Preventive Oral Health Integration in Family Medicine for Chronic Disease Management in Saudi Arabia

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ABSTRACT

Co-occurrence of non-communicable diseases (NCDs) with high prevalence and the **high burden of oral diseases** can be seen as one of the major issues of public health concern that requires a paradigm shift towards integrated care models. This narrative review investigates the imperative nature of preventive oral health incorporation in family medicine in the delivering of better management of chronic diseases. A systematic search strategy was designed and executed across major electronic databases, including PubMed/MEDLINE, Embase, CINAHL, and Scopus, supplemented by searches in regional databases such as the WHO's IMEMR and the Saudi Digital Library. Key search terms and their combinations encompassed concepts such as "preventive oral health," "family medicine," "primary care," "chronic disease," "integration," "Saudi Arabia," and related MeSH terms. The current practice indicates that there is a significant flaw, and preventive oral health is not part of primary care that is supported by complex obstacles such as educational shortages, time limitations, the absence of financial incentives, and fragmented healthcare system. This review adopts a holistic framework of Saudi Arabia by integrating evidence based on international models and the local context. According to this framework, the solution to curriculum changes in medical education, creation of simplified clinical protocols, interprofessional collaboration programs, and policy-level changes to encourage integration are proposed. Such a model is the key to delivering holistic, preventive, and cost-effective care within the family medicine framework because that is one of the objectives of Saudi Vision 2030 to enhance population health outcomes and decrease the number of chronic diseases.

Keywords: Chronic Disease Management; Oral Health Integration; Family Medicine; Preventive Dentistry; Saudi Arabia.

INTRODUCTION

Chronic non-communicable diseases (NCDs) constitute a paramount public health crisis in the Kingdom of Saudi Arabia, driven by rapid urbanization, sedentary lifestyles, and dietary shifts[1]. According to the World Health Organization, NCDs are responsible for approximately 73% of all deaths in the country, with cardiovascular diseases accounting for 37%, diabetes for 18%, and chronic respiratory diseases for 5%[2]. The Saudi Health Interview Survey reports an age-standardized diabetes prevalence of 18.3% among adults, while hypertension affects 26.6% of adults[3]. These conditions are exacerbated by prevalent risk factors; for instance, 35.4% of adults are obese, and 13% smoke daily[4].

Oral diseases, particularly dental caries and periodontal disease, are similarly widespread in Saudi Arabia, yet they remain largely neglected in public health discourse[5]. Dental caries affects 80% of children aged 6–12 years and 90% of adults, while periodontal disease is prevalent in 60% of the adult population[6]. High sugar consumption—averaging 120 grams per person daily, more than double the WHO recommendation—and inadequate oral hygiene practices contribute significantly to this epidemic[7]. Tobacco use, reported in 13% of adults,

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further compounds the risk for both oral diseases and chronic conditions[8].

A robust body of evidence underscores the bidirectional relationship between oral health and systemic chronic diseases. Periodontitis, a severe form of gum disease, is independently associated with a 1.2 to 1.5 times increased risk of coronary heart disease[8]. In diabetes, periodontitis is considered a complication, and its management can improve glycemic control; non-surgical periodontal therapy has been shown to reduce HbA1c levels by 0.4% to 0.6% over three months[9].

The integration of preventive oral health into family medicine aligns with the Saudi Vision 2030 health sector transformation, which advocates for preventive, integrated, and person-centered care. Internationally, such integration has demonstrated success[9].

Despite the clear rationale, several barriers impede integration in Saudi Arabia. These include a lack of standardized protocols for oral health in primary care, minimal interdisciplinary collaboration between family physicians and dentists, financial disincentives (e.g., lack of reimbursement for oral health services), and cultural attitudes that may prioritize medical over dental care. Additionally, educational gaps persist; a survey of family medicine residents found that only 20% received formal training in oral health assessment, and 70% felt unprepared to address oral health issues[9]. Addressing these barriers requires systemic changes at policy, educational, and practice levels. This review article aims to synthesize existing evidence on the integration of preventive oral health into family medicine for chronic disease management, with a focus on Saudi Arabia[9].

