients about oral side effects and preventive care	Xerostomia, candidiasis, dental caries	Enhanced self-care, adherence to oral hygiene
Collaboration with Dental Teams	Communication of medication risks and coordinated care planning	MRONJ risk, bleeding complications	Safer dental procedures and treatment outcomes
Salivary Flow Stimulation Recommendations	Advice on saliva substitutes, sialogogues, hydration	Xerostomia	Symptom relief, reduced risk of secondary infections
Monitoring for Oral Infections	Early detection of mucosal infections in at-risk patients	Oral candidiasis, ulcerations	Timely intervention, reduced morbidity

8. Clinical Implications for Pharmacists and Dentists

The growing prevalence of polypharmacy among geriatric patients necessitates a paradigm shift in how oral and dental health risks are identified and managed. Both pharmacists and dentists occupy critical, complementary positions within the healthcare system and are uniquely positioned to mitigate medication-related oral complications through coordinated, patient-centered care.

From a pharmacist's perspective, polypharmacy assessment extends beyond preventing systemic adverse drug reactions to include oral health outcomes. Medication therapy management (MTM) services provide an essential platform for evaluating cumulative drug burden, anticholinergic load, and drug–drug interactions that predispose patients to xerostomia, mucosal lesions, and impaired healing. Pharmacists can proactively identify medications commonly associated with oral adverse effects—such as antidepressants, anticholinergics, antihypertensives, and antiresorptive agents—and flag high-risk regimens for review. Deprescribing initiatives, dose adjustments, and therapeutic substitutions represent evidence-based strategies that can significantly reduce oral morbidity without compromising disease control.

Pharmacists also play a key role in patient education, counseling older adults on the oral consequences of their medications, proper hydration, saliva-stimulating strategies, and the importance of regular dental care. Importantly, pharmacists are often more accessible than other healthcare professionals, making them well positioned to detect early oral complaints that may otherwise go unreported. Referral to dental professionals upon identification of persistent oral symptoms represents a critical intervention point.

From a dental perspective, the clinical implications of polypharmacy are equally profound. Dentists must integrate pharmacological knowledge into routine dental assessments, recognizing that many oral conditions in older adults are iatrogenic rather than age-related. Comprehensive medication histories should be considered a standard component of geriatric dental evaluations, with attention paid to medications

affecting salivary flow, coagulation, immune function, and bone metabolism. Failure to account for these factors may result in misdiagnosis, ineffective treatment, or preventable complications. Dental treatment planning in polypharmacy patients often requires modification. The use of anticoagulants, antiplatelet agents, and nonsteroidal anti-inflammatory drugs necessitates careful bleeding risk assessment, while immunosuppressive therapies and antidiabetic agents influence healing and infection risk. Dentists must also consider potential drug interactions with commonly prescribed dental medications, including antibiotics, analgesics, and antifungals.

Preventive dentistry assumes heightened importance in this population. Intensified fluoride regimens, salivary substitutes, antimicrobial mouth rinses, and individualized oral hygiene protocols are essential to counteract medication-induced vulnerability. Dentists also play a vital role in monitoring for serious drug-related conditions, such as medication-related osteonecrosis of the jaw, and coordinating care with pharmacists and prescribers before invasive procedures. Collectively, the clinical implications for pharmacists and dentists underscore the necessity of moving beyond siloed practice models. Addressing polypharmacy-related oral health risks requires shared responsibility, mutual awareness of professional roles, and a commitment to collaborative care.

