The bi-directional relationship among oral health and other systemic diseases and conditions provides a strong rationale for integration of oral health and primary care practice. Patient care services may be coordinated across different times, places, and professional disciplines to provide a team approach to care for overall health.

Common infectious oral diseases are widespread, often begin as children, and affect people throughout the lifespan. The 2010 Global Burden of Disease Study declared oral diseases as the number one problem “collectively affecting 3.9 billion people” [1]. Untreated caries in permanent teeth was the most prevalent condition worldwide (all age global prevalence of 35%), and both severe periodontitis and untreated caries in deciduous teeth were in the top 10 diseases worldwide (6th and 10th most prevalent conditions, affecting 11% and 9%, respectively, of the global population) [1].

In the United States, national data from 2011–2014 showed that about 24% of children aged 2–5 years had experienced dental caries in primary teeth, with 11% having untreated caries and 19% of adolescents aged 12–19 having untreated caries [2]. The 2009–2010 North Carolina survey of kindergarten children showed that although the proportion with untreated tooth decay was 15%, disparities remained for American Indian, Asian, and black children. One-third of kindergarten children already had experienced tooth decay [3]. In 2013–2014, 18% of kindergarten children in rural counties were affected with untreated disease [4] compared to 13% statewide [5]. Jackson and colleagues, using North Carolina data, demonstrated that children with poor oral health status were nearly 3 times more likely than classmates with good oral health to miss and perform poorly in school as a result of dental pain [6].

Yet, there has been a historic divide between the medical and dental professions [7]. There are 5 medical schools in North Carolina. Of those schools, UNC-Chapel Hill and East Carolina University (ECU) each have a dental school on their campus; Wake Forest University, Duke University, and Campbell University—all private schools—do not. There was a combined first-year enrollment of 645 medical students in 2015 [8], and UNC-Chapel Hill and ECU annually enroll 82 and 52 dental students, respectively, in 4-year programs. ECU graduated its first class of general dentists in 2015 [9]. North Carolina had medical residents in training in 2014 at 10 locations around the state [8]. Half of these locations hosted dental residency programs [10].

In 2014, North Carolina nationally ranked 28th with its physician-to-population ratio [11] and 47th in active dentist-to-population ratio [9]. In 2016, there were 23 active licensed physicians in North Carolina per 10,000 population. Of the 100 counties, 83 had fewer than 23 per 10,000, including 3 counties with none. In comparison, in 2016, there were 4.9 licensed dentists in practice in North Carolina per 10,000 population, with 55 counties having fewer than 3.3 dentists per 10,000 population [12]. Nationally, there are 6.1 practicing dentists per 10,000 population [13].

The World Health Organization (WHO) has long encouraged the collaboration of health care providers to bring the best possible health outcomes. WHO defines interprofessional education (IPE) as “when 2 or more professions learn with, about and from each other to enable effective collaboration and improve health outcomes” and interprofessional collaborative practice as “when multiple health workers from different professional backgrounds provide comprehensive services by working with patients, their families, careers, and communities to deliver the highest quality of care across settings” [14]. The UNC Craniofacial Center is a longstanding example of team-based, patient-centered interprofessional care.

IPE implementation took on new urgency in the United States when accreditation standards for collaborating with other members of the health care team were established for health professions’ educational programs [15]. Both UNC-Chapel Hill and ECU dental schools have implemented IPE activities. It is more difficult when multiple types of health professionals are not trained at the same location.

Overall, in 2016, there were 140 dental care and 147 primary care health professional shortage area (HPSA) designations in North Carolina [16]. Table 1 shows the number of
HPSAs occurring in rural counties [17]. There are 14 rural counties that have only a dental and 10 counties with only primary care HPSAs, 28 with both dental and primary care HPSAs, and 31 with HPSAs that additionally impact behavioral medicine. These data suggest that there could be definite benefits to the public’s health from integrating dental and primary care to provide patients with access to health professionals who can screen, monitor, and refer patients to the appropriate clinician.

Integration of Oral Health and Primary Care

Oral infections have been linked with chronic diseases such as diabetes and cardiovascular disease that share common risk factors and impact conditions like pregnancy. Oral diseases cause pain and disrupt basic functions, including eating, sleeping, speaking, and a person’s self-esteem, resulting in a significant societal impact. Thus, like other public health concerns, one must galvanize our health care resources to address the problem utilizing a system-wide health care approach.

The bi-directional relationship among oral health and other diseases and conditions provides a strong rationale for a bi-directional relationship between oral health care and primary care. Infection and inflammation in the oral cavity can affect other organ systems. Similarly, systemic diseases such as diabetes affect periodontal status; some medications cause hyposalivation, a risk factor for dental caries; and arthritis and cognitive disorders limit oral hygiene self-care ability, all impacting oral health [18].

There are numerous ways in which integration of oral health and primary care may occur [19]. Patient care services may be coordinated across different times, places, and professional disciplines. Multiple health professionals may develop a combined, coordinated care plan for their patients. This approach has historically been done within medical disciplines, but less frequently between medicine and dentistry, aside from the traditional referral process. Within health care systems, one might integrate financial and delivery systems to assure the best type of care be available for patients to achieve the highest level of health possible.