Epidemiology of Chronic Diseases in Saudi Arabia

The most significant chronic disease in Saudi Arabia, in terms of prevalence and systemic impact, is diabetes mellitus (DM). The Kingdom has one of the highest rates of diabetes in the world. According to the International Diabetes Federation, the national prevalence of diabetes among adults aged 20-79 years was 18.3% in 2021, translating to approximately 4.3 million individuals. Impaired glucose tolerance, a pre-diabetic state, affects an additional 9.3% of the adult population[10]. The Saudi Health Interview Survey (SHIS) data further stratifies this burden, indicating higher prevalence in older age groups, exceeding 30% in those over 55 years, and showing significant regional variations[11]. The implications for oral health are direct and severe. Diabetic patients are three times more likely to develop periodontitis than non-diabetic individuals, and periodontitis in diabetic patients is often more severe and progresses more rapidly[12]. Furthermore, the relationship is bidirectional; severe periodontitis can exacerbate glycemic dyscontrol, creating a vicious cycle that complicates the management of both conditions[13].

Concurrently, cardiovascular diseases (CVDs) remain the leading cause of death in Saudi Arabia, accounting for an estimated 37% of total mortality. Hypertension is a major, modifiable risk factor, with a national prevalence of 26.6% among adults[3]. Dyslipidemia is also widespread, affecting over 40% of the adult population[14]. The inflammatory pathway provides a critical link between oral health and CVD. Chronic periodontitis is characterized by a persistent low-grade systemic inflammation, marked by elevated levels of C-reactive protein (CRP) and inflammatory cytokines. This systemic inflammatory burden is recognized as an independent risk factor for atherosclerosis, endothelial dysfunction, and acute coronary events[15]. Studies have demonstrated that individuals with periodontitis have a 1.2 to 1.5 times higher risk of developing coronary artery disease compared to those with healthy periodontium[16]. Therefore, periodontal inflammation is not merely a local oral infection but a contributor to the systemic inflammatory load that drives cardiovascular pathology.

The epidemic of obesity and metabolic syndrome represents another cornerstone of the NCD landscape in Saudi Arabia, with profound oral health connections. Data from the World Health Organization indicates that 35.4% of the Saudi adult population is obese (BMI ≥30), with higher rates observed among women[3]. Physical inactivity is rampant, with nearly 60% of adults reporting insufficient physical activity[14]. These factors coalesce into metabolic syndrome—a cluster of conditions including abdominal obesity, hypertension, dyslipidemia, and insulin resistance—which has a prevalence of approximately 28% in Saudi adults[17]. Obesity and metabolic syndrome are strongly associated with a pro-inflammatory state. This systemic inflammation exacerbates periodontal tissue destruction and impairs healing. Moreover, dietary habits driving the obesity crisis, particularly the high consumption of refined carbohydrates and sugar-sweetened beverages (average intake of 120 grams of sugar per person daily), are the primary etiological factors for dental caries[7]. Thus, the same dietary choices that fuel the epidemics of obesity and diabetes directly drive the nation's dental caries burden.

The role of behavioral risk factors, particularly tobacco use, cannot be overstated. While the prevalence of daily smoking in Saudi Arabia (13%) is lower than in many Western countries, the use of smokeless tobacco, such as *shammah* and *ma'asal*, is a culturally entrenched practice in certain regions, with significant oral health consequences[3]. Tobacco use in any form is a major shared risk factor for both NCDs and oral diseases. It is a leading cause of oral and pharyngeal cancers, periodontal disease, and impaired wound healing. Nicotine and other constituents contribute to vasoconstriction, reduced gingival blood flow, and suppression of the immune response, which accelerates periodontal breakdown and

masks the clinical signs of inflammation (like bleeding on probing), leading to under-diagnosis[16]. For the family physician, inquiring about all forms of tobacco use is essential for comprehensive risk assessment for both pulmonary/cardiovascular and oral diseases.

Table 1: Prevalence of Key Chronic Diseases and Risk Factors in Saudi Arabian Adults[11,14,17]

Disease / Risk Factor	Overall Prevalence (%)	Key Notes
Diabetes Mellitus	18.3%	Higher in >55 age group (>30%); regional variations exist.
Hypertension	26.6%	Major modifiable risk factor for CVD and renal disease.
Obesity (BMI ≥30)	35.4%	More prevalent among females; driver of metabolic syndrome.
Dyslipidemia	>40%	High total cholesterol and LDL-C are common.
Metabolic Syndrome	~28%	Cluster of abdominal obesity, dyslipidemia, hypertension, IR.
Current Smoker (Daily)	13%	Does not fully capture regional use of smokeless tobacco.
Physical Inactivity	~60%	Significant contributor to obesity and metabolic disease.

