

THE SCIENTIFIC DISCOURSE ON INNOVATIVE PERSPECTIVES REGARDING THE ROLE OF FAMILY DENTISTS IN PRIMARY DENTAL CARE AND PUBLIC HEALTH: CHALLENGES, EVIDENCE AND FUTURE DIRECTIONS GLOBALLY

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ABSTRACT

Family dentists occupy a pivotal position in modern healthcare systems, serving not only as primary providers of oral health services but also as critical contributors to the wider spectrum of public health. Traditionally, their role has been confined to the prevention, diagnosis, and treatment of common dental conditions; however, evolving evidence highlights that family dentistry extends far beyond the operatory, linking oral health directly with systemic well-being, quality of life, and population health outcomes. This paper explores innovative perspectives on the global role of family dentists in primary dental care and public health, with an emphasis on challenges, evidence, and future directions that underscore their expanding significance. At the core of family dentistry lies the continuity of care across all age groups, which uniquely positions these practitioners as long-term guardians of oral health. Evidence shows that routine preventive interventions delivered in primary dental care settings can reduce the burden of oral diseases that remain among the most prevalent worldwide, such as caries, periodontitis, and oral cancers. Yet, the impact of family dentists transcends clinical practice. By adopting a biopsychosocial framework, they become central actors in health promotion campaigns, community-based prevention programs, and multidisciplinary collaborations that address the social determinants of health. Their frequent contact with patients allows them to engage in early detection of systemic conditions with oral manifestations, such as diabetes, cardiovascular diseases, and autoimmune disorders, thereby reinforcing the bidirectional relationship between oral and general health. Despite this potential, significant challenges hinder the full integration of family dentists into public health infrastructures globally. These include inequitable access to primary dental care, disparities in workforce distribution between urban and rural areas, limited inclusion of oral health in national healthcare policies, and underfunded public health initiatives. Furthermore, cultural, socioeconomic, and political barriers exacerbate inequalities in oral health outcomes, particularly in low- and middle-income countries where dental care remains predominantly treatment-oriented rather than preventive. Addressing these challenges requires systemic innovations, including policy reforms that recognize oral health as integral to overall health, investment in preventive strategies, and incorporation of family dentists into interprofessional healthcare models. Emerging evidence supports the transformative role of family dentists in population health through school-based oral health education, tele-dentistry services in underserved regions, community water fluoridation advocacy, and participation in vaccination or screening campaigns for oral and systemic diseases. The adoption of digital health technologies, artificial intelligence, and data-driven public health surveillance further expands their potential to contribute to early diagnosis, personalized care, and large-scale health monitoring. These innovations, combined with a

growing global awareness of oral health's relevance to noncommunicable diseases, point toward a future in which family dentists act not merely as service providers but as public health leaders. The family dentists are uniquely positioned to bridge the gap between individual clinical practice and collective health promotion. By reimagining their role within the broader framework of primary care and global public health, and by addressing structural barriers, family dentistry can evolve into a cornerstone of sustainable healthcare systems. This paradigm shift requires international cooperation, research-driven policies, and innovative models of practice that place oral health at the heart of public health strategies worldwide.

Keywords: Family dentists; primary dental care; preventive dentistry; public health; oral-systemic health; healthcare policy; global health; tele-dentistry.

INTRODUCTION

The story of family dentistry and its evolving role in primary dental care and public health is deeply intertwined with the broader history of medicine, public health reform, and the changing nature of societies themselves. Oral health has long been treated as a discrete discipline, sometimes marginalized from the central currents of medicine, and yet its relevance has become increasingly undeniable as evidence demonstrates profound interconnections between oral health and systemic well-being. The modern family dentist, therefore, embodies a profession that is simultaneously clinical, educational, social, and political, tasked with addressing not only the immediate dental concerns of patients but also the larger determinants of health that shape populations globally. In an era defined by rapid technological innovation, global demographic shifts, and persistent inequalities, examining innovative perspectives on the role of family dentists is not merely an academic exercise but a necessity for guiding sustainable healthcare systems of the future.

Historically, dentistry developed in parallel to medicine, influenced by societal structures, guild traditions, and the evolution of surgical and prosthetic techniques. By the nineteenth century, dentistry began to formalize as a profession distinct from general medicine, with its own institutions, training pathways, and areas of expertise. This separation, however, created lasting consequences that still shape healthcare delivery today. Oral health became siloed, often excluded from public health frameworks and national health systems. Family dentists, working predominantly in private practice models, often became isolated from broader public health initiatives. This fragmentation has contributed to inequities in access and has delayed the recognition of oral health as a core component of general health. It is against this historical backdrop that the contemporary movement to reintegrate family dentistry into the fabric of public health gains urgency.

The conceptual framework of family dentistry has always emphasized continuity of care across the human lifespan, a principle that resonates strongly with primary care philosophies. Unlike specialized dental practices that focus on narrow clinical domains, family dentists manage the diverse needs of children, adults, and the elderly, often caring for multiple generations within the same household. This continuity not only strengthens patient-provider relationships but also enhances opportunities for preventive interventions, longitudinal health monitoring, and personalized care. The biopsychosocial model, increasingly adopted across healthcare disciplines, finds particular relevance here. Oral health is not simply a matter of biological pathology; it is shaped by psychosocial dynamics, economic circumstances, cultural practices, and environmental exposures. The family dentist, by virtue of their sustained engagement with individuals and families, is positioned to interpret and respond to this complex interplay of determinants.

Globally, the burden of oral disease remains staggering. Dental caries, periodontal disease, and tooth loss are among the most prevalent conditions worldwide, affecting billions of individuals and contributing to pain, functional limitations, and reduced quality of life. Oral cancers, frequently diagnosed at late stages, add a layer of mortality and morbidity that disproportionately affects disadvantaged groups. These

conditions do not exist in isolation; they intersect with systemic illnesses, exacerbate chronic disease trajectories, and generate significant economic costs for individuals and societies. The World Health Organization has increasingly highlighted oral health as a critical public health concern, yet translation of this recognition into concrete policy and funding remains inconsistent across regions. Family dentists, as front-line providers, carry the responsibility of addressing these global challenges not only within the operatory but also through advocacy, education, and participation in health systems reform.

In developed nations with well-resourced healthcare systems, family dentists face distinct opportunities and challenges. Preventive services are often more accessible, yet inequalities persist along socioeconomic lines. The elderly population, for example, is expanding rapidly in Europe, North America, and parts of Asia, bringing new complexities in managing polypharmacy, multimorbidity, and geriatric syndromes that have oral health implications. In these contexts, family dentists must adapt their practice models to include geriatric-friendly care, interdisciplinary collaboration with medical teams, and use of advanced technologies for monitoring systemic-oral interactions. In contrast, in low- and middle-income countries, the dominant challenge is lack of access. Dental services are often concentrated in urban centers, heavily reliant on out-of-pocket payments, and skewed toward treatment rather than prevention. Here, family dentists can play a transformative role through mobile clinics, community-based preventive programs, and tele-dentistry initiatives that bridge geographical barriers. These contrasting realities demonstrate that while the role of family dentists is globally significant, its expression is shaped by local epidemiology, policy environments, and resource constraints.

The integration of oral health into public health frameworks requires reimagining the dentist's role as not just a technical expert but as a public health leader. This involves participation in interdisciplinary health teams, contribution to surveillance systems, and active involvement in shaping policy. The evidence linking oral health with systemic diseases strengthens the argument for such integration. Periodontitis has been associated with increased risks of cardiovascular disease, adverse pregnancy outcomes, and poor glycemic control in diabetes. Conversely, systemic conditions like osteoporosis, HIV, and autoimmune diseases often manifest in the oral cavity, where family dentists may be the first to recognize signs. By identifying these conditions early, dentists can facilitate timely referrals and interventions, underscoring their potential as sentinels of general health. The COVID-19 pandemic further highlighted the importance of oral health providers in infectious disease control, vaccine advocacy, and maintaining continuity of care under crisis conditions. These lessons reinforce the indispensability of family dentists in public health resilience.

The future of family dentistry is also being shaped by technological innovation. Artificial intelligence offers new tools for risk prediction, diagnosis, and personalized treatment planning. Digital health technologies enable seamless sharing of patient data across disciplines, supporting integrated care pathways. Tele-dentistry expands access to underserved regions, while minimally invasive techniques and biomaterials enhance preventive and restorative care. Genomic science introduces possibilities for personalized oral healthcare, linking genetic risk factors with tailored preventive regimens. For family dentists, embracing these innovations requires continuous professional development, adaptability, and advocacy for equitable distribution of new technologies. Without attention to equity, technological progress risks deepening the divide between privileged and marginalized populations.

Policy and education reform are equally essential. Dental curricula must prepare future practitioners not only for clinical excellence but also for leadership in community health, research, and interprofessional collaboration. This includes training in health economics, behavioral sciences, epidemiology, and digital health competencies. Policymakers, in turn, must address workforce distribution, ensuring incentives for family dentists to serve in rural and underserved areas. Universal health coverage schemes must explicitly include oral health, recognizing it as integral to overall well-being rather than as an optional or luxury

service. International organizations, from the WHO to regional health bodies, have a vital role in harmonizing policy frameworks, supporting evidence-based guidelines, and fostering cross-border collaboration in oral health research and practice.

The intersection of family dentistry with global public health also aligns closely with the United Nations Sustainable Development Goals. Oral health contributes to Goal 3 on good health and well-being, but also intersects with goals related to education, reduced inequalities, and sustainable cities and communities. For instance, school-based oral health education improves both health and educational outcomes by reducing absenteeism due to pain. Advocacy for sugar reduction policies addresses both obesity and oral disease, illustrating the interconnectedness of health determinants. In this sense, family dentists can be viewed as agents of sustainable development, contributing to global agendas that transcend the boundaries of traditional dental practice.

The role of family dentists in contemporary healthcare has evolved considerably over the past century, reflecting broader transformations in medical science, public health policy, and societal expectations. Oral health, once regarded as a narrowly defined clinical discipline focused on the treatment of caries, periodontal disease, and tooth loss, is now recognized as a fundamental component of general health and well-being. Increasingly, oral conditions are understood not only as local problems but also as indicators and determinants of systemic health. This shifting paradigm has placed family dentists at the intersection of primary dental care and global public health, positioning them as essential providers of preventive services, educators, early diagnosticians, and advocates for equitable healthcare delivery. Exploring this expanded role requires a critical examination of both the challenges and opportunities shaping dental practice worldwide, as well as the evidence base that supports innovative approaches to integrating dentistry within public health frameworks.

Family dentistry, by definition, is rooted in continuity of care across the lifespan, spanning pediatric, adult, and geriatric populations. This longitudinal relationship fosters trust, familiarity, and consistent monitoring of oral health trajectories over time. Such continuity allows family dentists to recognize patterns of disease progression, identify early warning signs of systemic illnesses with oral manifestations, and provide holistic care that accounts for the biological, psychological, and social dimensions of health. The family dentist often serves as the first point of contact in dental systems, akin to the role of family physicians in general medicine. By being accessible, familiar, and patient-centered, family dentists are uniquely positioned to deliver preventive interventions that reduce the burden of oral diseases and to engage communities in health promotion activities that extend beyond the dental chair. This dual role situates family dentists not only as clinicians but also as integral actors in advancing public health goals.

The global burden of oral diseases underscores the urgent need for innovative strategies in primary dental care. According to the World Health Organization, oral diseases affect nearly 3.5 billion people worldwide, with dental caries being the most common noncommunicable disease globally. Periodontal disease, edentulism, and oral cancers further contribute to significant morbidity, impacting quality of life, nutritional status, employability, and social participation. The prevalence of these conditions reflects profound inequalities across socioeconomic strata, geographical regions, and healthcare systems. In many low- and middle-income countries, access to affordable and timely dental care remains limited, with the majority of services concentrated in urban centers and dominated by private, fee-for-service models. Even in high-income nations with more comprehensive systems, disparities persist, particularly among marginalized populations such as migrants, rural residents, and socioeconomically disadvantaged groups. These inequities highlight systemic challenges that family dentists are well placed to address through community-based practice models, outreach, and integration with broader healthcare networks.

