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Delta Dental of Minnesota Foundation

Promising Practices in Improving Oral Health Care Service Delivery and Access

A Literature Review prepared for the Delta Dental of Minnesota Foundation

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Introduction

Delta Dental of Minnesota Foundation has worked since its inception in 2009 to expand access to oral health services and improved oral health for underserved populations in Minnesota. They do this primarily by awarding grants and providing oral health resources to organizations with a shared mission throughout Minnesota, and encouraging collaboration and leadership in the field. To further inform this work, Delta Dental of Minnesota Foundation and Wilder Research collaborated to create the following literature review around identified areas of interest to the Foundation. This literature review aims to provide clarity around promising oral health service delivery and policies that aim to bolster the dental workforce and delivery models, all with the mission of breaking down barriers to positive oral health. The methods used in conducting this literature review can be found in the Appendix.

The current state of oral health

Oral health issues and dental disease present a unique public health concern; while many are unaware of the oral health crisis in the United States, it is rampant. In fact, the surgeon general issued a report in 2000 declaring dental and oral diseases a "silent epidemic" (U.S. Department of Health and Human Services, 2000). These sentiments were echoed by the Institute of Medicine in 2010 and affirmed by the Health Resources and Services Administration (HRSA) in 2014 (Institute of Medicine and National Research Council, 2011; U.S. Department of Health and Human Services, 2014). The total cost of dental services reached $111 billion in 2013, with significant spending on remedying preventable oral disease (Phillips & Hummel, 2016). Tooth decay is one of the most common chronic conditions of childhood in the United States, yet it is largely preventable (Centers for Disease Control and Prevention, 2014).

In Minnesota disparities exist and persist. The American Academy of Pediatric Dentistry and the American Academy of Pediatrics recommend at least one dental visit each year, yet only 61 percent of Minnesota children age 1 to 17 living in low-income households had a past year dental visit, compared to 85 percent of Minnesota children in high-income households (Minnesota Department of Health [MDH], 2018b).

The field of oral health provides ample opportunities for public health improvement; numerous barriers to consistent oral health care exist for those living in the United States. Among these are:

- **The lack of dental insurance and high cost of out-of-pocket payments for dentist visits.** Even though there has been improvement over the years, about one in four Americans in 2016 did not have dental insurance coverage. In Minnesota, the percentage of residents without dental insurance has decreased from 33 percent in 2011 to 26 percent in 2015 (MDH, 2015a).
- **Low Medicaid reimbursement rates that result in dental practices that do not accept public insurance.** In 2016, 83.9 million Americans received dental insurance through public insurance; however, from one-half to two-thirds of dentists in the United States do not accept public insurance (National Association of Dental Plans, 2018). In 2015, 1.4 million Minnesotans were enrolled in public insurance programs, however, only 32 percent of enrollees received dental care (MDH, 2015b). Sixty-five percent of all active licensed dentists in Minnesota in 2011 submitted at least one Medical Assistance claim; however, about 36 percent of those dentists made claims for 20 patients or fewer (Office of the Legislative Auditor, 2013). Additionally, of the dentists who do accept public insurance, many limit the number of publicly insured patients they accept.
- **A field-wide shortage of dentists.** There has been a decrease in the number of practicing dentists in the United States over the past two decades. Over the next decade, it is estimated that two dentists will retire for every new dental graduate (Dollins, Bray, & Gadbury-Amyot, 2013). In Minnesota, there were 58.54 dentists per 100,000 people as of 2018, the national average was 60.97 (American Dental Association, 2019).
- **A clustering of dentists into suburban areas.** "Dental Deserts," or areas in which there are not enough oral health professionals, are frequently found in rural areas, low-income areas, and areas with historically marginalized communities. In 2017, 53 million Americans lived in areas that had been federally designated as having a shortage of dentists (Koppelman & Singer-Cohen, 2017). Nearly two-thirds of all counties in Minnesota are designated as dental care Health Professional Shortage Areas (HPSAs) either for low-income individuals or based on geography (Minnesota Department of Health, Office of Rural Health & Primary Care, 2018).
- **A disconnect between the medical and dental fields.** While important for general health, doctors are not trained to search for or identify concerns around oral health. Due to this siloing of services, patients often consider dental care as discretionary. While patients may be consistently seeing a doctor, oral health concerns may be missed (Phillips & Hummel, 2016). However, the percentage of Minnesotans that

reported not receiving needed dental care due to cost dropped from 17 percent in 2011 to 12 percent in 2015 (MDH, 2015a).