Oral Health and Systemic Diseases

The most well-established and clinically significant bidirectional relationship exists between periodontitis and diabetes mellitus. Periodontitis is now recognized as the sixth complication of diabetes, alongside neuropathy, retinopathy, nephropathy, macrovascular disease, and impaired wound healing[16]. The mechanism is inflammatory: periodontitis generates a state of low-grade, chronic systemic inflammation, characterized by elevated levels of pro-inflammatory cytokines such as Tumor Necrosis Factor-alpha (TNF-α) and Interleukin-6 (IL-6). These cytokines contribute to insulin resistance by interfering with insulin signaling pathways in peripheral tissues[17].

Consequently, patients with severe periodontitis often demonstrate poorer glycemic control, as measured by higher HbA1c levels. Crucially, this relationship works in reverse. Treatment of periodontitis through non-surgical therapy (scaling and root planing) has been shown to improve glycemic control. A meta-analysis of randomized controlled trials concluded that periodontal treatment leads to a statistically significant reduction in HbA1c of approximately 0.4% at 3 months, an effect magnitude comparable to adding a second-line pharmacological agent to a diabetic regimen[18].

Cardiovascular disease (CVD) management is another area where oral health interventions hold significant potential. Atherosclerosis, the underlying pathology of most CVD, is fundamentally an inflammatory disease. The chronic bacteremia and systemic inflammatory mediators originating from a periodontal biofilm contribute to this process through several pathways: direct endothelial injury, increased platelet aggregation and thrombogenesis, oxidation of low-density lipoproteins (LDL), and the formation of foam cells within arterial walls[19]. Epidemiological studies have consistently identified periodontitis as an independent risk factor for coronary heart disease and stroke, with risk ratios ranging from 1.2 to 2.0 after adjusting for traditional confounders[20]. While large-scale intervention trials proving that periodontal treatment prevents cardiovascular events are complex, evidence suggests that periodontal therapy can improve surrogate markers of cardiovascular health. Studies have demonstrated reductions in systemic inflammatory markers like C-reactive protein (CRP) and improved endothelial function following periodontal treatment[21].

The impact of poor oral health extends to respiratory conditions, particularly pneumonia and chronic obstructive pulmonary disease (COPD). The oral cavity, especially in individuals with poor hygiene, periodontal disease, or xerostomia, can become colonized by respiratory pathogens such as *Streptococcus pneumoniae*, *Staphylococcus aureus*, and gram-negative bacilli. Aspiration of these pathogens or of enzymes from periodontal bacteria that alter respiratory epithelium adhesion sites can lead to infection[22].

Table 2: Oral-Systemic Disease Connections: Mechanisms and Management Implications [16- 21]

Systemic Disease	Primary Oral Condition Linked	Proposed Pathophysiological Mechanisms	Key Clinical Implications for Management
Diabetes Mellitus	Periodontitis	1. **Bidirectional Inflammation:** Periodontal cytokines (TNF-α, IL-6) induce insulin resistance. 2. **Hyperglycemia** impairs neutrophil function & healing in periodontium.	Periodontal treatment can lower HbA1c by ~0.4%. Oral evaluation is essential in annual diabetes reviews.
Cardiovascular Disease	Periodontitis	1. **Systemic Inflammation:** Increased CRP, fibrinogen. 2. **Direct Vascular Effects:** Bacteremia, endothelial dysfunction, increased platelet aggregation.	Managing periodontitis reduces systemic inflammatory burden. Consider it a modifiable CVD risk factor.
Respiratory Infections (Pneumonia)	Poor Oral Hygiene, Periodontitis	Aspiration of oropharyngeal pathogens (e.g., *S. pneumoniae*, *P. gingivalis*) into lower airways.	Improved oral hygiene reduces pneumonia risk, especially in elderly & hospitalized patients.
Adverse Pregnancy Outcomes	Periodontitis	Inflammatory mediators (PGE2, TNF-α) enter bloodstream, potentially triggering preterm labor and affecting fetal development.	Non-surgical periodontal therapy during pregnancy is safe and may reduce risk of preterm birth.
Rheumatoid Arthritis (RA)	Periodontitis	1. **Shared Inflammatory Pathways:** Similar cytokine profiles (TNF-α, IL-1, IL-6). 2. **Autoantigen Formation:** Bacterial enzymes (PAD) can citrullinate host proteins, triggering autoimmunity.	Periodontal treatment may reduce RA disease activity (DAS28 score). Joint dental-rheumatology care is beneficial.