According to epidemiological concerns, the evolving understanding of the relationship between oral health and systemic health has broadened the responsibilities of family dentists. Conditions such as

diabetes, cardiovascular disease, respiratory illnesses, and autoimmune disorders demonstrate well-documented links with oral health status. Periodontitis, for instance, has been associated with adverse pregnancy outcomes, poor glycemic control, and increased cardiovascular risk. Likewise, oral manifestations are often the first indicators of systemic diseases such as HIV/AIDS or leukemia. These intersections underscore the need for family dentists to operate within multidisciplinary healthcare frameworks, collaborating with physicians, nurses, dietitians, and public health professionals to provide integrated, patient-centered care. As the global burden of chronic noncommunicable diseases rises, the dentist's role in prevention, early detection, and management becomes increasingly critical.

Despite their potential, family dentists face significant structural and systemic barriers that limit their contribution to public health. One major challenge is the traditional separation of dentistry from mainstream medicine, a division rooted in historical, educational, and financial frameworks. This separation has resulted in fragmented healthcare delivery, with oral health often excluded from public health policy, funding streams, and universal healthcare coverage. Consequently, dental services remain inaccessible to large segments of the population, reinforcing inequities and undermining global health targets. Another challenge lies in workforce distribution. Many countries report a maldistribution of dental professionals, with concentrations in urban areas and shortages in rural or underserved regions. Family dentists, who could play a pivotal role in addressing these disparities, are often constrained by limited resources, inadequate policy support, and insufficient integration into public health infrastructure.

The changing landscape of healthcare also demands innovation in the scope and delivery of family dental practice. Advances in digital technologies, artificial intelligence, and tele-dentistry are redefining how care is accessed, monitored, and delivered. Tele-dentistry, for example, has emerged as a powerful tool for extending services to remote communities, enabling consultations, triage, and preventive education where traditional in-person care is impractical. Similarly, digital diagnostic tools, chairside imaging, and AI-driven predictive analytics offer family dentists new capabilities in early disease detection and personalized care planning. Integrating these innovations into routine family dental practice has the potential to transform both individual and population-level outcomes. Yet the implementation of these technologies requires not only financial investment but also training, ethical oversight, and equitable distribution to prevent widening the digital divide.

Another important dimension is the dentist's role in community and population health promotion. Beyond the clinic, family dentists can act as advocates for preventive policies such as water fluoridation, sugar taxation, and smoking cessation initiatives. They can participate in school-based oral health programs, collaborate with local governments to design community-level prevention strategies, and engage in health literacy campaigns that empower individuals to take control of their oral health. These activities expand the dentist's role from an individual service provider to a public health actor with influence on structural determinants of health. In this capacity, family dentists align with the broader goals of the United Nations Sustainable Development Goals, particularly those addressing health equity, education, and reduced inequalities.

Future directions in the role of family dentists must consider both opportunities and challenges in global contexts. In high-income countries, the focus may be on integrating dentistry with primary medical care, leveraging digital health technologies, and addressing aging populations with complex healthcare needs. In contrast, in low- and middle-income settings, the priority may lie in expanding access through mobile clinics, public-private partnerships, and preventive strategies tailored to local epidemiological profiles. Across all contexts, policy reform is essential to embed oral health into universal healthcare coverage, ensure equitable workforce distribution, and prioritize prevention over treatment. Academic institutions also play a critical role by reforming curricula to prepare dentists for broader roles in interdisciplinary teams and community health initiatives.

As the field evolves, family dentists must embrace an identity that combines clinical expertise with public health leadership, research engagement, and community advocacy. The evidence increasingly demonstrates that oral health cannot be isolated from overall health, nor can it be achieved without systemic interventions that address socioeconomic and cultural determinants. Family dentists stand at the forefront of this transformation, with the potential to bridge gaps in healthcare systems, promote equity, and contribute meaningfully to the well-being of populations worldwide. This reimagined role requires a global perspective that acknowledges diverse contexts, fosters innovation, and builds upon evidence to guide sustainable practice models. By situating family dentistry at the nexus of primary care and public health, we open the door to a more holistic, equitable, and forward-looking vision of healthcare for the twenty-first century.

The role of family dentists in primary dental care and public health is undergoing a profound transformation. No longer confined to the treatment of caries and extractions, the family dentist of the twenty-first century is envisioned as a clinician, educator, innovator, policy advocate, and public health leader. This expanded role is both an opportunity and a challenge, demanding new competencies, systemic reforms, and a global perspective that accounts for diverse cultural, economic, and epidemiological contexts. The future of oral health—and indeed of healthcare more broadly—depends on reimagining the contributions of family dentists to align with the realities of a complex, interconnected world. By integrating innovative practices, embracing evidence-based policy, and addressing structural barriers, family dentists can help build more equitable, resilient, and holistic health systems worldwide.

BACKGROUND

The landscape of primary healthcare is perpetually evolving, shaped by the relentless currents of scientific discovery, demographic shifts, economic pressures, and a deepening understanding of the intricate links between oral health and systemic well-being. At the heart of this dynamic field, particularly within the domain of dentistry, stands the family dentist—a professional whose role, while traditionally foundational, is now being re-examined and redefined through innovative perspectives. The title "Innovative Perspectives on the Role of Family Dentists in Primary Dental Care and Public Health: Challenges, Evidence, and Future Directions Globally" encapsulates a critical inquiry into the future of oral healthcare delivery. To fully appreciate the necessity of this inquiry, one must first traverse the historical context of dental care, comprehend the modern burden of oral diseases, understand the paradigm shift towards a health-centric model, and recognize the unique position of the family dentist at the convergence of individual care and community health. This background sets the stage for exploring the challenges that constrain this potential, the evidence that supports an expanded role, and the future directions that could redefine global oral health.

The historical trajectory of dentistry offers crucial insights into its present state. For centuries, dental care was largely remedial, a response to pain and infection, often delivered by barbers or general physicians with limited tools and knowledge. The professionalization of dentistry in the 19th and 20th centuries established it as a distinct medical field, leading to standardized education, licensure, and the development of sophisticated techniques for restoring form and function. This era cemented the surgical and restorative model of care, a model that overwhelmingly focused on the treatment of disease after its manifestation. The family dentist, or general dental practitioner, emerged as the primary point of contact within this system, responsible for diagnosing decay and periodontal disease, performing fillings, extractions, and prosthetics, and providing basic preventive advice, typically centered on oral hygiene instruction. This model achieved significant successes, relieving immense suffering and restoring the ability to eat and speak for millions. However, it was inherently limited, often operating in isolation from the broader healthcare system and focusing on a narrow set of oral conditions rather than the patient's overall health status. The dental practice

was frequently seen as a separate entity, a workshop for the mouth, rather than an integral component of primary healthcare.

This historical separation is particularly significant given the overwhelming and persistent global burden of oral diseases. According to the Global Burden of Disease Study, oral conditions affect nearly three and a half billion people worldwide, making them the most common non-communicable diseases (NCDs). Untreated dental caries in permanent teeth is the single most prevalent condition, affecting a significant portion of the global population. Periodontal disease, a major cause of tooth loss, is also immensely widespread. The impact of these diseases extends far beyond the mouth. They are a leading cause of pain and suffering, leading to missed school days, reduced workplace productivity, and diminished quality of life. The psychosocial consequences can be severe, affecting self-esteem, social interaction, and even nutritional status, as individuals may avoid certain foods due to dental problems. Crucially, the distribution of this burden is not equitable. A profound disparity exists, with marginalized populations—including those of low socioeconomic status, racial and ethnic minorities, rural communities, the elderly, and individuals with special needs—disproportionately affected. These populations face formidable barriers to accessing traditional dental care, including cost, geographic availability, cultural factors, and fear. This inequity underscores the failure of a purely treatment-oriented, clinic-based model to address the population-level needs of oral health. It highlights the urgent necessity for approaches that transcend the confines of the dental chair and address the social, economic, and environmental determinants of health.

It is within this context of historical limitation and overwhelming need that a powerful paradigm shift has gained momentum: the recognition of the inextricable link between oral health and general systemic health. This is perhaps the most significant development shaping innovative perspectives on the role of dentistry. The mouth is not an isolated organ; it is a gateway to the body and a mirror reflecting overall health. Robust scientific evidence now solidly links poor oral health, particularly periodontitis, to a range of serious systemic conditions. The chronic inflammation associated with periodontal disease has been implicated in the pathogenesis and progression of cardiovascular diseases, including atherosclerosis and endocarditis. It is a recognized comorbidity for diabetes, with a well-established bidirectional relationship where diabetes increases the risk for periodontitis, and severe periodontitis can adversely affect glycemic control. Associations have also been found with adverse pregnancy outcomes, respiratory diseases like pneumonia, and rheumatoid arthritis. Furthermore, the oral cavity can be the site of manifestations of systemic diseases and a source of pathogens that can compromise individuals with weakened immune systems. This biological integration demands a clinical integration. It is no longer tenable for oral healthcare to operate in a silo, separate from the rest of medicine. The mouth must be reintegrated into the body for healthcare purposes, necessitating collaboration, shared patient records, and interprofessional education and practice.

The paradigm shift is further reinforced by the evolving concept of primary healthcare, as championed by the World Health Organization. The seminal Alma-Ata Declaration defined primary healthcare as essential care based on practical, scientifically sound, and socially acceptable methods, made universally accessible to individuals and families through their full participation and at a cost the community can afford. It emphasizes health promotion, disease prevention, and addressing the wider determinants of health, not just curative services. This holistic, person-centered approach stands in contrast to a narrow, disease-focused model. For dentistry, this means moving beyond a "drill-and-fill" mentality to embrace a role that includes health education, dietary counseling, tobacco cessation programs, early childhood caries prevention initiatives, and community-wide outreach. It positions oral health as a fundamental component of overall health and well-being, not a luxury or an afterthought.

It is at the precise intersection of this new health paradigm and the existing dental care infrastructure that the family dentist finds a new and vastly expanded potential role. The family dentist is uniquely

positioned to be a key agent of change in this new era. Unlike dental specialists who focus on a specific area of the mouth or a particular procedure, the family dentist provides continuous, comprehensive, and personalized care to individuals and families across all age groups. They often see multiple generations of the same family, granting them a longitudinal view of their patients' health histories, social circumstances, and risk factors. This continuity of care fosters trust and a therapeutic relationship that is essential for effective health promotion and behavioral change. The family dental practice, therefore, is not just a treatment center but a potential health hub within the community. This existing, widespread network of primary oral care providers represents an immense and underutilized resource for public health. The innovative perspective argues that the family dentist must be empowered and supported to step into this broader role, transitioning from a sole focus on technical procedures to becoming an oral physician and a health advocate.

The expanded role encompasses several key dimensions. First is the embrace of a true preventive and health-promotion model. This goes beyond telling patients to brush and floss. It involves conducting detailed caries and periodontal risk assessments, applying evidence-based preventive agents like fluoride varnishes and dental sealants, and providing personalized coaching on diet and lifestyle. Second is the role of an early screener and health sentinel. The family dentist, during a routine examination, is in an ideal position to identify early signs of systemic conditions. This can include screening for oral cancer through visual and tactile examinations, checking for signs of eating disorders, noting manifestations of vitamin deficiencies, and identifying patients with undiagnosed diabetes based on oral symptoms. They can then refer patients to physicians for diagnosis and management, facilitating early intervention. Third is the critical function of navigation and care coordination. The family dentist can serve as the point of contact, helping patients navigate the complex healthcare system, communicating with physicians, pharmacists, and other health professionals to ensure integrated and coherent care. Finally, there is a community-level public health role. Family dentists can engage with local schools to provide sealant programs, participate in health fairs, advocate for community water fluoridation, and collaborate with public health agencies on outreach programs targeting vulnerable populations.

However, this promising vision is fraught with formidable challenges that must be acknowledged. The existing dental care systems in many countries are not structured to support or incentivize this expanded, preventive, and health-oriented role. Payment models, particularly fee-for-service structures, often reimburse for procedures like fillings and crowns more generously than for time-consuming preventive counseling, risk assessments, or interprofessional collaboration. This creates a significant financial disincentive for dentists to practice in this new way. The dental curriculum, while increasingly incorporating these concepts, has historically been focused on technical proficiency and restorative skills, leaving many practicing dentists underprepared for roles in screening, health communication, and public health advocacy. There is a pressing need for continuing education and professional development in these areas. Furthermore, deep-seated silos between dentistry and medicine persist, characterized by separate electronic health records, a lack of common language, and limited opportunities for interprofessional learning and practice. Overcoming these structural and cultural barriers is essential. Finally, the global context adds another layer of complexity. The challenges and potential solutions for a family dentist in a high-income country with a well-developed infrastructure will be vastly different from those facing a provider in a low-resource setting where access to basic care, electricity, and even clean water may be limited. A one-size-fits-all approach is impossible; innovative perspectives must be adaptable and context-specific.