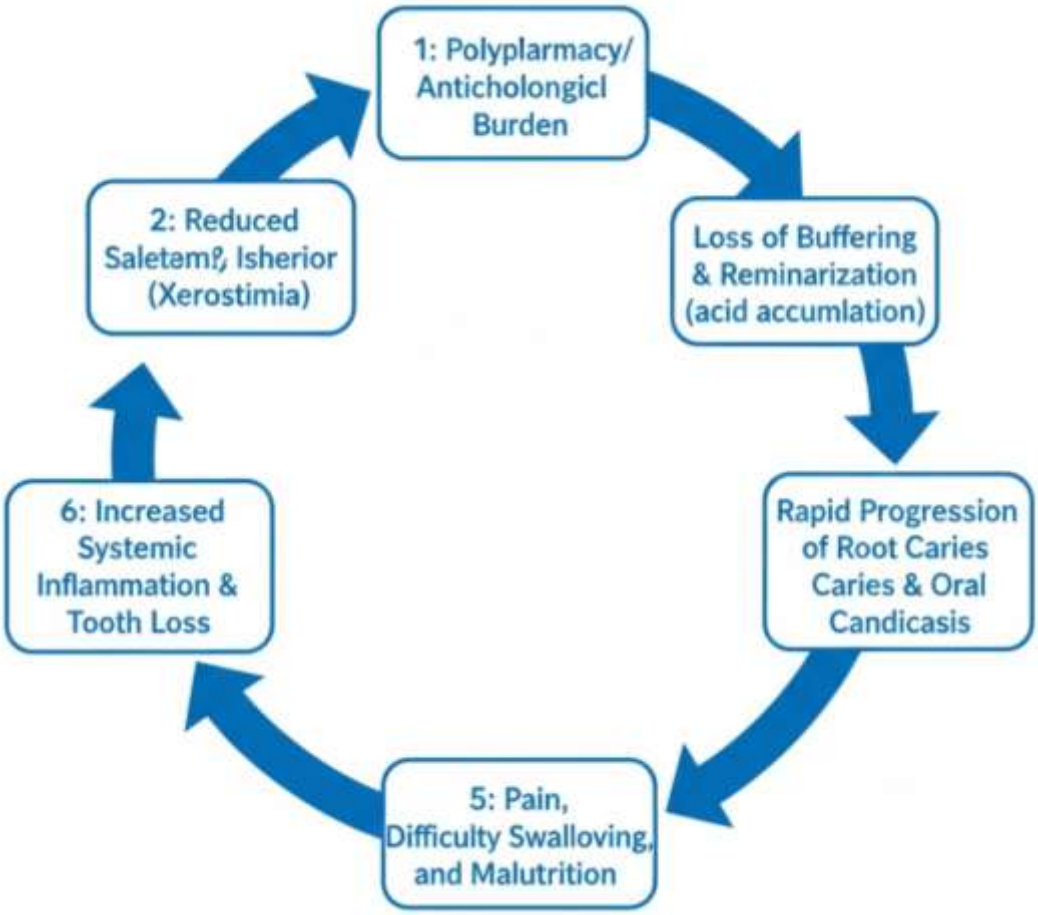


Figure 2. The "Vicious Cycle" of Medication-Induced Oral Decay

9. Interprofessional Collaboration Model

The complexity of polypharmacy-related oral health challenges in geriatric patients necessitates an interprofessional care model that integrates pharmacological expertise with dental clinical practice. Traditional healthcare delivery models often fragment care, with limited communication between pharmacists, dentists, and physicians. This fragmentation contributes to underrecognition of medication-induced oral disease and delays in intervention. An effective interprofessional collaboration model is grounded in shared accountability, structured communication, and role clarity. At the core of this model is the recognition that oral health is inseparable from systemic health and that medications represent a common risk factor across both domains. Pharmacists and dentists serve as complementary gatekeepers: pharmacists identify medication-related risks, while dentists observe their clinical manifestations.

Within this model, bidirectional communication is essential. Pharmacists conducting medication reviews should routinely assess oral symptoms and document potential drug-related oral adverse effects. When concerns arise, timely referral to dental professionals allows for early diagnosis and intervention. Conversely, dentists identifying unexplained xerostomia, mucosal lesions, or impaired healing should consult pharmacists to review medication regimens and explore pharmacological contributors. Health information technology can significantly enhance collaboration. Shared electronic health records, secure messaging platforms, and integrated medication lists facilitate real-time information exchange and reduce reliance on patient recall. In settings where full integration is not feasible, standardized referral forms and communication protocols can serve as practical alternatives.

Education and training represent another critical component of the collaboration model. Interprofessional education initiatives that expose pharmacy and dental students to shared clinical scenarios foster mutual understanding and prepare future practitioners for collaborative practice. Continuing professional development programs can further strengthen collaboration by updating clinicians on emerging evidence related to polypharmacy and oral health. From a systems perspective, embedding pharmacists within dental clinics or establishing formal referral networks between community pharmacies and dental practices can operationalize collaboration. In long-term care facilities, interdisciplinary care teams that include pharmacists and dental consultants are particularly well positioned to manage complex medication regimens and maintain oral health.

The proposed interprofessional collaboration model not only improves clinical outcomes but also aligns with broader healthcare goals, including patient safety, quality of care, and healthy aging. By leveraging the strengths of both professions, this model transforms polypharmacy from an unmanaged risk factor into a shared target for preventive intervention.