Many dental care providers and funders, public health practitioners, and academics have determined different strategies for addressing the oral health crisis in the United States, both by identifying improvements to be made in service delivery and by strategizing around how to address the workforce crisis.

Promising practices in oral health service delivery

Oral health is integral to the general health and well-being of all Americans. While there are increasingly safe and effective means to treat and prevent the most common dental diseases – dental caries and periodontal diseases – there are many disparities in oral health status that persist among our most vulnerable populations, including children, older adults, people lack or without insurance (U.S. Department of Health and Human Services, 2000). The following section is a summary of recent literature on promising dental therapies and treatments, the latest research on medical-dental integration, and improved and innovative models for delivery of care. The areas of focus for this literature search were determined by the Delta Dental of Minnesota Foundation team and are not exhaustive of all promising practices in oral health care.

Preventive and restorative care

Dental sealants

In 2016, the Centers for Disease Control and Prevention (CDC) reported that dental sealants to shield teeth in the back of the mouth could prevent up to 80 percent of cavities in school-aged children, yet data show that about 60 percent do not get them. One of the most effective ways to implement this treatment is through school-based sealant programs (SBSPs) (CDC, 2016). According to a study looking at sealant use prevalence and the mean number of decayed and filled first molars, it was approximated that 6.5 million low-income children could potentially benefit from the delivery of sealants through SBSPs (Griffin, 2016). With funding from Delta Dental of Minnesota Foundation and in partnership with nonprofit dental clinics, the Minnesota Department of Health has worked to develop a statewide, coordinated school-based dental sealant program that targets schools with lower-income families and schools in rural communities, due to the strong evidence showing that sealants are an effective measure to prevent tooth decay among children. Another promising treatment includes application of fluoride varnish and silver diamine fluoride. However, research studies indicate that more studies are needed to prove their effectiveness.

In 2013 Delta Dental of Minnesota Foundation initiated a partnership with the Minnesota Department of Health to increase sealant use among children considered most at risk of poor oral health. Through its 'Smiles@School' program, the Foundation has contributed over $1.5 Million to support school-based sealant programs throughout the state.

Fluoride — toothpaste, varnish, and the "new" silver diamine

Dentists have been using fluoride in many forms for decades. The most well-known use of fluoride by the public may be the fluoridation of tap water, which has been shown to prevent tooth decay. Systematic reviews also confirm the benefits of using fluoride toothpaste in preventing caries in children and adolescents when compared to placebo. However, the effects of fluoride on caries prevention is relative to the level of fluoride concentration (Walsh et al., 2010; Santos, Nadanovsky, & Oliveira, 2013).

Brushing teeth with fluoride toothpastes has led to substantial global caries decrease in the last decades (Nadanovsky & Sheiham, 1995; Bratthall, Hänsel-Petersson, & Sundberg, 1996). Fluoride toothpastes range in level of fluoride concentration, but they should contain at least 1,000 ppm fluoride to be effective in controlling caries in preschoolers, children, and adolescents (Santos, Nadanovsky, & Oliveira, 2013; Santos, Oliveira, Nadanovsky, 2013; Wright et al., 2014; Walsh et al., 2010).

Since 1994, when the Food and Drug Administration approved the use of fluoride varnish, it has become a routine treatment to prevent caries in young children. The use of fluoride varnish for prevention in both primary and permanent teeth was highlighted in a meta-analysis conducted in 2008. Findings suggest that fluoride varnish can have a substantial caries-inhibiting effect, but that the quality of evidence is moderate and includes high risk of bias studies with considerable heterogeneity (Marinho, Worthington, Walsh, & Clarkson, 2008; Twetman & Dhar, 2015; Anderson et al., 2016). Studies do consistently show, however, that there are no adverse events related to the application of fluoride varnish (Garcia et al., 2017). Despite a lack of solid evidence supporting its effectiveness, fluoride varnish is widely used in dental clinics across the U.S. as it is quick and easy to apply. Based on evidence identified by the American Dental Association, fluoride varnish is effective when applied topically to permanent teeth of school-aged children and adolescents, and to the primary teeth of preschool children. They have also recommended that it be applied to older adults to reduce root caries, and adults who are susceptible to dental caries (American Public Health Association, 2010).