Reimagining the role of the family dentist is built upon a confluence of factors: a historical model that has proven insufficient to address global needs, the staggering and inequitable burden of oral disease, the revolutionary understanding of the oral-systemic health connection, and the aligning principles of

modern primary healthcare. The family dentist, with their unique position of trust and continuity of care, is poised to evolve from a technical restorer of teeth into a comprehensive primary healthcare provider and public health advocate. This evolution is not merely a desirable enhancement but a necessary response to global health challenges. The path forward requires a critical examination of the evidence supporting this expanded role, a clear-eyed assessment of the systemic and educational challenges that impede it, and a global dialogue to forge future directions that can unlock the immense potential of family dentists to improve not just oral health, but overall health and well-being for populations around the world. This paper will delve into these very issues, exploring the challenges, synthesizing the evidence, and proposing innovative pathways for the future.

GOAL

The primary goal of this study is to critically examine and redefine the role of family dentists within the dual contexts of primary dental care and public health on a global scale. Specifically, it seeks to explore innovative perspectives that highlight how family dentists contribute to disease prevention, health promotion, and systemic healthcare integration beyond their traditional clinical responsibilities. By analyzing challenges such as inequitable access, workforce distribution, and policy fragmentation, alongside emerging opportunities created by technological advancements, interprofessional collaboration, and public health initiatives, the study aims to provide a comprehensive understanding of the evolving responsibilities of family dentists. The broader objective is to generate evidence-based insights that can inform healthcare policy, guide curriculum reform in dental education, and promote sustainable strategies that position family dentists as pivotal actors in advancing population health and achieving global health equity.

METHODOLOGY

The present study employed a narrative review and analytical synthesis approach in order to explore the evolving role of family dentists within the dual frameworks of primary dental care and public health at a global level. Given the complex and multifaceted nature of the topic, the methodology was designed to capture not only empirical data but also conceptual perspectives, policy frameworks, and innovative practices shaping the field. Unlike systematic reviews that rely on rigid inclusion and exclusion criteria, the narrative review strategy enabled a broader exploration of diverse sources, encompassing scientific literature, public health reports, international policy documents, and emerging evidence from both high-income and low- and middle-income countries.

The review process began with an extensive literature search across major academic databases, including PubMed, Scopus, Web of Science, and Google Scholar, covering the period from 2015 to 2025. To peer-reviewed journal articles, grey literature was included to provide a comprehensive picture of the topic. This encompassed World Health Organization reports, guidelines issued by national dental associations, position papers from global health organizations, and governmental policy frameworks related to oral health integration into primary care systems. Including grey literature allowed the study to account for policy-level insights and practical experiences that may not yet have been captured in academic publications but which are central to understanding real-world challenges and solutions.

Sources were screened for relevance based on their focus on family dentists, their role in primary care, or their contributions to public health. Studies that addressed only narrow aspects of clinical dentistry without broader reference to systemic, policy, or public health implications were excluded. Priority was given to literature that provided evidence of integration between oral and general health, explored innovative strategies such as tele-dentistry and artificial intelligence, or highlighted global disparities in access and workforce distribution. Data extraction focused on identifying recurring themes, innovations,

challenges, and proposed future directions. The analysis was guided by an interpretive framework that combined the biopsychosocial model of health with public health systems theory. This framework allowed for exploration of how family dentists contribute not only to clinical outcomes but also to community health, social equity, and health system sustainability. The extracted findings were organized thematically into categories such as preventive care, systemic disease interactions, technological innovations, workforce challenges, policy integration, and global health implications. These themes provided the structure for synthesis and interpretation in the subsequent sections of the study.

Critical appraisal of the evidence was undertaken to assess the robustness, limitations, and applicability of findings across different contexts. Rather than applying rigid scoring systems, the appraisal was qualitative, focusing on identifying gaps in evidence, contextual limitations, and areas where further research is needed. Comparative perspectives were applied to highlight differences between high-income and low- and middle-income countries, as well as between regions with varying policy approaches to oral health.

By combining diverse sources of evidence with conceptual analysis, this methodology enabled a holistic examination of the role of family dentists in both primary care and public health globally. The approach reflects the understanding that oral health cannot be adequately studied in isolation but must be contextualized within broader social, cultural, economic, and political frameworks. The chosen methodology also provides flexibility to integrate future innovations and emerging evidence, ensuring that the study remains relevant in the rapidly changing landscape of global health.

RESULTS AND DISCUSSION

The synthesis of the literature and global evidence reveals that family dentists occupy a unique and pivotal position within primary healthcare systems, functioning as both clinicians and agents of public health. Across diverse regions and healthcare models, family dentists are recognized not merely for their role in treating dental disease but for their capacity to deliver preventive interventions, educate communities, and integrate oral health into broader health systems. The findings indicate a complex interplay between clinical responsibilities, population health advocacy, and systemic constraints, underscoring the multifaceted nature of the profession. The evidence suggests that while family dentists have historically been perceived primarily as providers of restorative and corrective care, their scope is rapidly expanding to encompass preventive, diagnostic, and interprofessional functions that are central to improving population health outcomes.

Global analyses indicate that the distribution of family dentists is heavily influenced by economic development, healthcare infrastructure, and policy priorities. In high-income countries such as the United States, the United Kingdom, Germany, and Japan, family dentists typically operate within structured primary care systems supported by insurance mechanisms or publicly funded programs. These frameworks facilitate patient access to routine check-ups, preventive care, and early disease detection. Data from these regions demonstrate that regular engagement with family dentists is associated with reduced incidence of dental caries, periodontitis, and tooth loss, as well as improved oral hygiene practices and patient knowledge. Moreover, these dentists often participate in multidisciplinary teams, collaborating with physicians, dietitians, nurses, and other health professionals to manage chronic diseases with oral manifestations, such as diabetes, cardiovascular conditions, and autoimmune disorders. Such integration highlights the potential for family dentists to act as conduits between oral and systemic healthcare, reinforcing the concept of patient-centered care within a holistic health paradigm.

Conversely, low- and middle-income countries face markedly different realities. In regions such as Sub-Saharan Africa, South Asia, and parts of Latin America, family dentists are often concentrated in urban centers, creating a pronounced rural-urban disparity in access. In these contexts, the majority of dental services are delivered in private clinics, leaving marginalized populations underserved or entirely excluded

from preventive and primary dental care. Epidemiological data from these regions consistently indicate high prevalence of untreated dental caries, advanced periodontal disease, and oral infections, which contribute to substantial morbidity and diminished quality of life. The scarcity of trained personnel exacerbates these challenges, highlighting the urgent need for workforce expansion, innovative service delivery models, and policy interventions that prioritize oral health as a fundamental component of primary healthcare. The evidence underscores that, without systemic reforms, family dentists in these settings are constrained in their ability to contribute effectively to population health objectives.

The literature also emphasizes the preventive and health-promoting functions of family dentists. Regular dental visits provide opportunities not only for early detection of caries and periodontal disease but also for the identification of systemic conditions manifesting orally. For example, family dentists frequently encounter signs of diabetes, vitamin deficiencies, immunodeficiency states, and hormonal imbalances, allowing for timely referral to appropriate medical specialists. Preventive interventions—including fluoride application, sealants, patient education on oral hygiene, dietary counseling, and tobacco cessation support—demonstrate measurable improvements in oral health outcomes and, by extension, systemic health. Studies conducted in both developed and developing countries reveal that when family dentists are integrated into community-based programs, such as school oral health initiatives or maternal-child health campaigns, there is a significant reduction in disease prevalence and improved adoption of preventive behaviors among populations at risk. These findings indicate that the scope of family dentists extends far beyond the treatment chair, positioning them as proactive agents in disease prevention and health promotion.

The investigation into the innovative perspectives on the role of family dentists globally reveals a landscape characterized by profound dissonance between a compelling evidence-based rationale for role expansion and a persistent reality of systemic, educational, and professional constraints. The results of this synthesis, drawn from a multidisciplinary analysis of clinical research, health systems analyses, sociological studies, and policy documents, present not a single unified narrative but a complex and often contradictory tapestry. The discussion that follows intertwines with these results, aiming to interpret their meaning, explore their implications, and confront the significant challenges they unveil. This integrated results and discussion section is structured around four emergent thematic domains: the unequivocal evidence supporting an integrated oral-systemic health model and the family dentist's pivotal role within it; the formidable structural and cultural barriers that inhibit the actualization of this role; the critical disparities in global contexts that demand divergent innovative approaches; and the foundational transformations required across education, policy, and technology to navigate a path forward. It is within the tensions between these domains that the future of family dentistry will be negotiated.

The most robust and convergent body of evidence underpinning this thesis lies in the irrefutable scientific validation of the oral-systemic health connection, which fundamentally reconfigures the biological and clinical justification for the family dentist's expanded scope. The results of countless longitudinal studies, meta-analyses, and systematic reviews now establish that periodontitis is not an isolated oral infection but a chronic inflammatory disease with significant systemic ramifications. The evidence for a bidirectional relationship with diabetes is particularly powerful, with periodontitis recognized as a major complicating factor for glycemic control, and diabetes acknowledged as a major risk factor for the progression of periodontitis. The biological mechanisms, involving the systemic dissemination of inflammatory mediators and bacterial pathogens, are well-elucidated. Furthermore, the associations with adverse pregnancy outcomes, respiratory diseases, rheumatoid arthritis, and cardiovascular diseases, while sometimes demonstrating correlation rather than outright causation, are supported by plausible pathophysiological pathways and a substantial body of epidemiological data. This evidence base creates an incontrovertible imperative for a healthcare model that does not arbitrarily dissect

the human body at the maxilla and mandible. The discussion, therefore, must move beyond questioning the existence of these links to critically examining the clinical and professional responsibilities they engender.

The new clinical mandate for the family dentist, positioning them as a crucial primary care sentinel. The results indicate that the dental practice, characterized by its nature as a site of regular, preventive maintenance visits for a generally asymptomatic patient population, represents a vastly underutilized platform for early detection and health promotion. Evidence demonstrates that opportunistic screening during routine examinations can effectively identify signs of non-communicable diseases. For instance, intraoral and extraoral examinations can detect manifestations of HIV/AIDS, leukemia, and vitamin deficiencies, while screening questionnaires and clinical findings can raise strong suspicions of undiagnosed diabetes or eating disorders like bulimia nervosa. The most significant public health opportunity lies in oral cancer screening. Given the persistently high mortality rates associated with late-stage diagnosis, the family dentist's role in visual and tactile examination is not merely an add-on but a moral and professional obligation. The discussion surrounding this evidence, however, must grapple with nuanced challenges: the sensitivity and specificity of screening methods in a general practice setting, the ethical management of false positives and the anxiety they may induce, and the development of clear, effective referral pathways to ensure that screening translates into timely medical intervention. The results confirm the potential; the discussion must address the practical complexities of implementation to realize a model where the family dental practice functions as a proactive health node, not a reactive repair shop.

Concurrent with the clinical evidence is a powerful economic and public health argument for a prevention-oriented, publicly engaged model of family dentistry. The results of economic burden studies are staggering, indicating that global expenditures on treating oral diseases run into hundreds of billions of dollars annually, coupled with even greater indirect costs from productivity losses. The evidence is unequivocal that these costs are overwhelmingly driven by a failure of prevention and early intervention. The results further demonstrate that the burden of disease is not distributed equitably but follows a steep social gradient, disproportionately affecting populations who face the greatest barriers to accessing traditional, clinic-based curative care. This inequity renders the conventional surgical-restorative model not merely inefficient but fundamentally unjust. The discussion arising from these results must, therefore, forcefully argue that innovation is not a luxury but a necessity for sustainability and equity. It compels a redefinition of "value" in dental care—shifting the metric from procedural throughput to population health outcomes. The family dentist's innovation, in this light, includes engaging in community-level health promotion, advocating for policies like sugar-sweetened beverage taxes and community water fluoridation, and participating in school-based sealant programs. This represents a radical departure from the historic identity of the profession, challenging the very notion of where dentistry happens and whom the dentist serves. The results show that the most significant gains in population oral health will be made not by perfecting the class II restoration but by addressing the social, commercial, and political determinants of health, and the discussion must confront the profession's readiness to embrace this vastly broader mission.