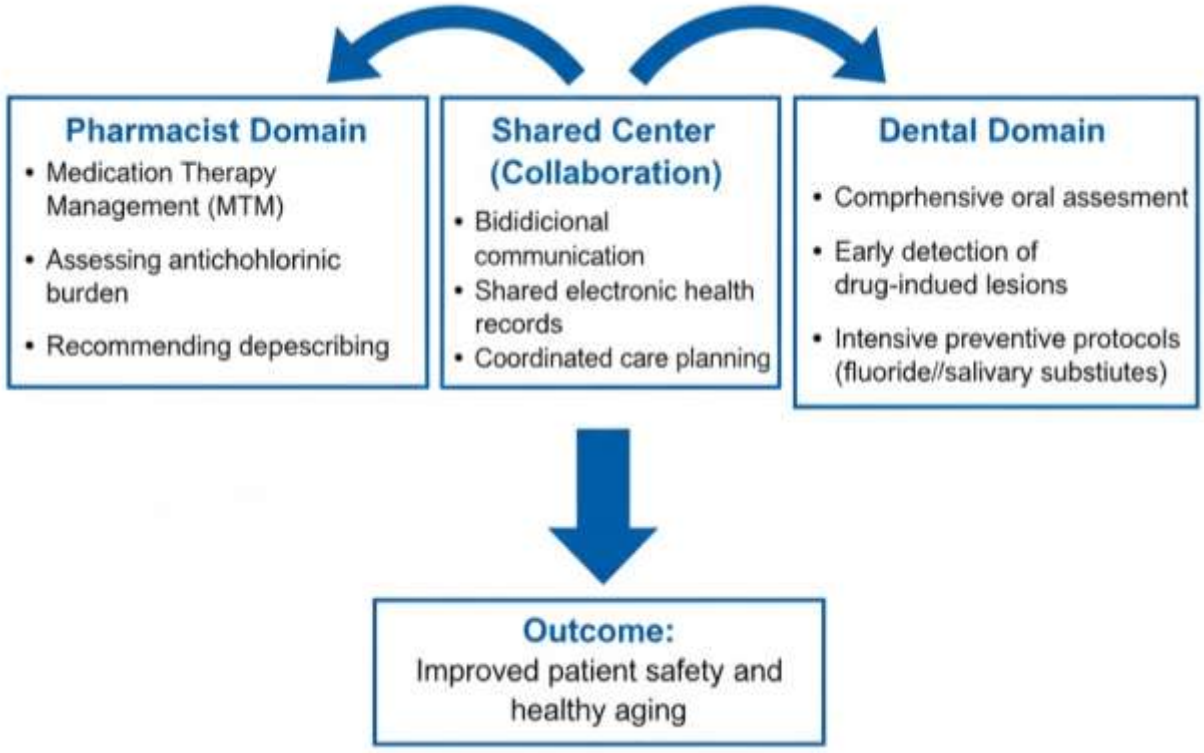


Figure 3. Interprofessional Collaboration Model

10. Conclusion

Polypharmacy is an increasingly prevalent and clinically significant phenomenon in geriatric healthcare, with far-reaching implications for oral and dental health. This review highlights that many oral conditions commonly observed in older adults—such as xerostomia, dental caries, periodontal disease, mucosal lesions, and impaired healing—are not inevitable consequences of aging but are often pharmacologically mediated and potentially preventable.

From a pharmacological perspective, the cumulative effects of multiple medications, particularly those with anticholinergic, immunosuppressive, and bone-modifying properties, play a central role in oral health deterioration. From a dental perspective, these effects complicate diagnosis, treatment planning, and long-term maintenance of oral function. Addressing these challenges requires a comprehensive understanding of medication-related oral adverse effects and their clinical manifestations.

Pharmacists and dentists share responsibility for mitigating the oral consequences of polypharmacy. Through medication therapy management, deprescribing initiatives, preventive dental strategies, and patient education, both professions can contribute to improved oral and systemic health outcomes. Interprofessional collaboration represents a critical mechanism for integrating these efforts and ensuring that geriatric patients receive holistic, coordinated care.

Future research should prioritize longitudinal and interventional studies, standardized assessment methods, and evaluation of collaborative care models. By recognizing polypharmacy as a modifiable risk factor and fostering interdisciplinary approaches, healthcare systems can better support healthy aging and preserve oral health and quality of life in geriatric populations.