Silver diamine fluoride 38% (SDF), a more recent promising treatment for active dental caries in primary teeth in children and adults, was cleared by the U.S. Food and Drug Administration (FDA) in 2016, receiving the FDA's Breakthrough Therapy Designation (BTD). BTD represents the FDA's effort to address an unmet, serious, and life-threatening medical need where there is no available therapy. Originally cleared for treatment of dentinal hypersensitivity, it is now cleared for arresting active caries. This clearance is based on the review of 10 worldwide randomized clinical trials evaluating SDF for caries arrest in children age 3-9 or adults age 60-89, as well as studies conducted by the manufacturer. Collectively, these trials involved approximately 1,500 subjects who were

monitored for 1-3 years (Decisions in Dentistry, 2016). An evidence-based guideline has been provided by the American Academy of Pediatric Dentistry (AAPD) (Crystal et al., 2017). These recommendations are based on a 2016 systematic review and meta-analysis by Gao et al. (2016).

Despite its approval from the FDA, well-designed clinical trials comparing the outcomes of SDF to other treatments for the arrest of carious lesions in primary and permanent teeth are still needed to further build the evidence base for this treatment (American Dental Association, 2017; Clemens et al., 2018). There are some precautions when using SDF as it will stain defects in the tooth structure, such as carious lesions and restorative margins, and can stain other things it comes in contact with. However, it will not stain sound tooth structure and is very cost effective as it is non-surgical and one drop can be used for multiple teeth. Studies suggest that SDF has great potential to aid the dental public health community to address dental caries in at-risk populations (Clemens et al., 2018; Chu & Lo, 2008).

Integration of dental and primary care

The integration of oral health and primary care, while not a novel concept, is relatively new in practice (Gauger, Prosser, Fontana, & Polverini, 2018). In 2014, the U.S. Department of Health and Human Services Health Resources and Services Administrations introduced *Integration of Oral Health and Primary Care Practice*, a report that sought to improve early detection of oral health problems and preventive measures by increasing oral care proficiency among primary care physicians and encourage interdisciplinary integration and collaboration (2014). On the oral health side, the American Dental Association adopted policy supporting human papillomavirus (HPV) vaccine in 2018, urging dentists to support the use and administration of it for cancer prevention (ADA News, 2018). There is also a growing recognition that oral health providers play an important role in primary care by monitoring medical conditions such as hypertension (Elangovan et al., 2014) and diabetes (Creanor et al, 2014) during patient visits. In addition, research found that dentists play an important role in smoking cessation, because they can encourage patients to stop smoking and promote success by advising patients to use cessation medications (Zhang et al., 2017).

In 2014, Delta Dental of Minnesota Foundation awarded $1.8 million in multi-year grants to organizations for the purpose of 'transforming the safety net system to include integration of dental and medical care.' Funded strategies included co-locating dental services in medical clinics, piloting telehealth efforts, and improving technology infrastructure to allow provider access to both medical and dental records.

However, the documentation of medical-dental integration models is sparse, therefore evidence pointing to which approaches are successful in different contexts is largely unknown. There are enough programs, policies, and frameworks being implemented to start to get an idea of what the possibilities are for promoting health equity, oral disease prevention, and health promotion through medical-dental integration strategies.

Conceptual frameworks, policies, and programs

A review by Harnagea et al. in 2018 found that, in general, oral health integrated care programs were designed in the public health sector and based on partnerships with various private and public health organizations, governmental bodies, and academic institutions. Strategies used to integrate oral health care often include building interdisciplinary networks, training non-dental care providers, oral health champion modelling, enabling care linkages and care coordinated processes, and using e-health technologies. This review found that there is a lack of reporting on long-term outcomes associated with these programs, likely due to the recent implementation of them. The authors state, "Scientific, evidence-based and rigorous evaluation research are needed to provide data on cost-effectiveness and sustained outcomes of oral health integrated models" (Harnagea et al., 2018, p. 10).

A 2018 review by Gauger et al. on integration models that target pediatric populations found that most collaborations were based within Federally Qualified Health Centers and that, while there were varying levels of integration, collaboration, and services offered, each offered a baseline of oral care. The minimum offered was oral health risk assessment, oral health instruction, topical fluoride application, and assessment for further treatment. These integration models most benefit individuals that utilize FQHC and help those on Medicaid and CHIP insurance plans as models in the U.S. are most commonly located at these sites. The majority of private providers do not accept these insurance plans (Gauger, Prosser, Fontana, & Polverini, 2018).