The major thematic domain revealed is a constellation of deeply entrenched barriers that systematically inhibit the adoption of this innovative perspective. The most recalcitrant of these is the financial architecture underpinning dental care in most high-income countries: the fee-for-service reimbursement model. The results of numerous practice analyses and economic studies demonstrate a profound misalignment between this model and the activities required for a public health-oriented practice. The system generously reimburses technically complex procedures like crowns, implants, and endodontics, while offering minimal or no compensation for the time-intensive cognitive labor of health risk assessments, dietary counseling, tobacco cessation coaching, interprofessional communication, and patient education. This creates an inescapable economic disincentive for dentists to practice in the manner the evidence advocates. The discussion here must acknowledge the economic realities of running a practice. A

dentist who spends thirty minutes on smoking cessation counseling is, under current systems, generating significantly less revenue than a colleague who performs two fillings in the same time. This is not a failure of individual will but a systemic failure. Therefore, any discussion of innovation that does not centrally address payment reform is intellectually dishonest. The results point to the need for pilot programs and research into alternative payment models, such as capitation, global budgets for defined populations, or pay-for-performance schemes that reward measurable health outcomes—a shift from rewarding *volume* to rewarding *value*.

Equally formidable is the barrier of professional silofication and the historical separation of dentistry from the broader healthcare system. The results of sociological and ethnographic research into healthcare professions reveal a deeply ingrained cultural divide between dentistry and medicine, perpetuated by separate educational pathways, distinct professional identities, different licensing bodies, and—most practically—incompatible health information technologies. The absence of interoperable electronic health records (EHRs) represents a critical operational barrier to the integrated care model that the evidence demands. A family dentist cannot easily access a patient's glycemic history or current medications, nor can they seamlessly communicate findings of elevated blood pressure or suspected diabetes to a primary care physician. This forces communication back to archaic methods like faxes or phone calls, which are inefficient and prone to failure. The discussion must extend beyond a simple call for "better collaboration" to a critical analysis of professional tribalism. It requires exploring the historical roots of this separation and advocating for concrete steps to dismantle it, beginning with integrated EHR systems and mandatory interprofessional education (IPE) during training. Until a dentist and a physician share a common language and a common digital platform, the vision of the dentist as a member of a holistic healthcare team will remain largely aspirational.

A critical barrier resides within the very core of dental education itself. The results of curriculum analyses across global institutions indicate that while there is a growing awareness of the need for change, the core pedagogy remains overwhelmingly focused on technical and surgical proficiency within a biological framework of disease. Students spend thousands of hours mastering operative techniques on typodonts and patients but receive scant training in public health principles, health policy analysis, and practice management under alternative payment models, leadership, or the skills of interprofessional collaboration. This creates a workforce that is exquisitely trained for the paradigm of the past but unprepared for the demands of the future. The discussion must therefore focus on the necessity of a seismic pedagogical shift. Innovation requires a new curriculum that balances technical excellence with competencies in health promotion, communication, systems thinking, and evidence-based practice. It requires moving students out of the cloistered dental clinic and into community health centers, medical wards, and public health departments to foster a broader identity. This is not about adding a course; it is about transforming a worldview. The results are clear: without fundamental educational reform, new graduates will continue to be socialized into a system that the evidence indicates is obsolete, perpetuating the cycle of misaligned priorities.

The overarching thematic domain, and perhaps the most challenging for a global thesis, is the stark heterogeneity of contexts in which family dentistry is practiced. The results of this analysis definitively reject a one-size-fits-all approach to innovation. The challenges and potential solutions in a high-income, technologically advanced urban center are fundamentally different from those in a resource-poor, rural setting in a low-income country. In the former, innovation might focus on the integration of artificial intelligence for radiographic diagnosis, the use of salivary biomarkers for personalized caries risk assessment, and the development of complex integrated care networks. The barrier is often not a lack of resources but the inertia of entrenched systems and financial models. In contrast, in many parts of the world, the primary barrier is a catastrophic shortage of any trained dental workforce at all. Here, the most

innovative perspective may involve a radical rethinking of the "family dentist" model itself. The results from countries like New Zealand and Canada support the effectiveness of dental therapists—mid-level providers trained to perform basic preventive and restorative procedures—in expanding access to care for remote and underserved populations. The discussion must, therefore, engage courageously with the politically contentious issue of task-shifting and scope-of-practice expansion. It must prioritize access to basic care over professional protectionism. Furthermore, innovation in low-resource settings may leverage mobile health (mHealth) technology for patient education and reminders, or deploy portable, battery-operated equipment for rural outreach clinics. The global discussion, therefore, is not a single conversation but a multiplex of parallel dialogues, each requiring context-specific evidence, respect for local constraints, and culturally appropriate solutions. The common thread is not the specific intervention but the shared goal of achieving health equity through the most effective and efficient means available.

Synthesizing the evidence of need, the analysis of barriers, and the diversity of global contexts leads inevitably to the final domain: the articulation of foundational transformations required for a viable future. The results of this synthesis suggest that the path forward is not incremental adjustment but a coordinated reinvention across multiple fronts. First, the pedagogical transformation of dental education is the essential long-term catalyst. This requires a decisive move from a technically-dominated curriculum to an integrated, competency-based model that produces "oral physicians." This new graduate would be equally fluent in performing a high-quality restoration as they are in interpreting a patient's HbA1c level, conducting a motivational interview for tobacco cessation, navigating the local public health landscape, and collaborating effectively with a medical team. This transformation depends on universities breaking down their own internal silos and fostering genuine IPE with medical, nursing, and pharmacy schools.

The discussion must propose concrete and politically viable strategies for financial and regulatory reform. This involves piloting and rigorously evaluating alternative payment models to build an evidence base for their effectiveness. It requires advocacy directed at government health ministries and private insurers to demonstrate the long-term cost-effectiveness of prevention and early intervention. On a regulatory level, it necessitates reviewing and modernizing scopes of practice to allow for both the expanded role of the dentist in health screening and the legitimate role of mid-level providers in extending the reach of the care team. This is a complex political endeavor that will require the dental profession to engage in policy advocacy with a unified and evidence-based voice.

The future is inextricably linked to technological integration. The discussion must emphasize that interoperable health information systems are not a luxury but a fundamental prerequisite for integrated care. The development of dental modules within mainstream medical EHRs, or vice versa, is a technical and political challenge that must be overcome. Furthermore, the responsible adoption of emerging technologies—from teledentistry for consultation and triage to AI for diagnostic support—must be actively explored and evaluated not just for their clinical efficacy but for their potential to improve access and equity.

The results of this comprehensive investigation present a profession at a crossroads. The evidence from biology, clinical science, and public health provides a powerful and coherent argument for the family dentist to evolve into a primary oral healthcare provider, a health sentinel, and a public health advocate. However, this potential is held in check by a formidable array of economic, educational, and systemic barriers that are deeply embedded in the history and culture of the profession. The global context adds layers of complexity, demanding solutions that are specific to local needs and resources. The discussion, therefore, culminates not in a simple prescription but in a call for a courageous and collaborative project of reinvention. It demands that the profession critically examines its own traditions, engages in honest dialogue with its partners in medicine and public health, and advocates fiercely for the systemic changes required to align practice with evidence. The ultimate innovation is not a new technology or a new procedure, but a new mindset: one that sees the family dentist not as a solitary technician treating teeth, but

as an integral and indispensable node in a global network dedicated to achieving whole-person health and health equity for all populations.

Family dentists play a central and evolving role in the promotion of oral and systemic health, serving as both clinicians and public health advocates. This article provides a comprehensive analysis of their contributions to primary dental care, preventive strategies, community engagement, and health system integration across diverse global contexts. Evidence indicates that family dentists significantly reduce the prevalence of oral diseases, facilitate early detection of systemic conditions with oral manifestations, and promote health literacy through patient education and community outreach. Their preventive and diagnostic interventions are enhanced by emerging technologies, including tele-dentistry, digital health platforms, and artificial intelligence, which expand access and enable personalized care. Comparative analyses highlight successful models from Brazil, the United Kingdom, India, and Scandinavia, demonstrating the impact of policy integration, workforce planning, and interdisciplinary collaboration on population health outcomes. Despite these advances, challenges remain, including workforce maldistribution, inequitable access, financial barriers, policy fragmentation, and cultural determinants of health. Future directions emphasize technological innovation, educational reform, policy alignment, and interprofessional collaboration to optimize the role of family dentists in achieving equitable, sustainable, and integrated oral and systemic healthcare. The findings underscore the indispensable role of family dentists in shaping the future of global health, positioning them as key actors in the realization of comprehensive, preventive, and community-centered health strategies.

A recurring theme in the literature is the role of family dentists in bridging the gap between individual patient care and community-level health initiatives. In many countries, family dentists serve as the interface between formal healthcare systems and local communities, translating public health policies into actionable practices and providing culturally sensitive health education. For instance, in Brazil, the Family Health Strategy integrates dental teams into primary care units, allowing family dentists to engage in household visits, community education, and preventive interventions. This model has demonstrated success in reducing oral disease prevalence, improving early diagnosis, and fostering community engagement. Similarly, in the United Kingdom, the National Health Service's provision of routine dental check-ups facilitates systematic monitoring of population oral health, early identification of high-risk groups, and implementation of targeted preventive programs. These examples highlight the capacity of family dentists to influence health outcomes at both individual and population levels, demonstrating that their impact is maximized when aligned with structured health systems and community-oriented policies.

Despite these positive findings, significant challenges persist globally. In high-income countries, access inequalities remain pronounced among socioeconomically disadvantaged populations, ethnic minorities, and migrants. Barriers such as financial constraints, geographic distance, and limited health literacy reduce the effectiveness of preventive interventions, even in well-resourced systems. In low- and middle-income countries, the challenges are magnified by insufficient workforce, limited infrastructure, and underfunded public health initiatives. Moreover, cultural perceptions of oral health, traditional practices, and lack of awareness often impede utilization of professional dental services. The evidence indicates that these challenges require multifaceted solutions, encompassing policy reform, education, technological innovation, and interprofessional collaboration. Family dentists, by virtue of their dual clinical and public health roles, are strategically positioned to contribute to these solutions, yet their potential remains underutilized in many regions.

The role of the family dentist in primary dental care represents a critical nexus in the healthcare system, embodying a unique blend of clinical expertise, continuous patient relationships, and community presence. This discussion synthesizes a broad array of evidence, examining the current realities, challenges, and transformative potential of this role. It explores the evolution from a traditionally reactive, procedure-

based model towards a proactive, health-centered paradigm, considering the implications of this shift for patient outcomes, public health, professional identity, and the broader healthcare landscape. The analysis reveals that while the evidence overwhelmingly supports an expanded and integrated role for family dentists, significant structural, economic, and educational barriers persist, creating a dissonance between potential and practice. Navigating this dissonance requires a fundamental reimagining of dental care delivery, one that embraces prevention, prioritizes equity, and fosters collaboration across the health professions.

The foundation of the family dentist's value lies in the continuity of care they provide. Unlike specialist counterparts who address specific conditions or age groups, the family dentist engages with individuals and families across the lifespan. This longitudinal relationship fosters a deep understanding of patient history, genetic predispositions, environmental factors, and behavioral patterns. It creates a context of trust that is indispensable for effective health promotion and the management of chronic conditions, which are the hallmark of modern dentistry. The management of caries, for instance, is increasingly understood not as a series of restorative events but as a lifelong management of a biofilm-mediated disease influenced by diet, saliva, and social habits. The family dentist, through repeated interactions, is uniquely positioned to monitor risk factors, provide personalized coaching, and intervene early with minimally invasive techniques. This continuous care model stands in stark contrast to episodic, pain-driven visits, which remain prevalent, particularly among underserved populations. The results of numerous studies indicate that patients with a regular source of dental care exhibit better oral health outcomes, higher rates of preventive service utilization, and lower long-term treatment costs. This suggests that the relational aspect of family dentistry is not a soft benefit but a core determinant of clinical effectiveness.

The biological justification for this expanded, continuous role has been solidified by the robust evidence illuminating the oral-systemic health connection. The mouth is no longer considered an isolated organ but is recognized as a mirror reflecting overall health and a portal for systemic inflammation. The pathophysiological pathways linking periodontitis to conditions such as diabetes mellitus, cardiovascular disease, adverse pregnancy outcomes, and rheumatoid arthritis are well-documented. Chronic periodontal inflammation serves as a reservoir of pro-inflammatory cytokines and bacteria that can disseminate throughout the body, exacerbating metabolic control and contributing to endothelial dysfunction. This evidence fundamentally reconfigures the clinical mandate of the family dentist. A periodontal examination transforms from a narrow assessment of tooth-supporting tissues into a critical evaluation of a patient's inflammatory status. The diagnosis of periodontitis must now trigger a series of considerations that extend far beyond the oral cavity, including assessment of diabetic risk, communication with primary care physicians, and a reinforced emphasis on anti-inflammatory periodontal therapy. The family dentist thus becomes a vital sentinel in the early detection and management of systemic disease, operating at the intersection of oral and general health.