11. References

1. Al-Eitan, L. N., Rababa'h, K., & Alfaqih, M. A. (2019). The impact of polypharmacy on oral health and dental care in elderly patients: A literature review. International Journal of Clinical Pharmacy, 41(2), 362–372. https://doi.org/10.1007/s11096-019-00826-z
2. Alshehri, A., Hakeem, H., & Alghamdi, H. (2021). Medication-related osteonecrosis of the jaw: A narrative review. International Journal of Dentistry, 2021, Article 8830153. https://doi.org/10.1155/2021/8830153
3. Bartels, C. M., Brookhart, M. A., & Vanderweele, T. J. (2019). Polypharmacy and adverse drug reactions in older adults: Mechanisms and management. Geriatrics, 4(2), 24. https://doi.org/10.3390/geriatrics4020024
4. Cruickshanks, K. J., & Klein, R. (2015). Aging and oral health. In K. M. Hazzard et al. (Eds.), Hazzard's Geriatric Medicine and Gerontology (7th ed., pp. 915–929). McGraw Hill.
5. Fried, T. R., O'Leary, J., Towle, V., Goldstein, M. K., Trentalange, M., & Martin, D. K. (2014). Health outcomes associated with polypharmacy in community-dwelling older adults: A systematic review. Journal of the American Geriatrics Society, 62(12), 2261–2272. https://doi.org/10.1111/jgs.13153
6. Gil-Montoya, J. A., de Mello, A. H., Barrios, R., Gonzalez-Moles, M. A., & Bravo, M. (2015). Oral health in the elderly patient and its impact on general well-being: A nonsystematic review. Clinical Interventions in Aging, 10, 461–467. https://doi.org/10.2147/CIA.S54630
7. Hughes, C. M., McElnay, J. C., & Fleming, G. F. (2004). Benefits and risks of polypharmacy in elderly patients. Drugs & Aging, 21(11), 793–811. https://doi.org/10.2165/00002512-200421110-00002
8. Maher, R. L., Hanlon, J., & Hajjar, E. R. (2014). Clinical consequences of polypharmacy in elderly. Expert Opinion on Drug Safety, 13(1), 57–65. https://doi.org/10.1517/14740338.2013.827660
9. Masnoon, N., Shakib, S., Kalisch-Ellett, L., & Caughey, G. E. (2017). What is polypharmacy? A systematic review of definitions. BMC Geriatrics, 17(1), 230. https://doi.org/10.1186/s12877-017-0621-2
10. McInnis, T., & Rudnicka, L. (2016). Medication-related oral side effects in the elderly. Journal of Pharmacy Practice, 29(4), 345–350. https://doi.org/10.1177/0897190015582610
11. Navazesh, M. (2003). How can oral health care providers effectively manage xerostomia? Journal of the American Dental Association, 134(1), 61–69. https://doi.org/10.14219/jada.archive.2003.0014
12. Petersen, P. E., & Yamamoto, T. (2005). Improving the oral health of older people: The approach of the WHO Global Oral Health Programme. Community Dentistry and Oral Epidemiology, 33(2), 81–92. https://doi.org/10.1111/j.1600-0528.2005.00219.x
13. Ruggiero, S. L., Dodson, T. B., Fantasia, J., Goodday, R., Aghaloo, T., Mehrotra, B., & O'Ryan, F. (2014). American Association of Oral and Maxillofacial Surgeons position paper on medication-related osteonecrosis of the jaw—2014 update. Journal of Oral and Maxillofacial Surgery, 72(10), 1938–1956. https://doi.org/10.1016/j.joms.2014.04.031
14. Scully, C. (2003). Drug effects on salivary glands: Dry mouth. Oral Diseases, 9(4), 165–176. https://doi.org/10.1034/j.1601-0825.2003.009004165.x
15. Silvestre-Rangil, J., Silvestre, F. J., & Rangil, T. (2020). The impact of polypharmacy on the oral health of elderly patients: A cross-sectional study. Journal of Clinical Medicine, 9(3), 743. https://doi.org/10.3390/jcm9030743
16. Stewart, W. F., Lipton, R. B., & Kolodner, K. (2001). Impact of medication burden on xerostomia and dental caries in elderly patients. The Journals of Gerontology Series A, 56(12), M779–M784. https://doi.org/10.1093/gerona/56.12.m779
17. World Health Organization. (2023). Ageing and health. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health
18. Yoon, J. M., Shin, J. Y., & Kim, S. (2018). Oral health implications of medication-related xerostomia in older adults. Journal of the Korean Gerontological Nursing, 20(2), 77–87. https://doi.org/10.17079/jkgn.2018.20.2.77