Two conceptual frameworks that have been used to implement oral health in primary care include the Integration of Oral Health and Primary Care Practice (IOHPCP) Initiative, proposed by the Health Resources and Services Administration and the Oral Health Delivery Framework, developed by practitioners, policymakers, and other stakeholders (Harnagea et al., 2018). IOHPCP is an initiative with three inter-related components: 1) a draft set of oral health core clinic competencies appropriate for primary care clinicians, 2) the presentation of a systems approach to delineate the interdependent elements that would influence the implementation and adoption of the core competencies into primary care, and 3) the characterization and outline of the basis for implementation strategies and translation into primary care practice in safety net settings (U.S. Department of Health and Human Services, 2014).

The Oral Health Delivery Framework, in contrast, provides a structure for defining operational components of oral health integration. Key components of the framework include a series of steps for primary care physicians: ask, look, decide, act, and document. This framework is used by Smiles for Life, which provides a National Oral Health Curriculum that offers self-paced, online education that is certified as continuing education for both clinicians and non-clinician care team members (Phillips & Hummel, 2016). Both frameworks may be useful tools for any effort to integrate medical and dental care.

Oral health care integration policies differ not only between countries, but also within countries at the national and local levels. Most countries have policies that focus on care coordination plans, rather than fully integrated oral health strategies. Some policies emphasize care for specific population groups such as early childhood, children, adults with special needs, elders, rural and remote communities, as well as Aboriginal and Indigenous populations (Harnagea et al., 2018).

Interprofessional collaborative practice

Efforts such as interprofessional education (IPE) and interprofessional collaboratives have hastened shifts to unite dentistry and medicine in recent years. IPE is defined as students from two or more professions learning about, from, and with each other to enable effective collaboration and improve health outcomes; and multiple health workers from different professional backgrounds working together with patients, families, and communities to deliver the highest quality of care (World Health Organization, 2010).

An Oral Health Strategic Framework, 2014-2017 developed by the U.S. Department of Health and Human Services outlines five overarching goals, including the integration of oral health in primary health care and an increase in the dissemination of oral health information, which calls for private-public partnerships and collaborative practices (U.S. Department of Health and Human Services, 2016). This framework, in support of collaborative practices, has led to increased funding for oral health care in community health clinics and grants to support training for the integration of oral health into primary care at medical schools and other educational institutions.

Due to a history of medical and dental separation and siloing in insurance, practice, and professional education, significant changes will be needed among our educational as well as public and private insurance systems. While oral health electives and rotations exist at several medical schools, broader adoption of oral health training in medical education could dramatically improve oral health for the highest-risk groups (Cohen, 2013; Mouradian et al., 2006; Silk, O'Grady Stille, Baldor, & Joseph, 2009). As mentioned earlier, Smiles for Life has a National Oral Health Curriculum aimed at providing

education to primary care physicians with the goal of making sure oral health is routinely and strategically included in primary care visits. Some of the greatest barriers to working in interprofessional teams are lack of interoperable electronic records, differing reimbursement structures, and persistent health disparities (Schmitt, Blue, Aschenbrener, & Viggiano, 2011).

Barriers and facilitators to integrated care

A 2017 scoping study by Harnagea et al., provides a descriptive synthesis of the barriers and facilitators of the integration of oral health into primary care. Key barrier-related themes included lack of political leadership and health care policies, implementation challenges, discipline-oriented education, lack of continuity of care and services and patients' oral health care needs. The facilitation of integration included supportive policies and resources allocation, interdisciplinary education, collaborative practices between dental and other healthcare professionals, presence of local strategic leaders, and geographical proximity (Harnagea et al., 2017).

Improved models for delivery of care

In addition to the integration of medical and dental practices, other models of care have arisen to address disparities in dental disease and address barriers to care such as access and acceptance of public insurance programs. Some of the strategies that are beginning to be documented and researched are described in the following section.

School-based oral health care

School-based oral health care initiatives have shown promise in reducing untreated dental disease by providing fluoride varnishing, identifying unmet dental needs, and providing referrals to community-based, accessible dental providers (Dudovitz et al., 2018). As mentioned earlier, school-based sealant programs have increased the prevalence of dental sealant use, proving to be a highly effective intervention to prevent tooth decay in children who may not have access to regular care; however, most children have not received sealants. Increasing this practice could greatly reduce tooth decay associated problems and treatment costs (Griffin, 2016).