The global burden of oral diseases remains staggering, with untreated dental caries representing the most prevalent condition worldwide. This burden is disproportionately borne by marginalized groups—those of low socioeconomic status, racial and ethnic minorities, rural residents, the elderly, and individuals with special healthcare needs. These populations face formidable barriers to accessing traditional dental care, including cost, geographic availability, and cultural factors. The results of public health research consistently demonstrate that a clinic-based, curative model is incapable of addressing these population-level inequities. It is a system that waits for disease to occur and then requires individuals to navigate complex barriers to receive treatment. An innovative perspective, therefore, positions the family dentist not only as a clinician within a practice but as a health advocate and resource within the community. This involves engaging in community-wide health promotion, advocating for policies that address the social determinants of health (such as sugar-sweetened beverage taxes and community water fluoridation), and

participating in school-based sealant programs and outreach initiatives for homeless populations. The family dental practice can function as a community health hub, leveraging its position of trust to improve not just individual patient health but the health of the population it serves.

The realization of this potentiated role is confronted by a formidable array of systemic barriers. The most significant of these is the financial architecture that underpins dental care in many countries, particularly the fee-for-service reimbursement model. This model operates as a powerful structural determinant of clinical behavior, creating a profound misalignment between economic incentives and evidence-based care. It generously rewards technical, procedural interventions—such as fillings, crowns, and extractions—while offering minimal or no compensation for the cognitive, time-intensive work of health risk assessment, preventive counseling, care coordination, and interprofessional communication. A dentist who spends thirty minutes conducting a tobacco cessation intervention or managing a patient's caries risk factors is financially penalized under this system, as that time could have been spent generating income through procedures. This economic reality effectively stifles innovation and perpetuates a surgical-restorative paradigm. The discussion must therefore contend with the necessity of payment reform. Alternative models, such as capitation (a fixed per-patient-per-month fee), value-based payments tied to achieved health outcomes, or bundled payments for the comprehensive management of a condition like periodontitis, must be rigorously piloted and evaluated. Transitioning to such models is complex, requiring sophisticated risk-adjustment and new practice management capabilities, but it is essential for aligning financial incentives with the preventive, health-oriented practice that the evidence demands.

An equally entrenched barrier is the historical and cultural silofication of dentistry from the broader healthcare system. This separation is manifested in segregated educational pathways, distinct professional identities, separate licensing boards, and, most pragmatically, incompatible health information technologies. The absence of interoperable electronic health records (EHRs) between medical and dental providers presents a critical operational obstacle to integrated care. The family dentist often operates in an information vacuum, lacking access to a patient's medical history, current medications, or laboratory results. Conversely, findings from the dental examination that have systemic implications—such as poor glycemic control in a diabetic patient or signs of osteoporosis on a radiograph—cannot be seamlessly communicated to the patient's physician. This forces reliance on inefficient, outdated methods like faxes and phone calls, which are prone to failure. Overcoming this divide requires more than a plea for "better collaboration." It demands a foundational commitment to interprofessional education (IPE), where dental, medical, nursing, and pharmacy students train together to develop a shared language, mutual respect, and a understanding of respective roles and responsibilities. Furthermore, it requires a political and technical commitment to developing integrated health information platforms that bridge the medical-dental divide, enabling the secure and efficient exchange of patient data for comprehensive care coordination.

The development of a workforce capable of meeting these new challenges begins with dental education, which itself represents a significant site of constraint. The results of curriculum analyses reveal that despite evolving awareness, the core of dental education remains overwhelmingly focused on technical and surgical proficiency within a biological framework of disease. Students spend thousands of hours mastering operative techniques on manikins and patients but receive comparatively minimal training in public health principles, practice management under alternative payment models, leadership, health policy, or the skills required for effective interprofessional collaboration. This produces a new generation of clinicians who are exquisitely prepared for the paradigm of the past but underprepared for the demands of the future. A transformative innovation would be the evolution of the dental curriculum from its technically dominated model towards one that produces "oral physicians." This new graduate would be a hybrid clinician-manager-advocate, equally competent in performing a high-quality restoration as they are in interpreting a patient's HbA1c level, conducting a motivational interview for behavioral change, navigating

the local public health infrastructure, and leading a team-based approach to patient care. This requires universities to break down their own internal silos and create authentic, embedded interprofessional learning experiences.

The challenges and opportunities for the family dentist are radically different across national and economic contexts. In high-income countries with a saturated dental workforce, the primary challenges are those of misalignment and integration—leveraging a sophisticated workforce for greater public health impact within complex, often fragmented, healthcare systems. Innovation here may focus on managing complex elderly patients with multiple morbidities, integrating with primary care medical homes, and adopting advanced diagnostic technologies. In stark contrast, in many low- and middle-income countries (LMICs), the fundamental challenge is often one of absolute scarcity. The dentist-to-population ratio can be critically low, and basic infrastructure for even simple restorative care may be absent. In these contexts, the most innovative perspective may involve a radical rethinking of the dental team itself. Strong evidence supports the efficacy and cost-effectiveness of mid-level providers—dental therapists—who can be trained in a shorter timeframe to deliver the majority of essential primary care services, including prevention, simple restorations, and extractions. The discussion must therefore courageously engage with the politically contentious issue of task-shifting, confronting professional opposition that often prioritizes protection of scope-of-practice over population health needs. The ethical imperative of equity demands a pragmatic approach: it is better to have a large cadre of competent therapists providing essential care to a population than a tiny elite of dentists serving only the affluent few. Innovation in LMICs may also involve leapfrogging legacy systems entirely, embracing mobile digital technology (mHealth) for patient education and reminders, and deploying portable, battery-operated equipment for rural outreach.

Peering into the future, the role of the family dentist will be further shaped by technological acceleration. The emergence of artificial intelligence (AI) for diagnostic support in radiography and oral cancer detection, the development of salivary biomarkers for personalized caries and periodontal risk assessment, and the growth of teledentistry for consultation and monitoring are all poised to change practice. The discussion surrounding this technological future is dual-faced, filled with both promise and peril. The promise is one of greater diagnostic precision, earlier intervention, and more personalized care plans. Teledentistry can expand access to remote and homebound populations. However, the peril lies in the potential for de-skilling, algorithmic bias, ethical concerns regarding data privacy, and the threat of exacerbating health inequities through a "digital divide." The most innovative perspective views technology not as a replacement for the clinician, but as a powerful tool that amplifies their capabilities. The family dentist must evolve into a sophisticated interpreter of AI-generated data, a guide for patients navigating the implications of their genetic risk profiles, and the humanistic core of an increasingly technological practice. This requires the cultivation of a new digital literacy within the profession.

The evidence presents a compelling vision for the family dentist as a central figure in primary healthcare—a continuous caregiver, a manager of oral and systemic health, a community health advocate, and a collaborator within an integrated health team. This potential, however, is held in check by powerful structural, economic, and educational barriers that are deeply embedded in the history and culture of the profession. The path forward therefore requires a courageous and coordinated project of reinvention. It demands a critical examination of professional traditions, a commitment to payment reform that rewards value and outcomes, a transformation of dental education to produce oral physicians, and an embrace of interprofessional collaboration and technological innovation. The ultimate goal is to align the reality of dental practice with the overwhelming evidence base, transforming the family dental practice from a standalone workshop for surgical repair into an integrated node within a comprehensive healthcare network, dedicated to achieving whole-person health and health equity for all populations. This is not a simple evolution but a necessary revolution for the relevance and impact of the profession in the 21st century.

The analysis further reveals that family dentists can act as critical nodes in health promotion beyond clinical settings. Their interactions with patients provide opportunities for counseling on nutrition, tobacco and alcohol cessation, and general lifestyle modifications that influence both oral and systemic health. This preventive orientation aligns with global health strategies emphasizing noncommunicable disease control and health promotion across the lifespan. In addition, family dentists often participate in advocacy for public health interventions, including water fluoridation, school-based oral health programs, and regulation of sugar-rich products. The literature demonstrates that these contributions have measurable effects on population-level health outcomes, reinforcing the argument that family dentists are central to achieving broader public health objectives.

Comparative analysis of different healthcare systems underscores the importance of policy frameworks in shaping the impact of family dentists. Countries that have effectively integrated dental care into primary health services demonstrate higher rates of preventive service utilization, lower disease prevalence, and improved equity in access. Conversely, where oral health is excluded from universal health coverage or treated as a peripheral service, disparities are more pronounced, and the potential public health impact of family dentists is constrained. These findings suggest that the effectiveness of family dentists in promoting oral and systemic health is contingent not only upon individual competence but also upon supportive systemic, financial, and policy environments.

Emerging evidence also points to the transformative potential of technology in expanding the role of family dentists globally. Tele-dentistry, electronic health records, and mobile health platforms allow for remote consultation, education, and monitoring, particularly in underserved regions. Artificial intelligence and digital imaging enable early detection of oral pathology and predictive risk assessment, supporting more personalized and proactive care. These innovations hold the promise of bridging gaps in access, improving preventive care, and facilitating integration of dental practice with general healthcare services. However, the literature cautions that technology must be implemented thoughtfully, with attention to equity, training, and infrastructure, to avoid exacerbating existing disparities.

The evidence underscores that family dentists occupy a critical position at the intersection of clinical care and public health. Their ability to provide preventive care, identify systemic disease manifestations, engage with communities, and contribute to health policy makes them indispensable actors in the global health landscape. However, challenges including inequitable access, workforce maldistribution, policy fragmentation, and cultural barriers continue to limit their full potential. Integration of technological innovations, supportive policy frameworks, and interprofessional collaboration are essential for optimizing the impact of family dentists on both individual and population health outcomes. These findings provide a foundation for understanding the evolving role of family dentists and inform the subsequent discussion of clinical contributions, systemic health linkages, and future directions in global practice.

Family dentists serve as the cornerstone of primary dental care, and their clinical contributions extend far beyond restorative procedures to encompass prevention, early diagnosis, and holistic patient management. Across global contexts, evidence demonstrates that regular engagement with family dentists significantly reduces the prevalence and severity of oral diseases, including dental caries, periodontal conditions, and edentulism. Preventive strategies administered by family dentists, such as professional cleaning, fluoride treatments, sealant applications, and patient education, have shown substantial efficacy in improving both short-term and long-term oral health outcomes. These interventions are particularly impactful when delivered in a context of continuous care, where dentists monitor patients across developmental stages, adapting preventive regimens to age-specific and risk-related factors. In children, for instance, early intervention and parental education can prevent the onset of caries, establish proper oral hygiene behaviors, and reduce the likelihood of malocclusions. Similarly, among adults, periodic

assessment and reinforcement of oral hygiene practices significantly diminish periodontal inflammation and limit the progression of chronic conditions that could complicate systemic health.

The interrogation of the family dentist's role within the modern healthcare ecosystem reveals a discipline in a state of profound, yet hesitant, metamorphosis. The results of this synoptic analysis, synthesizing evidence from clinical science, health services research, political economy, sociology of professions, and innovation theory, depict a reality of immense potential stifled by systemic inertia. The discussion that follows does not merely present findings but constructs a critical narrative, arguing that the evolution required is not one of incremental adjustment but of foundational paradigm shift. This integrated results and discussion is organized around five dialectical tensions: the potentiation of the clinical encounter versus the limitations of the biomedical model; the economic rationale for value-based care versus the hegemony of procedural reimbursement; the globalized knowledge of best practice versus the localized reality of structural determinism; the technological promise of integration versus the ethical perils of algorithmic practice; and the emergent model of the dentist as a node within a health network versus the enduring archetype of the autonomous practitioner. It is within the crucible of these tensions that the future of primary dental care will be forged.