The association between maternal periodontitis and adverse pregnancy outcomes, such as preterm low birth weight (PLBW) and preeclampsia, has been a significant focus of research. The proposed mechanism involves the hematogenous dissemination of periodontal pathogens and inflammatory mediators, such as prostaglandin E2 (PGE2) and TNF-α, from the oral cavity to the fetoplacental unit [3].

These agents can stimulate uterine contractions and cervical dilation prematurely or disrupt normal placental development. While findings across studies have varied, systematic reviews indicate that periodontitis is associated with a 2-4 times increased risk of PLBW, independent of traditional risk factors like smoking and socioeconomic status. Importantly, intervention studies suggest that non-surgical periodontal therapy during pregnancy is safe and may reduce the risk of preterm birth, particularly in women with high-risk pregnancies. This underscores the importance of including oral health screening and counseling as a component of prenatal care in family medicine [12].

A compelling link also exists between periodontitis and rheumatoid arthritis (RA), both chronic inflammatory diseases with remarkably similar underlying immunopathology. The cytokines driving tissue destruction in periodontitis (e.g., TNF-α, IL-1β, IL-6) are the same pivotal cytokines targeted by biologic therapies in RA. Furthermore, a specific periodontal pathogen, *Porphyromonas gingivalis*, possesses a unique enzyme, peptidylarginine deiminase (PAD), which can citrullinate host proteins. The generation of citrullinated proteins is a key step in the production of anti-citrullinated protein antibodies (ACPAs), which are highly specific for RA and often present years before clinical onset. This has led to the hypothesis that periodontitis may be an environmental trigger for RA in genetically susceptible individuals. Clinically, patients with RA often have more severe periodontitis, and treating periodontitis has been

shown in some studies to modestly reduce RA disease activity scores and systemic inflammation [3, 22].

Beyond these major associations, oral health plays a role in other systemic conditions. Chronic kidney disease (CKD) patients have a high burden of oral disease, and periodontitis may contribute to systemic inflammation and endothelial dysfunction, exacerbating cardiovascular comorbidities, which are the leading cause of death in CKD. Oral manifestations are also common in many systemic conditions; for example, lichen planus can manifest orally, and medication-induced xerostomia (dry mouth) from antidepressants, antihypertensives, and other common drugs significantly increases the risk of caries and oral candidiasis. For the family physician, a brief oral examination can sometimes reveal signs of nutritional deficiencies, immunosuppression, or manifestations of systemic illness [21, 22].

Practices in Preventive Oral Health within Family Medicine

Current evidence indicates that preventive oral health activities are not a routine component of standard family practice in many regions. A systematic review of primary care providers' practices found that while most acknowledge the importance of oral health, fewer than 25% routinely perform oral screenings or provide anticipatory guidance during well-child visits or chronic disease management appointments[22]. In the Saudi context, studies specific to family medicine are limited but revealing. One survey of family physicians in Riyadh found that only 12% reported routinely inquiring about oral health symptoms (e.g., bleeding gums, dry mouth) during consultations for diabetic patients[23]. Even fewer (approximately 8%) reported performing any form of visual oral cavity examination[23].

The scope of potential preventive oral health practices within family medicine is broad and can be stratified by patient age and risk status. For pediatric patients, this includes oral health risk assessment (e.g., feeding practices, fluoride exposure), counseling parents on diet and hygiene, and the application of fluoride varnish, which is an evidence-based intervention that can be efficiently performed by medical providers[24].

For adults, especially those with chronic conditions like diabetes, hypertension, or a history of CVD, practices should include screening questions for gingival bleeding and tooth mobility, a visual check for obvious caries or severe inflammation, assessment for xerostomia (a common side effect of over 500 medications), and tobacco cessation counseling that includes its oral effects[25]. Despite this clear scope, implementation is sporadic.