Community-based public health programs

Oral health education and prevention programs or interventions

Programs that target healthy behaviors, such as daily tooth brushing, regular contact with fluoride sources, and healthy diet and limited consumption of sugar are often used in conjunction with other efforts to improve oral health in adults and children. A systematic review looking at the effectiveness of oral health education programs found that oral health education improves the knowledge, attitude, and practice of oral health and reduces plaque, bleeding on probing of the gums, and caries increment. This review also found that oral health programs are often most successful when they are labor intensive, involve multiple stakeholders, and receive significant funding and support (Nakre & Harikiran, 2013). An additional systematic review focused on the effectiveness of educational interventions in health services found that most studies evaluating behavioral and periodontal outcomes showed significant improvements in oral health. All studies found a reduction in new lesions or cases of the disease in the group receiving the interventions; however, not all studies found the differences to be statistically significant (Menegaz, Silva, & Cascaes, 2018).

Oral health care and prevention of early childhood caries is increasingly incorporated into the Women, Infant, and Children (WIC) program, nursing, midwifery, and other programs and is a promising strategy to decrease oral health disparities experienced in early childhood (Fadl, Blair, & Hassounah, 2016; Gold & Tomar, 2018). California has incorporated oral health education and caries prevention into early childhood home visiting models. Specific home visiting programs, such as Early Head Start, Healthy Families America, Nurse-Family Partnership, Parents as Teachers, and Welcome Baby have incorporated oral health services in various ways (The Children's Partnership, 2016).

In Minnesota, the state legislature awarded funds for Healthy Teeth. Healthy Baby, a program that promotes dental health among infants and toddlers through education to parents/caregivers and public health professionals. The campaign is geared toward communities of color and recent immigrants. The campaign uses motivational interviewing techniques and educational and communications materials that are appropriate for non-English speaking parents and caregivers (MDH, 2018a).

Volunteer programs for dentists

While programs that provide free oral health services to underserved children are implemented nationally, no studies have been conducted to show their effectiveness or impact on prevention. The Give Kids A Smile (GKAS) program utilizes the services of 10,000 dentists annually and has served more than 5.5 million children since 2003 (ADA

Foundation, 2018). Minnesota has donated services to GKAS since its inception. In 2017, over 2,000 dental professionals volunteered at more than 125 clinics across the state (Minnesota Dental Association, 2017).

Portable/mobile care models

Mobile or portable dental clinics can be an effective way to provide services to specific populations like older adults, those in long-term care, and children; address geographic barriers to accessibility, such as for people living in rural areas; and reach generally hard-to-reach populations such as low-income families, new immigrants, people experiencing homelessness, and persons with mental illness or substance abuse problems. It can be challenging to get transportation to a dental clinic, as well as access a dental clinic that accepts public assistance insurance (Medicaid) (Oral Health Workforce Research Center, 2016). Four case studies by the Oral Health Workforce Research Center illustrate the ways in which mobile clinic models have changed access to oral health care for those in long-term care, "Prior to the [mobile model], we were required to get [patients] to a dentist. So to find a dentist to be able to [treat elderly patients] or who would accept whatever the payment was from public assistance was almost impossible." (Oral Health Workforce Research Center, 2016, p.46).

A systematic review on mobile dental units found that overall they help to address issues of accessibility, affordability, and sustainability barriers. They are successful at reaching more people than dental clinics with a fixed location and are able to operate in more flexible ways than stationary clinics to address temporal, geographic, and cultural barriers to health care utilization (Vashishtha et al., 2014; Oral Health Workforce Research Center, 2016). Services provided by mobile dental clinics range from comprehensive primary care to discrete selected services (Vashishtha et al., 2014).

Despite the growing number of mobile dentistry programs, most of these programs are in the formative stage and there is a lack of data to show the impact or outcome of services provided. Further longitudinal clinical studies are needed to assess the long-term benefits of the use of mobile dentistry to determine and measure its efficacy in underserved communities (Vashishtha et al., 2014).

Teledentistry

Local safety net providers, such as Children's Dental Services, Apple Tree Dental, the University of Minnesota, and Hennepin Healthcare are at the forefront of piloting teledentistry in Minnesota. The 2017 passage of a parity policy ensures that teledentistry is reimbursed by Medicaid in Minnesota. Recruitment and workforce sustainability are often a challenge in rural areas resulting in significant dental provider shortages.

Teledentistry is showing some promise as a strategy to support rural, isolated, and new health care workers, increasing access to advice and education for rural dental practitioners, and increasing access to specialists that may have previously been unattainable (Irving, Stewart, Spallek, & Blinkhorn, 2017). Modern teledentisty is cost effective and utilizes readily available daily-integrated technologies. A qualitative systematic review found five main themes in studies that explored the accuracy and effectiveness of teledentistry in practice.