The preventive role of family dentists is further amplified when integrated with broader public health initiatives. In many countries, family dentists participate in school-based programs that provide both education and preventive services, effectively reducing disease incidence at the population level. Research from Scandinavian countries indicates that school dental programs, coupled with routine visits to family dentists, reduce the prevalence of dental caries by up to 50% in children and adolescents. In addition to direct clinical interventions, family dentists serve as educators, counseling patients on nutrition, tobacco cessation, alcohol reduction, and lifestyle behaviors that influence oral and systemic health. This dual function as clinician and educator situates family dentists as agents of both individual and community-level change, enhancing health literacy and empowering patients to adopt behaviors that prevent disease and maintain long-term oral health.

The study consistently emphasizes the critical role of family dentists in early detection of oral and systemic conditions. Oral manifestations often precede or accompany systemic diseases, and the family dentist is frequently the first healthcare professional to recognize these signs. For example, gingival inflammation, oral ulceration, and mucosal lesions may indicate underlying autoimmune disorders, hematological malignancies, or immunodeficiencies. In diabetic patients, periodontal disease serves both as a complication and a marker of glycemic control, with family dentists capable of identifying disease progression and coordinating with medical providers to optimize management. Similarly, family dentists often detect early manifestations of cardiovascular disease, nutritional deficiencies, and viral infections such as HIV, facilitating timely referral and intervention. This integration of oral and systemic health monitoring underscores the importance of interdisciplinary collaboration and highlights the unique position of family dentists as sentinels of overall health.

To disease detection, family dentists contribute to health promotion through structured preventive programs and individualized patient counseling. Preventive strategies extend to vulnerable populations, including pregnant women, elderly individuals, and patients with chronic conditions, where oral health directly influences systemic outcomes. Among pregnant women, for instance, periodontal inflammation has been associated with adverse outcomes, including preterm birth and low birth weight. Family dentists, through routine monitoring and targeted preventive care, mitigate these risks and contribute to maternal-child health outcomes. In geriatric populations, family dentists address challenges such as xerostomia, root caries, prosthetic management, and polypharmacy interactions, thereby supporting functional independence, nutrition, and quality of life. The literature emphasizes that preventive care delivered

consistently by family dentists reduces healthcare costs, limits the burden on secondary and tertiary services, and contributes to more efficient health system utilization.

The integration of evidence-based clinical practice with preventive care is enhanced by advancements in diagnostic and monitoring technologies. Digital radiography, intraoral scanners, and chairside imaging facilitate early detection of caries, periodontal disease, and oral malignancies. Additionally, the application of artificial intelligence for risk assessment, image analysis, and predictive modeling enables family dentists to anticipate disease progression, customize preventive strategies, and allocate resources effectively. These technological innovations extend the impact of preventive care beyond the clinic, allowing for proactive management and long-term monitoring. Studies indicate that practices incorporating digital technologies demonstrate higher adherence to preventive protocols, earlier detection of pathology, and improved patient engagement. Tele-dentistry, in particular, has emerged as a transformative tool in remote or underserved regions, enabling consultation, triage, and education without the constraints of geographic barriers. By combining traditional preventive approaches with these innovations, family dentists maximize both clinical efficacy and population-level health outcomes.

Family dentists also play a central role in addressing the oral-systemic health nexus. The concept that oral health is inseparable from general health is supported by a growing body of epidemiological and clinical research. Periodontal disease, for example, has been linked to systemic inflammation, atherosclerosis, and adverse cardiovascular events, while chronic oral infections have been associated with insulin resistance and poor glycemic control in diabetic patients. In addition, oral health influences nutritional status, speech, and psychosocial well-being, demonstrating the broader implications of dental conditions on daily functioning. Family dentists, through comprehensive assessment and intervention, contribute to both prevention and management of systemic conditions, coordinating with physicians and other healthcare providers to optimize patient outcomes. This collaborative approach not only enhances individual patient care but also strengthens the integration of oral health into primary healthcare systems.

The study highlights the contribution of family dentists to population health through community-based interventions. Public health programs frequently rely on the expertise of family dentists to implement screening campaigns, vaccination drives, oral cancer awareness initiatives, and behavioral health programs. Evidence from countries such as Brazil demonstrates that family dentists integrated into community health teams can significantly reduce caries incidence, improve oral hygiene behaviors, and enhance access to care among underserved populations. Similarly, in India, mobile dental units staffed by family dentists have been shown to provide essential preventive services in rural and remote communities, mitigating disparities and extending the reach of oral health interventions. These findings reinforce the dual clinical and public health responsibilities of family dentists, highlighting their potential to effect change at both the individual and societal levels.

Despite the substantial contributions of family dentists to preventive care and systemic health, barriers remain that limit their effectiveness. Workforce shortages, uneven distribution of dental professionals, and lack of integration into primary healthcare frameworks impede access to preventive services. Economic and policy factors, including out-of-pocket payment models and limited insurance coverage, further constrain patient engagement with preventive care. Cultural beliefs, health literacy limitations, and local practices also influence patient behavior and adherence, particularly in regions with high oral disease prevalence. The literature emphasizes that addressing these barriers requires comprehensive strategies encompassing education, policy reform, and innovative service delivery models that prioritize prevention, accessibility, and integration of oral and systemic health.

Emerging research highlights innovative approaches that expand the preventive and clinical role of family dentists. Personalized preventive care, informed by genetic, behavioral, and environmental risk factors, allows for tailored interventions that optimize outcomes. Digital platforms and mobile applications

support patient engagement, education, and adherence to oral hygiene routines. Artificial intelligence algorithms aid in early diagnosis, risk stratification, and clinical decision-making, enhancing the precision of preventive interventions. These innovations, combined with traditional preventive practices, reinforce the family dentist's central role in promoting oral and systemic health.

The evidence establishes that family dentists serve as essential providers of preventive care and early detection, bridging clinical practice with public health initiatives and systemic health monitoring. Their contributions extend across the lifespan, addressing the needs of children, adults, and the elderly, and encompass both individual patient management and population-level interventions. By integrating clinical expertise, preventive strategies, patient education, and interdisciplinary collaboration, family dentists enhance health outcomes, reduce disease burden, and contribute to more equitable and effective healthcare systems. The literature underscores that their full potential is realized when supported by appropriate policy frameworks, technological innovations, and workforce strategies that enable them to deliver comprehensive, patient-centered, and population-oriented care.

Family dentists play a pivotal role not only in individual patient care but also in the broader landscape of public health. Their contributions to community health are multifaceted, encompassing direct clinical interventions, health education, disease prevention programs, and policy advocacy. Evidence indicates that when family dentists are actively engaged in public health initiatives, there is a measurable reduction in the prevalence of oral diseases and associated systemic complications. These interventions range from school-based oral health programs and community screening initiatives to adult preventive campaigns, maternal-child health services, and chronic disease management. The dual function of the family dentist—as clinician and public health practitioner—enables them to translate public health objectives into actionable, context-specific practices that address the needs of diverse populations.

Community engagement by family dentists is particularly critical in regions where access to healthcare is limited or unevenly distributed. Mobile dental units, outreach programs, and tele-dentistry platforms have been deployed in rural and underserved urban areas to bridge gaps in access. In countries such as India and South Africa, community-based programs led by family dentists have significantly increased access to preventive services, early detection, and oral health education. These initiatives often involve collaboration with local health authorities, schools, non-governmental organizations, and community leaders to ensure cultural relevance, sustainability, and community participation. Evidence from longitudinal studies indicates that community-oriented interventions not only reduce disease burden but also foster trust, increase adherence to preventive practices, and empower individuals to take ownership of their oral health.

Public health impact is further enhanced through the integration of family dentists into national and regional health policies. Countries that recognize oral health as a core component of primary care and universal health coverage demonstrate improved population outcomes. For example, Brazil's Family Health Strategy incorporates dental teams within multidisciplinary primary care units, ensuring routine preventive services, patient education, and integration with systemic health care. Evaluations of this model indicate significant reductions in dental caries among children, improved periodontal outcomes, and enhanced access for marginalized populations. Similarly, in Scandinavian nations, comprehensive school-based programs and routine dental check-ups supported by public funding have resulted in one of the lowest incidences of oral disease globally. These examples illustrate the potential of well-structured policy frameworks to amplify the public health contributions of family dentists, particularly when aligned with preventive strategies, community engagement, and cross-sectoral collaboration.

Despite these successes, family dentists encounter substantial challenges that limit their capacity to maximize public health impact. One of the most significant barriers is workforce maldistribution, with dental professionals concentrated in urban and affluent regions, leaving rural and disadvantaged

populations underserved. This uneven distribution is exacerbated by economic incentives that favor private practice over community-based or public service roles. Furthermore, inadequate integration of oral health into primary healthcare systems results in fragmented services, duplicative efforts, and missed opportunities for early detection and prevention. Financial barriers, including high out-of-pocket costs and limited insurance coverage, further constrain access to care, particularly among vulnerable groups. Cultural factors, including beliefs about oral health, traditional practices, and low health literacy, also influence utilization of services and adherence to preventive recommendations. The literature consistently identifies these challenges as critical determinants of oral health inequities, underscoring the need for comprehensive strategies that address structural, economic, and social barriers.

Policy limitations constitute another major obstacle to the full realization of the family dentist's role in public health. In many countries, oral health remains marginalized in health policy agendas, with limited funding, inadequate workforce planning, and minimal inclusion in universal health coverage schemes. The separation of dental and medical education and practice historically reinforced this marginalization, creating silos that impede interprofessional collaboration and integrated care delivery. In the absence of supportive policies, family dentists face challenges in implementing preventive programs, participating in population-based initiatives, and contributing to systemic health improvements. Evidence suggests that aligning oral health policies with broader public health objectives, including noncommunicable disease prevention, maternal-child health, and health equity, is essential for maximizing the impact of family dentists on population health.

Innovative strategies have emerged to address these challenges and expand the scope of family dentists' contributions. Digital health technologies, including electronic health records, mobile applications, tele-dentistry platforms, and artificial intelligence, have transformed the delivery of dental care, particularly in underserved settings. Tele-dentistry enables remote consultations, triage, and patient education, reducing geographic and economic barriers to access. Artificial intelligence supports early detection of dental pathology, predictive modeling for disease risk, and personalized preventive strategies. Mobile health applications enhance patient engagement, adherence to oral hygiene routines, and real-time monitoring of oral health indicators. These innovations not only improve clinical outcomes but also facilitate integration with general healthcare services, enabling family dentists to function as central nodes in interdisciplinary health systems.

Community-based preventive programs also exemplify innovative approaches in the practice of family dentistry. School oral health programs, maternal-child initiatives, and community clinics staffed by family dentists demonstrate measurable reductions in disease prevalence and improvements in health literacy. Evidence indicates that combining clinical services with educational interventions amplifies preventive outcomes, reinforcing behavioral change and fostering long-term adoption of healthy practices. Furthermore, family dentists increasingly engage in advocacy for policy interventions such as water fluoridation, sugar reduction, and tobacco cessation, demonstrating the potential to influence population-level determinants of health. These activities exemplify the transition of the family dentist from a primarily clinical role to that of a public health leader, capable of shaping policy, practice, and health behaviors at the community level.

The study also shows the transformative potential of interprofessional collaboration in enhancing the public health impact of family dentists. By working closely with physicians, nurses, dietitians, and public health officials, family dentists contribute to comprehensive health promotion strategies that address both oral and systemic conditions. Collaborative care models facilitate early identification of chronic diseases, coordination of preventive interventions, and improved management of comorbidities. For example, joint initiatives targeting diabetes management and periodontal health have demonstrated improvements in glycemic control, reduction in periodontal inflammation, and enhanced patient adherence

to care plans. These findings underscore the importance of integrating family dentists into broader healthcare teams, emphasizing the interdependence of oral and general health and reinforcing the role of dentistry within primary healthcare frameworks.

Workforce development and education emerge as critical factors in optimizing the public health contributions of family dentists. Evidence indicates that curricula emphasizing preventive care, public health principles, community engagement, and interprofessional collaboration better prepare dentists to fulfill these expanded roles. Continuing professional development programs focused on emerging technologies, health promotion strategies, and systemic disease linkages further enhance competency and efficacy. In regions where educational reforms prioritize these competencies, family dentists demonstrate greater capacity to deliver preventive care, engage communities, and participate in policy initiatives. Conversely, insufficient training and limited exposure to public health concepts constrain the ability of family dentists to influence systemic outcomes, highlighting the need for ongoing investment in workforce education and development.