Table 3: Studies on Oral Health Practices Among Family Physicians and Primary Care Providers [22, 23, 24, 26, 27]

Study Location / Population	Key Findings on Preventive Oral Health Practices	Reference
Riyadh, Saudi Arabia (Family Physicians)	Only 12% routinely ask diabetic patients about oral symptoms; 8% perform oral exams. High perceived need for training.	Al-Ansari et al., 2020[23]
United States (Pediatricians)	77% provide oral health counseling; 44% perform knee-to-knee exams; <10% apply fluoride varnish routinely.	Lewis et al., 2017[24]
Canada (Family Medicine Residents)	91% agreed oral health is their responsibility, but 74% felt poorly prepared. Low confidence in performing screenings.	Doucet et al., 2019[26]
Australia (General Practitioners)	60% inquire about oral health in diabetic patients; 35% feel competent to identify periodontal disease.	George et al., 2016[27]
Multi-country Review	Major barriers: lack of training (92%), time (85%), and unclear referral pathways (78%).	Patel et al., 2021[22]

Several interconnected barriers contribute to these suboptimal practices. The most frequently cited barrier across global studies is a lack of formal training and perceived lack of competence. Many family physicians receive minimal to no education on oral health during medical school or residency training[26]. This leads to low self-efficacy in identifying oral pathologies, interpreting findings, and knowing appropriate referral indications. Time constraints during typically short consultations are another major practical hurdle, often causing oral health to be deprioritized in favor of more acute or traditional chronic disease management issues[22]. Systemic and financial disincentives play a critical role; in many fee-for-service systems, including elements of Saudi Arabia's health sector, there is no billing code or financial reimbursement for oral health screening or counseling, rendering it an uncompensated activity[28]. Furthermore, professional role perception and inter-professional boundaries create a significant barrier. A long-standing cultural and educational divide between medicine and dentistry fosters the perception that the oral cavity is exclusively the domain of dentists[29]. Some family physicians may hesitate to "intrude" into this area or may lack established relationships and communication channels with local dental professionals, making referral feel impersonal or ineffective. Lack of access to clear, simple clinical guidelines or protocols tailored for the primary care setting also contributes to inaction. Without a standardized, quick-reference tool to guide them—such as a "SNAP" (Smoking, Nutrition, Alcohol, Physical activity) style protocol for oral health—physicians are less likely to incorporate new screening elements into their already complex workflows[30].

Barriers to Effective Integration of Oral Health in Family Medicine

A foundational and nearly universal barrier is the deficiency in oral health education during medical and family medicine training. Most medical school curricula and family medicine residency programs globally dedicate minimal, if any, structured time to oral health assessment, the oral-systemic disease connection, or preventive oral health counseling[30]. A survey of family medicine residents in North America found that over 85% reported receiving less than three hours of oral health education during their entire training, and 74% felt "not at all prepared" to address oral health issues in practice[31]. This educational gap directly translates into low self-efficacy and clinical inertia. Physicians cannot be expected to confidently perform screenings, identify pathologies like gingivitis or early caries, or provide counseling on topics for which they have received no formal instruction. In Saudi Arabia, while specific national data is limited, studies of practicing family physicians indicate a strong correlation between those who received any form of post-graduate oral health training and a higher likelihood of engaging in preventive oral health practices[32]. Closely linked to knowledge deficits are significant clinical-practical barriers that hinder day-to-day implementation. Foremost among these is time constraint. The typical primary care consultation is brief and must address numerous competing preventive and curative priorities. Incorporating a thorough oral examination or detailed counseling on flossing technique is often perceived as unfeasible within these time limits[33]. The absence of streamlined, point-of-care clinical tools and protocols exacerbates this issue. Without simple, validated screening tools (e.g., short validated questionnaires, rapid visual inspection guides) integrated into electronic health record (EHR) templates or chronic disease flowcharts, the process remains ad-hoc and inefficient[34]. Furthermore, lack of immediate access to diagnostic tools (e.g., dental lights, explorers) and uncertainty about referral pathways and criteria create practical friction. A physician may identify a potential problem but then face delays or unclear procedures for referring the patient to an appropriate dental professional, leading to missed follow-through[35, 36].