- Using information and communication technology (ICT) – most teledentistry programs use personal internet connections, smartphones, and personal computers to gather, store, and forward required data. Technology is decreasing in cost and increasing in quality.
- Regulatory and system improvements – regulatory barriers such as remuneration for the clinical team need to be overcome as there is often limited financial support available for teledentistry advisors to be reimbursed for their time.
- Accuracy of teledentistry – the majority of studies assessing accuracy of teledentisty found that it was as reliable as face–to-face clinical observations.
- Effectiveness of teledentistry – studies found that teledentistry increased access to clinical services, cost savings, and timeliness with a high acceptability from clinicians, patients, and caregivers.
- Building and increasing clinical capacity of the dental workforce – evidence shows that teledentistry is a tool to build the capacity of clinicians through the creation of a supportive environment and learning experience. "Teledentistry was reported to be able to increase the ability of the remote dental team to provide treatment beyond their initial capacity and were able to increase specialist dentistry services" (Irving et al., 2017, p.142).

A recent systematic review by Estai et al. (2018), determined that while there is emerging evidence supporting the efficacy of teledentistry, there is a need for more conclusive evidence, particularly regarding its effectiveness, cost-effectiveness and long-term use, in order to make evidence-based policy decisions about its use.

Community health workers

Community health workers are defined as frontline public health workers who are trusted members of or have an unusually close understanding of the community served (American Public Health Association, 2018). The U.S. Bureau of Labor Statistics recognizes "community health worker" as a standard occupational classification, but in reality CHW can be used as a term for dozens of paid and volunteer job titles (U.S. Department of Health and Human Services, 2016; U.S. Department of Labor, 2017). These reasons, in addition to the many disease areas that are targeted by CHW programs, make is difficult to assess and summarize program effectiveness. Existing evidence shows that the most promising areas include using CHWs to deliver certain specific, high-value, preventive services – focused on reducing risk factors from chronic conditions – to low-income, minority, or other underserved populations (U.S. Department of Health and Human Services, 2016).

Delta Dental of Minnesota Foundation has contributed to the addition of Community Health Workers in Oral Health. One example began in 2015 with a $1.5 million award for workforce solutions that promote good oral health among populations experiencing health disparities. Open Door Health Center and Children's Dental Services incorporated Community Health Workers into their oral health education and mobile dentistry programs.

While CHWs have been well studied in areas of diabetes and asthma (Rothschild et al., 2014; Pérez-Escamilla et al., 2015; Campbell et al., 2015; Krieger, Song, & Philby, 2015; Viswanathan et al., 2010; Lewin et al., 2010), they are relatively new to the area of oral health. CHW training curriculum for oral health has begun to be developed as a first step toward generating evidence for oral health CHWs and determining their effectiveness (Martin, Frese, Lumsden, & Sandoval, 2018). While clear evidence is not available, academics claim that when case management is incorporated into a dental professional's practice via CHWs, prevention is elevated, leading to decreased costs and increased access (Grover, 2017).

Some promising findings from a report developed by the Minnesota Community Health Worker Alliance explores the integration of CHWs into oral health teams in Minnesota and indicates that there have been increases in completion of pediatric referral to specialists and that more children are cavity free. The report also showed that CHWs helped clients to understand the process and expectations, so missed appointments and gaps in the provider's schedule are reduced. Additionally, there has been a reduction in emergency room visits for patients interacting with CHWs (Minnesota Community Health Worker Alliance, 2016). Positive outcomes were also found in a study that investigated the effect of the availability of local CHWs on access to a program's preventive dental services for children. CHWs were found to be beneficial in promoting program enrollment, as well as facilitating and augmenting the delivery of preventive dental services (Mathu-Muju, Kong, Brancato, McLeod, & Bush, 2018).

Workforce policies to improve oral health care access

A lack of access to licensed oral health professionals continues to be a significant problem for large portions of the population. In fact, more than 53 million people in the United States lived in areas deemed a dental care Health Professional Shortage Area (HPSA) in 2017. The United States has seen a decrease in the number of practicing dentists in the past two decades (Dollins et al., 2013), and this problem is projected to grow; the Health Resources and Services Administration anticipates that by 2025, the shortage of dentists around the country will double (Koppelman & Singer-Cohen, 2017). The workforce problems in dentistry are twofold: not only is there a general dearth of dentists, but dentists are also highly concentrated, typically within more affluent and suburban areas (Koppelman & Singer-Cohen, 2017). This leaves individuals in the inner city and in rural areas with fewer options.