Emerging technologies also facilitate the measurement and evaluation of public health impact. Electronic patient records, population-level health databases, and digital monitoring platforms allow family dentists to track outcomes, identify high-risk populations, and implement targeted interventions. Data-driven approaches support evidence-based decision-making, optimize resource allocation, and enhance the effectiveness of community-based programs. Moreover, integration of these technologies with national health information systems enables coordination with broader health services, promoting continuity of care and enabling family dentists to function as integral contributors to population health monitoring and policy development.

The global evidence base underscores the importance of context-specific strategies. In high-income countries, the focus may be on integrating technological innovations, optimizing preventive interventions for aging populations, and addressing persistent inequalities among marginalized groups. In low- and middle-income countries, priority is given to expanding access through mobile clinics, community programs, and innovative financing models that reduce financial barriers. Across all settings, family dentists contribute most effectively when their clinical expertise is aligned with public health objectives, supported by appropriate policy frameworks, and enhanced through technological and educational innovations.

Family dentists serve as essential actors in public health, extending their impact far beyond the dental chair. Their engagement in community health initiatives, preventive programs, policy advocacy, and interprofessional collaboration contributes to the reduction of oral disease, improvement of systemic health, and advancement of population-level outcomes. Despite persistent challenges, including workforce shortages, inequitable access, and policy limitations, innovative strategies—particularly the adoption of digital technologies, community-based interventions, and evidence-informed education—demonstrate the potential to overcome these barriers. The literature underscores that optimizing the role of family dentists in public health requires a multifaceted approach that integrates clinical excellence, community engagement, technological innovation, workforce development, and systemic policy support, thereby ensuring that family dentists remain central to both individual and population health in a rapidly evolving global context.

The integration of family dentists into health systems and policy frameworks is fundamental to maximizing their contributions to primary dental care and public health. Evidence suggests that countries with well-structured policies supporting oral health demonstrate superior outcomes in disease prevention, access equity, and health promotion. Policy integration encompasses multiple dimensions, including workforce planning, inclusion of oral health in universal health coverage, financial mechanisms for preventive care, and alignment with broader health objectives such as the control of noncommunicable diseases. In high-income countries, structured policies ensure routine access to preventive services,

systematic monitoring of population oral health, and the promotion of early interventions. These frameworks also facilitate interprofessional collaboration, enabling family dentists to work closely with physicians, nurses, and public health officials to deliver comprehensive care.

Universal health coverage that explicitly includes dental services is a critical determinant of effective integration. For example, in the United Kingdom, the National Health Service provides coverage for preventive and restorative dental care, ensuring broad access to family dentist services across age groups and socioeconomic strata. This inclusion allows for systematic monitoring of oral health, early detection of disease, and the implementation of population-level preventive interventions. Evaluations indicate that this approach reduces inequalities, improves oral health literacy, and strengthens the alignment between dental and general health services. In contrast, in countries where dental care remains largely privatized or excluded from national health coverage, disparities in access are pronounced, and the preventive and public health roles of family dentists are constrained. Financial barriers limit patient engagement with routine services, increasing the prevalence of advanced disease and elevating long-term healthcare costs.

Workforce distribution policies are equally significant in shaping the public health impact of family dentists. Adequate numbers of trained professionals, equitable geographic deployment, and incentives for service in underserved regions enhance access to care and reinforce preventive interventions. Studies from Canada and Australia illustrate that policy measures, such as financial incentives, rural placement programs, and community service obligations, effectively redistribute dental professionals, reducing disparities and improving oral health outcomes in remote and socioeconomically disadvantaged populations. Conversely, in many low- and middle-income countries, workforce shortages and urban concentration of dentists perpetuate inequities, emphasizing the need for strategic planning, capacity building, and supportive policy interventions to optimize the role of family dentists in primary care and public health.

Comparative case studies illuminate the diversity of models and their effectiveness in integrating family dentists into broader health systems. Brazil's Family Health Strategy exemplifies a comprehensive approach, wherein dental teams are embedded within primary care units, providing preventive care, health education, and community outreach. Longitudinal evaluations demonstrate reductions in dental caries prevalence among children, improved periodontal health, and increased public awareness of oral hygiene practices. Importantly, the model emphasizes continuity of care, cultural competence, and collaboration with other healthcare professionals, highlighting the multidimensional contributions of family dentists.

In the United Kingdom, the integration of dental services into the National Health Service ensures that family dentists play a central role in preventive and restorative care, as well as in surveillance of population oral health. Routine dental visits, school-based programs, and targeted interventions for high-risk populations allow for early disease detection, behavior modification, and coordinated management of systemic conditions with oral manifestations. Evaluations of these programs indicate high levels of patient adherence, measurable reductions in oral disease, and enhanced equity in access. These findings underscore the value of policy-supported integration in optimizing the preventive and public health functions of family dentists.

In India, innovative approaches to extending the reach of family dentists include mobile dental units, community-based outreach programs, and collaboration with local health authorities. These initiatives target rural and underserved populations, delivering preventive care, education, and early diagnosis services. Evidence indicates significant improvements in oral health knowledge, increased utilization of dental services, and reductions in untreated dental disease. Challenges persist, including limited workforce capacity, infrastructure constraints, and financial barriers, but these models demonstrate the potential of creative solutions to overcome systemic obstacles.

The United States presents a complex landscape characterized by high-quality dental services for those with coverage but significant disparities among uninsured, low-income, and rural populations. Family

dentists operate in a mixed system, combining private practice, community health centers, and public programs. Innovations such as school-based preventive care, Medicaid-supported dental services, and tele-dentistry initiatives have expanded access, yet inequities persist. Studies highlight the critical importance of integrating family dentists into community health strategies, emphasizing interprofessional collaboration, policy support, and targeted resource allocation.

Future directions for the role of family dentists in global health emphasize the integration of technology, policy reform, workforce development, and interdisciplinary collaboration. Emerging digital tools, including tele-dentistry platforms, mobile health applications, and artificial intelligence, offer opportunities for risk assessment, preventive planning, early diagnosis, and patient engagement. These tools are particularly valuable in underserved regions, where access barriers impede traditional care delivery. Digital health solutions also enable longitudinal monitoring, population health analysis, and integration with broader healthcare systems, enhancing the capacity of family dentists to contribute to systemic health outcomes.

Workforce development is a parallel priority, requiring curricula and professional training programs that emphasize preventive care, public health principles, interprofessional collaboration, and technological competence. Evidence suggests that dentists trained in these competencies are more effective in community engagement, health promotion, and integration into health systems. Continuing professional development, mentorship, and exposure to global best practices further enhance the capacity of family dentists to address evolving population health needs.

Policy reform remains central to future progress. Integrating oral health into national health agendas, providing financial incentives for preventive care, ensuring universal coverage, and supporting equitable workforce distribution are essential for maximizing the impact of family dentists. Alignment with the Sustainable Development Goals reinforces the broader relevance of oral health, linking it to noncommunicable disease control, health equity, education, and social determinants of health. Advocacy by professional associations, collaboration with government agencies, and engagement with international organizations such as the World Health Organization are critical mechanisms for advancing these objectives.

The literature also highlights the importance of interdisciplinary and community partnerships. Family dentists, when integrated into primary care teams, contribute to holistic patient management, particularly for individuals with chronic conditions, developmental disorders, or complex medical histories. Collaboration with schools, community organizations, and public health agencies facilitates preventive interventions, health education, and early identification of risk factors, enhancing both individual and population health outcomes. Evidence suggests that these collaborative approaches are more effective in reducing disease burden, promoting health literacy, and fostering sustainable behavioral change than isolated clinical interventions.

Innovative global initiatives illustrate the transformative potential of family dentists' in future healthcare landscapes. In Singapore, integration of dental services into community health programs and use of digital platforms for risk assessment has improved access and preventive outcomes. In Sweden, school-based dental programs combined with national surveillance of oral health enable targeted interventions for high-risk populations. In Sub-Saharan Africa, pilot programs incorporating mobile clinics, tele-dentistry, and task-shifting to mid-level providers demonstrate promising reductions in oral disease prevalence and increased community engagement. These case studies highlight the adaptability of family dentists to diverse contexts and the importance of systemic support, technological innovation, and community-oriented strategies in maximizing impact.

Family dentists occupy a central and evolving role in primary dental care and public health, bridging clinical practice, community engagement, policy implementation, and health systems integration. Evidence

from comparative case studies, global analyses, and emerging innovations underscores that their contributions extend beyond individual patient care to influence population health, reduce disparities, and support systemic health outcomes. Future directions emphasize integration of technology, workforce development, policy reform, and interdisciplinary collaboration, creating opportunities for family dentists to function as pivotal actors in global health. Optimizing their role requires a comprehensive approach that aligns clinical excellence with public health objectives, ensures equitable access, and leverages innovation to enhance preventive, diagnostic, and educational functions. Through these strategies, family dentists will continue to transform the landscape of oral health, contribute to systemic well-being, and advance global health equity in an increasingly interconnected and complex world.

Highlights

Workforce development and education are central to the future of family dentistry. Curricula that emphasize preventive care, public health principles, interdisciplinary collaboration, and technological competence equip dentists to meet evolving global health needs. Continuing professional development, mentorship, and exposure to innovative models further enhance their ability to deliver high-quality care and participate meaningfully in population health strategies. Investments in workforce expansion, equitable distribution, and skill development are therefore essential for strengthening the role of family dentists as agents of preventive care, public health advocacy, and systemic integration:

- **Central Role in Prevention and Early Detection:** Family dentists provide preventive care and identify oral manifestations of systemic diseases, contributing to early diagnosis and improved health outcomes.
- **Community and Public Health Impact:** Through school programs, maternal-child initiatives, mobile clinics, and outreach services, family dentists extend their influence beyond clinical settings, promoting health literacy and equitable access.
- **Integration with Health Systems:** Policy-supported integration of family dentists into primary care systems enhances continuity of care, interprofessional collaboration, and alignment with population health objectives.
- **Technological Innovations:** Tele-dentistry, artificial intelligence, digital imaging, and mobile health platforms expand access, enable personalized interventions, and facilitate data-driven decision-making.
- **Global Evidence and Comparative Models:** Successful programs in Brazil, the United Kingdom, India, Singapore, and Scandinavia demonstrate that structured policy, workforce support, and community engagement maximize the impact of family dentists.
- **Challenges and Barriers:** Workforce shortages, geographic maldistribution, policy fragmentation, financial constraints, and socio-cultural factors limit the full realization of family dentists' potential.
- **Future Directions:** Emphasis on education, interprofessional collaboration, policy reform, technological adoption, and sustainable workforce planning will optimize the role of family dentists in promoting oral and systemic health globally.
- **Implications for Global Health:** Family dentists are integral to achieving health equity, reducing disease burden, and implementing comprehensive preventive strategies, positioning them as pivotal actors' in future healthcare systems.

The family dentists occupy a uniquely strategic position at the intersection of clinical practice, community engagement, and public health policy. Their contributions to preventive care, early disease detection, health promotion, and systemic health integration are critical for reducing oral and systemic disease burdens, promoting equity, and enhancing health outcomes across diverse populations. The evidence highlights the necessity of supportive policy frameworks, workforce planning, technological innovation, and community-oriented strategies to optimize their impact. Future directions should prioritize

integration of digital tools, alignment of dental and general healthcare services, development of interdisciplinary competencies, and expansion of equitable access to care. By addressing existing challenges and leveraging emerging opportunities, family dentists are poised to play an increasingly transformative role in global health, advancing not only oral well-being but also broader systemic and population health objectives.

SUMMARY

The comprehensive analysis presented in this study underscores the pivotal and multifaceted role of family dentists in advancing primary dental care and public health globally. Across diverse healthcare systems and socio-economic contexts, family dentists function not only as clinicians delivering restorative and preventive services but also as educators, advocates, and agents of systemic health integration. The evidence indicates that their contributions extend beyond individual oral health outcomes to encompass broader population-level effects, including reductions in disease prevalence, promotion of healthy behaviors, and facilitation of equitable access to care. Family dentists' engagement in both clinical and public health domains positions them uniquely to influence health trajectories across the lifespan, from early childhood through geriatric care, and to address the complex interplay between oral and systemic health.

One of the key insights emerging from this study is the essential role of family dentists in preventive care and early disease detection. Through regular monitoring, patient education, and targeted interventions, they are able to identify oral pathologies at an early stage, implement preventive measures, and coordinate care with other health professionals to manage systemic conditions manifesting orally. Preventive strategies such as fluoride application, sealant programs, professional cleanings, dietary counseling, and behavioral guidance have demonstrated measurable effectiveness in reducing the burden of oral disease. Moreover, family dentists are increasingly employing emerging technologies—such as digital imaging, artificial intelligence, and tele-dentistry—to enhance early detection, personalize preventive care, and extend their reach to underserved populations. These innovations amplify their clinical impact and facilitate integration with broader health systems, reinforcing the concept of dentistry as an essential component of holistic healthcare.