Table 4: Barriers to Oral Health Integration in Family Medicine

Category of Barrier	Specific Examples	Supporting Evidence / Manifestation
Educational & Training	Lack of curriculum in medical school/residency; Low clinician confidence & self-efficacy.	>85% of residents receive <3 hrs of training; 74% feel unprepared[31]. Saudi physicians with CME report 3x higher practice rates[32].
Clinical-Practical	Time constraints per visit; Lack of simple screening tools/protocols; Unclear referral pathways.	Cited as top barrier by 78% of GPs; Ad-hoc practices without EHR prompts are inefficient[33],[34].
Systemic & Financial	No reimbursement for oral health screening/counseling; Siloed medical & dental systems.	Non-billable services are consistently deprioritized[36]. Separate facilities & records hinder coordination[37].
Attitudinal & Cultural	Perception that oral health is "not my job"; Patient reluctance to seek dental care; Low priority.	40% of FPs believe oral exams are solely a dentist's role[38]. Cultural stigma & fear drive low dental attendance[39].
Patient-Related	Low oral health literacy; Financial constraints for dental care; Cultural beliefs & fear.	Patients may not report symptoms or understand links to systemic disease[39]. Dental costs are a significant deterrent.

Deeply ingrained attitudinal and cultural barriers further complicate integration. Among healthcare professionals, there persists a traditional professional territoriality, where the mouth is considered the exclusive domain of dentistry. Some family physicians express reluctance to "encroach" on a colleague's specialty or believe they lack the legitimate authority to advise on oral health[38]. This is compounded by patient attitudes and health literacy. Patients may not perceive oral health as relevant to their diabetes or heart disease management, and thus do not report symptoms like bleeding gums. In some cultural contexts, including parts of Saudi society, dental care may be sought only for pain relief (extraction-oriented) rather than prevention, and there may be underlying fear or stigma associated with dental visits[39].

Patient-level barriers interact with and reinforce system-level failures. Financial constraints are paramount; even if a family physician makes a perfect referral, the patient may face significant out-of-pocket costs for dental treatment, which is often not covered comprehensively by insurance schemes in the same way as medical care, leading to forgone care[40]. Geographic accessibility can be an issue, particularly in rural or remote areas of the Kingdom where dental specialist availability is limited.

Language and communication barriers in a multicultural expatriate and domestic population can also impede effective patient education and understanding of the importance of integrated care.

CONCLUSION

The management of chronic diseases in Saudi Arabia requires a holistic approach that moves beyond traditional medical silos. A clear bidirectional link exists between oral and systemic health, making oral care a vital component in managing conditions like diabetes and cardiovascular disease. Neglecting this connection undermines patient outcomes and increases long-term healthcare costs. Family medicine, with its continuous and comprehensive model of care, is the logical platform to integrate preventive oral health screenings, patient education, and coordinated dental referrals. Effective integration, however, faces significant barriers including gaps in medical education, limited clinical time, and systemic challenges like separate financing for medical and dental care. For Saudi Arabia, overcoming these obstacles is a strategic priority directly aligned with the preventive health goals of Vision 2030.

RECOMMENDATIONS

- Implement Structural Integration: Develop and mandate the use of standardized oral health screening tools within primary care electronic health records, coupled with formal referral pathways and financing models that incentivize interprofessional collaboration.
- Enhance Professional Education: Integrate oral-systemic health modules into undergraduate medical curricula and create accredited continuing education for family physicians to build competency and confidence in preventive oral health practices.
- Launch Public and Professional Awareness Campaigns: Initiate nationwide public health initiatives to educate patients on the oral-chronic disease link, alongside campaigns within the medical community to champion the physician's role in oral health promotion.

LIMITATIONS

This narrative review has several limitations. Its methodology, while comprehensive, does not constitute a systematic review, potentially introducing selection bias in the literature examined. The conclusions are also constrained by the relative scarcity of high-impact studies conducted specifically within the Saudi primary care context, necessitating reliance on evidence from other healthcare systems. Furthermore, the review focuses on conceptual and professional barriers, with less exploration of patient-level cultural and behavioral factors that may influence the acceptance of integrated care.

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