Adding to the issue of geographic barriers is the issue of cost. At the end of 2016, 23 percent of Americans lacked any dental insurance (National Association of Dental Plans, 2018). For those who are covered by public insurance, finding providers that accept that coverage is challenging. Dental practices may choose whether or not to accept public insurance, and less than 50 percent of dentists do so. Among those who do, many limit the total number of patients on public insurance they will provide care for. Medicaid does not provide an incentive for dentists to provide services to those receiving this benefit; reimbursement rates are low and the paperwork involved in getting those reimbursements is troublesome (Dollins et al., 2013).

Dental therapists

In response to these issues, Minnesota created a new type of dental practitioner position in 2009: dental therapists (Glasrud, Embertson, Day, & Diercks, 2009). Dental therapists serve a role similar to that of nurse practitioners in the medical field; that is, they can provide a broader range of services than dental hygienists in preventive and restorative care, but are still under general supervision by a state-licensed dentist; supervision by a dentist can include off-site review of records and diagnoses (Glasrud et al., 2009).

While this is a relatively new position in the United States, it has been described as a best practice in the provision of dental care across the world; as of 2017, 54 countries have a position similar to this (Dollins et al., 2013). Furthermore, dental practitioner positions akin to dental therapists are gaining traction in the United States. In 2017, 13 states had pending legislation or current advocacy efforts to create this position. As of April 2018, there were 86 licensed dental therapists in Minnesota who work at 54 different sites (34 are dually licensed in both dental hygiene and dental therapy and 48 have achieved

certification as ADTs – advanced dental therapists) (MDH & Minnesota Board of Dentistry, 2018).

Legislative and accreditation history

In 2007, a coalition of oral health leaders called the Safety Net Coalition Oral Health Committee lobbied the Minnesota Legislature to create a new position for a mid-level dental practitioner. Despite significant pushback from organized dentistry, this position was codified in 2009 (Glasrud et al., 2009).

Currently, two programs operate in Minnesota to certify dental therapists: Metropolitan State University and the University of Minnesota's School of Dentistry. Metropolitan State admits six students per year, and the University of Minnesota admits eight students per year (MDH & Minnesota Board of Dentistry, 2018). The accreditation granted by these programs only allows graduates to practice in Minnesota at present. In the future, states could collaborate to align dental practice acts to allow certification to cross state lines (Glasrud et al., 2009).

The first dental therapists in the United States began practicing in 2004 in Alaskan tribal villages, in accordance with federal law. However, Minnesota was the first to pass state legislation to authorize the new position of dental therapist (Glasrud et al., 2009). They have been followed in recent years by a growing number of states, including Maine, Vermont, and, most recently, Arizona (Koppelman et al., 2016; Grant & Angelone, 2018).

In practice

Patients served

Dental therapists are able to increase access for communities by simply placing more oral health practitioners in underserved areas. The Minnesota Department of Health and the Minnesota Board of Dentistry conducted an evaluation in 2014 that showed that dental therapists improve access for underserved patients, resulting in reduced wait times and travel distances (MDH, 2014). Case studies conducted by Wilder Research and the Pew Foundation have found hiring dental therapists decreased wait time, increased numbers of patients served, and increased numbers of diagnostic and restorative services (MDH and MBD, 2018). At present in Minnesota, dental therapists are limited to working in practice settings that serve low-income and underserved populations, including:

- Public and private "safety net" practices that provide care for those on public assistance

- Places defined in the "Limited Authorization for Dental Hygienists" statutes, including:
  - Nursing homes
  - Head Start programs
  - Nonprofit organizations
  - Correctional facilities
  - School and community clinics
- Medical facilities, assisted living facilities, and federally qualified health centers

Minnesota statutes define underserved populations as those who are enrolled in a Minnesota health care program, have a medical disability or chronic condition that creates a significant barrier to receiving dental care, or who do not have dental health coverage and whose family is at or within 200 percent of the federal poverty line (MDH, 2017). The evaluation of Minnesota's dental therapist program that was conducted for the Minnesota Legislature found that dental therapists were serving who they were intended to serve; 84 percent of patients served by Minnesota's dental therapists were enrolled in public insurance (Mathu-Muju, Friedman, & Nash, 2016). The Minnesota Department of Health and the Minnesota Board of Dentistry report that the geographic spread of active dental therapists in the state reflects the population of the state broadly: 41 percent of active dental therapists are employed in greater Minnesota, which is home to 45 percent of Minnesota's population (MDH and MBD, 2018).