The study also highlights the critical public health functions of family dentists. Their involvement in community-based programs, school initiatives, maternal-child health campaigns, and outreach services demonstrates a capacity to influence health behaviors, reduce disease disparities, and promote oral health literacy. In both high-income and low- and middle-income countries, evidence indicates that family dentists who engage in preventive programs at the community level contribute to reductions in disease prevalence, improvements in functional oral health, and greater adherence to healthy behaviors. These contributions are particularly significant in underserved regions, where access to care is limited, and social determinants of health exacerbate disparities. By bridging the gap between clinical care and population health, family dentists emerge as critical facilitators of health equity and community well-being.

Challenges persist, however, that limit the full realization of family dentists' potential. Workforce maldistribution, policy fragmentation, financial barriers, and cultural factors impede equitable access to care, particularly in low-resource settings. High-income countries, despite robust infrastructures, continue to experience disparities in access among socioeconomically disadvantaged groups and marginalized populations. Low- and middle-income countries face amplified challenges, including limited infrastructure, insufficient workforce, and underfunded public health initiatives. These systemic barriers highlight the need for strategic interventions that encompass policy reform, workforce development, technological innovation, and culturally sensitive approaches to community engagement. Family dentists, while central to these interventions, require supportive frameworks and systemic alignment to maximize their effectiveness.

Policy integration and health systems reform emerge as critical determinants of the impact of family dentists. Countries that embed oral health within primary care frameworks, provide universal coverage for preventive and restorative services, and align dental practice with broader health objectives demonstrate superior population outcomes. Comparative case studies, including examples from Brazil, the United Kingdom, India, Singapore, and Scandinavia, illustrate how structured policy environments enhance the capacity of family dentists to deliver preventive care, engage communities, and contribute to systemic health improvements. These models emphasize continuity of care, interdisciplinary collaboration, and evidence-based interventions, providing insights that can inform policy development in other regions.

Emerging technological innovations represent transformative opportunities for family dentists in both clinical and public health domains. Tele-dentistry, digital health applications, artificial intelligence, and mobile health platforms extend access to underserved populations, support personalized preventive care, and enhance monitoring of population health indicators. These technologies also facilitate data-driven decision-making, optimize resource allocation, and enable integration with general health services. Their adoption, combined with targeted workforce education and training, positions family dentists to function effectively as central nodes in interconnected healthcare systems, bridging gaps between individual care, community interventions, and systemic health initiatives.

FUTURE PERSPECTIVES

The evolving role of family dentists in primary dental care and public health presents numerous opportunities for innovation, integration, and global health advancement. As oral health continues to be recognized as a fundamental component of overall health, family dentists are uniquely positioned to bridge clinical practice with public health initiatives, preventive strategies, and population-level interventions. The future perspectives outlined below emphasize technological advancement, workforce development, policy integration, research priorities, and global health strategies.

Technological Innovation and Digital Integration: The integration of advanced technologies, including artificial intelligence, digital diagnostics, tele-dentistry, and electronic health record systems, is poised to transform primary dental care. AI-assisted diagnostic tools and predictive analytics can enhance early detection of oral and systemic diseases, facilitate personalized treatment planning, and enable continuous monitoring of population oral health trends. Tele-dentistry platforms will expand access to underserved and remote populations, providing consultation, triage, and follow-up services that bridge gaps in care. Mobile health applications and digital education platforms will further empower patients to adopt preventive behaviors, engage in self-monitoring, and access professional guidance without geographical constraints.

Workforce Development and Education: Future strategies emphasize equipping family dentists with the skills necessary for an increasingly integrated and preventive-oriented healthcare system. Curricula should incorporate interprofessional education, public health competencies, data literacy, and digital health technologies to prepare dentists for complex clinical and population health challenges. Continuing professional development programs will play a critical role in updating practitioners on evidence-based preventive strategies, emerging technologies, and policy-driven initiatives. Moreover, workforce planning must address global disparities by incentivizing practice in underserved regions, fostering interdisciplinary collaboration, and ensuring equitable distribution of dental professionals.

Policy and Systems Integration: Family dentists are expected to play a central role in policy-driven efforts to integrate oral health into broader healthcare systems. Future perspectives involve embedding dental services within universal health coverage frameworks, aligning preventive care with chronic disease management, and ensuring continuity between dental and general healthcare. Policymakers are increasingly recognizing the need for oral health inclusion in national health strategies, school-based

programs, and community outreach initiatives. Family dentists, as frontline practitioners, will contribute to the design, implementation, and evaluation of such policies, thereby enhancing the effectiveness and sustainability of health systems.

Community Engagement and Public Health Advocacy: The role of family dentists will continue to expand beyond clinical care into advocacy and community engagement. Future directions include active participation in health promotion campaigns, development of culturally sensitive educational programs, and leadership in initiatives targeting diet, hygiene, tobacco cessation, and sugar consumption. By fostering partnerships with schools, community organizations, and public health agencies, family dentists can influence social determinants of oral health, reduce disparities, and promote population-wide behavioral change.

Research and Evidence Generation: The advancement of the family dentist role will be supported by rigorous research and data-driven practices. Future perspectives include longitudinal studies evaluating the impact of preventive interventions, cost-effectiveness analyses of dental public health programs, and comparative studies across diverse geographic and socioeconomic contexts. Additionally, research will focus on integrating oral health metrics into general health monitoring frameworks, enabling family dentists to contribute meaningfully to systemic health outcomes.

Global Health and Equity: Family dentists are poised to contribute significantly to global health equity. Future strategies emphasize addressing disparities in access, workforce distribution, and service quality. Leveraging digital platforms, international collaborations, and standardized preventive care protocols will allow family dentists to deliver consistent, evidence-based care across regions. These efforts will be particularly impactful in low- and middle-income countries, where oral health burdens remain high, and preventive services are limited.

Interdisciplinary and Holistic Care Approaches: The future role of family dentists will increasingly involve integration into multidisciplinary healthcare teams, working alongside physicians, nurses, nutritionists, and public health specialists. Such collaboration will facilitate holistic care approaches, linking oral health with systemic disease management, mental health support, and chronic disease prevention. This model fosters a more patient-centered, coordinated, and efficient healthcare delivery system.

Sustainability and Preventive Paradigms: Preventive care will remain a cornerstone of future dental practice. Emphasis on sustainable, community-oriented, and evidence-based preventive interventions will shape the profession. Family dentists will serve as educators, advocates, and implementers of health-promoting behaviors, reinforcing the value of oral health within broader public health frameworks.

The future of family dentistry is characterized by technological innovation, interdisciplinary collaboration, global integration, and preventive-focused strategies. Family dentists are positioned not only as clinicians but as catalysts for systemic improvements, population health advancement, and equity-driven healthcare solutions. Their evolving role will require continuous adaptation, evidence-based practice, and proactive engagement in shaping policies, education, and community interventions that align with the emerging global health landscape. By embracing these perspectives, family dentists will continue to enhance oral and systemic health outcomes worldwide, ultimately contributing to a more integrated, preventive, and equitable healthcare system.

CONCLUSIONS

- Family dentists occupy a critical and multidimensional role in both primary dental care and public health, functioning as clinicians, educators, and public health advocates. The evidence demonstrates that their contributions extend beyond restorative and therapeutic interventions to encompass

preventive care, early detection of oral and systemic conditions, health promotion, and community engagement. Through structured preventive strategies, patient education, and interprofessional collaboration, family dentists reduce the burden of oral disease, promote health literacy, and support broader population health objectives.

- The integration of family dentists into primary healthcare systems and supportive policy frameworks is essential to maximize their impact. Countries that embed dental services within universal health coverage, prioritize equitable workforce distribution, and align oral health with systemic health initiatives consistently demonstrate improved population outcomes. Comparative analyses of programs in Brazil, the United Kingdom, India, and Scandinavia illustrate the effectiveness of structured, policy-supported models that combine clinical services with community-oriented preventive programs.
- Emerging technologies, including tele-dentistry, digital imaging, artificial intelligence, and mobile health platforms, present transformative opportunities for family dentists to expand access, deliver personalized preventive care, and participate in data-driven health management. Workforce development, emphasizing preventive care, public health competencies, interprofessional collaboration, and technological proficiency, further enhances their ability to contribute to systemic health outcomes.
- Despite these advances, significant challenges remain, including workforce maldistribution, inequitable access, policy fragmentation, financial barriers, and socio-cultural determinants that limit utilization of dental services. Addressing these barriers requires comprehensive strategies encompassing policy reform, educational innovation, technological adoption, and community-oriented approaches.
- The family dentists are indispensable actors in global health, positioned at the intersection of individual patient care, population health, and health system integration. Optimizing their role requires a multifaceted approach that combines clinical excellence, public health engagement, technological innovation, and supportive policy frameworks. By embracing these strategies, family dentists can continue to advance oral and systemic health, reduce disparities, and contribute meaningfully to the realization of equitable, preventive, and integrated healthcare worldwide.

RECOMMENDATIONS

Based on the comprehensive analysis of family dentists' roles in primary dental care and public health, several evidence-informed recommendations emerge to optimize their impact at individual, community, and systemic levels:

- **Policy Integration and Universal Coverage:** Oral health must be fully integrated into national health policies and universal health coverage schemes. Policymakers should ensure that preventive, diagnostic, and therapeutic dental services are accessible and affordable for all population groups, particularly underserved and vulnerable communities. Alignment of dental services with primary healthcare objectives will enhance continuity of care, reduce disparities, and improve overall health outcomes.
- **Workforce Planning and Distribution:** Strategic workforce planning is essential to ensure equitable access to family dentists. Policies should incentivize practice in rural, remote, and socioeconomically disadvantaged areas through financial incentives, professional development opportunities, and service-based obligations. Expanding the workforce, supporting mid-level dental providers, and promoting interdisciplinary collaboration will strengthen preventive care and public health delivery.
- **Emphasis on Preventive Care and Health Promotion:** Family dentists should prioritize preventive strategies across the lifespan, including caries prevention, periodontal health, oral hygiene education, and early detection of systemic conditions with oral manifestations. Community-based programs,

school initiatives, maternal-child health interventions, and outreach services should be systematically implemented to promote oral health literacy and sustainable behavioral change.

- **Integration of Technology:** Adoption of tele-dentistry, digital imaging, and electronic health records, mobile health platforms, and artificial intelligence can enhance access, improve early detection, enable personalized preventive strategies, and support population-level monitoring. Policymakers and healthcare organizations should invest in technological infrastructure and training to leverage these innovations effectively.
- **Education and Continuous Professional Development:** Dental curricula and continuing education programs should emphasize preventive care, public health principles, interprofessional collaboration, and technological competence. Preparing family dentists with these competencies will enable them to address evolving health needs, participate in systemic health initiatives, and effectively engage communities.
- **Interprofessional Collaboration:** Family dentists should be integrated into multidisciplinary healthcare teams, coordinating with physicians, nurses, nutritionists, and public health professionals. This collaboration facilitates comprehensive management of patients with chronic conditions, enhances preventive care, and reinforces the oral-systemic health nexus.
- **Community Engagement and Advocacy:** Family dentists should actively participate in community health promotion, policy advocacy, and public education. Engaging in campaigns for water fluoridation, sugar reduction, tobacco cessation, and healthy lifestyle behaviors amplifies the impact of preventive care and addresses population-level determinants of oral and systemic health.
- **Research and Evidence-Based Practice:** Ongoing research is necessary to evaluate the effectiveness of preventive interventions, technological innovations, and public health strategies. Family dentists should contribute to data collection, program evaluation, and knowledge dissemination to inform evidence-based practice and policy decisions.
- **Addressing Socio-Cultural and Economic Barriers:** Culturally sensitive care, health literacy initiatives, and financial support mechanisms should be implemented to overcome barriers that limit access to preventive and therapeutic services. Tailoring interventions to community needs enhances utilization, adherence, and health outcomes.

Implementing these recommendations will enhance the capacity of family dentists to provide high-quality, preventive, and equitable care, strengthen public health outcomes, and support the integration of oral health into global healthcare systems. By combining policy reform, workforce development, technology, and community engagement, family dentists can continue to play a transformative role in improving both oral and systemic health worldwide.

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