No Integration

In areas where there is no integration between medical and dental care providers, the patient is left to manage the challenges of seeking appropriate care. One costly result has been the seeking of dental care in hospital emergency departments (ED). People with no dental insurance, with Medicaid but without available Medicaid dental providers, who seek care after usual business hours or who have poor health literacy, may seek care in the only place they know they will not be turned away: the ED. North Carolina provides a good example of this problem. Based on disease category codes submitted by hospital emergency rooms for all patients seen with dental problems (ICD-9 All-listed Codes 525.9: Dental Disorder not otherwise specified), between 2007 and 2010, the national per capita rate of ED visits increased from 30 to 40 ED visits per 10,000 population, a 33% increase. The North Carolina rate increased from 50 to 70 ED visits per 10,000 population, a 40% increase [20], and by 2013, was almost 90 dental ED visits per 10,000 [4]. A North Carolina hospital report highlighted concerns associated with management of dental conditions by the ED. Over 90% of the dental patients treated by ED personnel received primarily pain management and infection control and were discharged without definitive dental treatment. Disturbingly, “48% of patients received a dose of opioid in the ED, and 81% received an opioid prescription” [21]. Use of opioids following dental pain have been shown to be an introduction to opioid use [22]. In 2014, US charges for dental ED visits totaled $1.9 billion [23]. The majority are for non-urgent, non-traumatic dental conditions that, according to Wall and colleagues, could be better treated in community settings [24]. A Minnesota Accountable Care Organization (ACO) with responsibility for total patient care installed community health workers in the ED to assess patients presenting with dental pain and then secured appropriate dental care for the problem, not just the symptoms [25]. This process reduced the number of ED visits for preventable dental conditions.

Integration Through a Formal Closed-Loop Referral Process

Recognizing that most physicians and dentists are in non-integrated practices, integration can begin using simple agreements regarding referral and acceptance of patients. North Carolina offers an early model of such a practice with the Into the Mouth of Babes (IMB) program, which began in 2001. Pediatricians provide preventive oral health services and dental referral for Medicaid-enrolled children up to age 42 months with poor access to dental care [26]. The program was developed in response to the prevalence of untreated early childhood caries in young children seen by physicians for well-child visits. The data confirms the potential behind such individual practice integration; children who

| Table 1. Health Professional Shortage Areas (HPSA) Designated for Rural North Carolina Counties in 2016 |
|---------------------------------------------------------------|
| **Dental care HPSA only** | **Primary care HPSA only** | **Both dental and primary care HPSA** | **Dental, primary care, and behavioral HPSA** |
| 14 | 10 | 28 | 31 |

Source. NC Department of Health and Human Services, Office of Rural Health, Health Statistics and Data [17]. State fiscal year 2016 North Carolina Health Professional Shortage Areas Map, Rural NC counties designated health professional shortage areas.
received 4 or more IMB visits experienced an average of 17% reduction in dental caries-related treatments up to 6 years of age compared to children with no IMB visits [27].

Alternative integration approaches have been implemented in rural states such as New Mexico and Colorado, where physicians either employ or co-locate dental hygienists in their practice to provide preventive oral health services to children, pregnant women, and patients with chronic diseases such as diabetes [28, 29].

Integrating Through Shared Financing

ACOs increasingly state that they can’t be responsible for improving overall health if they do not control the oral health services [25]. HealthPartners, a nonprofit ACO in Minnesota, offers a combined medical and dental health plan with 100% coverage, with no copays or maximums, for most preventive dental services for patients who are pregnant or diabetic, including extra oral exams and cleanings if warranted [30]. Physicians refer the pregnant woman to the dentist early in the pregnancy so that she may receive timely oral health care.

The State of Oregon’s transformation of health presents a wide-scale model of integration through shared financing. Beginning in 2012, Oregon took the 3 siloed health systems—medical, behavioral, and oral health—and created Coordinated Care Organizations (CCOs) responsible for “health outcomes by providing and delivering physical, behavioral, and oral health services on one global budget” [31]. They have already demonstrated care coordination approaches that include referral of patients with chronic diseases and emphasize prevention and patient education [32, 33].

Co-Location and Closer Integration of Medical and Dental Providers

Some ACOs, like Kaiser Permanente Northwest, encourage co-location in shared facilities where possible, and closer integration of medical and dental providers through integrated electronic health records (EHR). Their quality improvement philosophy is to engage the patient and compare preventive services received, such as mammograms, flu shots, or colonoscopy, against the patient’s care plan. Any provider channels the information back to the patient, encouraging him/her to complete the recommended service. Kaiser recently reported that dentists had closed more preventive “care gaps” than any department except Family Medicine [25]. Such integration has enabled Kaiser to improve their Healthcare Effectiveness Data and Information Set (HEDIS) and quality of care metrics [34].

The American Dental Association has studied the integration of medical screening into dental practice and concluded that with the dentist’s “expertise and network” it may be beneficial for dentists to provide medical screenings [35]. Having dentists emphasize prevention in areas such as tobacco cessation, and now preventive care gaps for immunizations and chronic diseases, may help improve patients’ overall health, especially in areas with a physician shortage.

Barriers to Integration

There are a number of barriers that constrain the innovative, integrated medical and dental care approaches seen in other states. Restrictive licensing and scope of practice acts are challenges that discourage innovative employment of dental hygienists in physician offices or underserved areas, or nurse practitioners in dental offices. For example, the North Carolina Dental Hygiene Act limits the number of dental hygienists a dentist may employ in practice to 2 and allows only a dentist to supervise hygienists [36]. Secondly, the lack of integrated EHRs prevents all health care providers from seeing a patient’s common care plan and treatment status. Care coordination, navigation systems, and transportation assistance can help to educate and direct patients with health literacy challenges or limited resources to the right place for care, avoid EDs, and enhance patients’ ability to access preventive care. Payment structures, like the growing ACO structure, encourage health plan leaders to develop innovative financing models to enable a multidisciplinary care team to develop the best evidence-based care plan possible.

The health care landscape is changing and starting to address these barriers. By increasing communication, coordination, and integration between medical and dental practices, we should move closer to the triple aim [37] to improve the patients’ health care experience, reduce cost, and improve population health. NCMJ
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