Costs

The cost of service continues to be a pervasive issue in the field of dental care. The creation of the dental therapist position is, in part, a response to this issue, as they are able to provide critical oral health services for lower cost to a practice than a dentist, due to differences in salary levels (MDH, 2017; MDH and MBD, 2018).

Medicaid reimbursement rates are cited as a primary reason why those on public insurance continue to be underserved by dental practitioners (Dollins et al., 2013). Medicaid reimbursement rates have been deemed to be too low to properly compensate and incentivize dentists to provide services to those on public insurance, as well as the administrative burden of accepting Medicaid and filing for reimbursement (MDH, 2017).

Dental therapists, however, have been lauded as a way to address low reimbursement rates. Because of the lower cost to a practice of employing a dental therapist as opposed to a dentist, accepting public insurance becomes more financially feasible for practices (Koppelman & Singer-Cohen, 2017). Notably, one recent case study of a rural clinic in Minnesota noted that while their dental therapist's billings were almost equivalent to that

of the average billing for the clinic's dentists (at 94%), the therapist's hourly wage was up to 50 percent less than that of a dentist in rural Minnesota, resulting in significantly lower costs for the practice (Koppelman, 2018). Wilder Research case studies of dental therapists in Minnesota found that clinics saw net benefits to their practices, as additional revenue outweighed costs for a net gain to the clinics' monthly revenue (Wagner, Ferris, & Diaz, 2017a; Wagner, Ferris, & Diaz, 2017b).

While lowering costs is essential in increasing access to dental care, it is important to ensure that lowered costs don't come at the expense of worse patient outcomes or satisfaction. Case studies found that patients were very satisfied with the quality of care they received from their dental therapists; these results were similar to those of dentists and dental hygienists at the same practice (Wagner, Ferris, & Diaz, 2017a; Wagner, Ferris, & Diaz, 2017b). Additionally, oral health integration may be one way to lower health care costs, as health insurance payment shifts towards value-based care. The integration of oral health into accountable care organizations (ACOs) and other payment models are currently being piloted and studied. These new systems, based on health outcomes rather than services rendered, will place more of a focus on preventive care and improved collaboration among a myriad of care providers, ultimately reducing overall health care costs (Simon, 2016).

While assessment in this area is still new, initial results point to equivalent levels of patient outcomes and satisfaction when comparing services provided by a dental therapist and those provided by a dentist (Mathu-Muju et al., 2016; Koppelman & Singer-Cohen, 2017).

Dental hygienists

Minnesota law also allows expanded functions for dental assistants and dental hygienists, including limited authorization for dental hygienists in certain settings (such as Head Start sites, nursing homes, group homes, and tribal and community clinics) under collaborative agreements with dentists (Minnesota Department of Health, 2014).

Improving the career pipeline

As mentioned, there is a shortage of licensed dentists, and this shortage is expected to grow (Dollins et al., 2013). The expense of attending dental school, compounded with decreasing returns on that investment, seem to deter potential dental students from entering the field. Dental students have been reported to have an average debt of $262,000; this amounts to a $3,300 loan payment per month (Holter, 2018). Because of these financial demands, new dentists are pushed to work in metropolitan areas that can

provide higher salaries. In addition to this, the dental workforce is aging; data from the Minnesota Department of Health indicates that within the next 10 years, 50 percent of current Minnesota dentists will be retired (Holter, 2018). In short, the country has too few dentists, and those who do practice are pushed to very specific areas, leaving many without access to dental care. Below we outline a few strategies that have been implemented to address this workforce crisis.

Financial incentive programs, including scholarships and loans

There are a variety of programs that have been designed to lessen the financial burden for new or potential dentists who are interested in working in underserved areas. These include scholarships and loans with service requirements or options, or loan repayment or forgiveness programs to incentivize work in rural, underserved, or Health Professional Shortage Areas (What Works for Health, 2010).

- Access to a loan repayment program has been found to be the most significant predictor of dental students planning to participate in public service; relatedly, increasing student debt was the most significant barrier (Davidson et al., 2011).
- This strategy has shown promise in Minnesota, where multiple programs are supporting repayment:
  - The Martha Mordini Rukavina Loan Forgiveness Program has successfully attracted five dentists to the Iron Range. Those five dentists serve 21,163 patients (Holter, 2018).
  - The Minnesota Health Care Loan Forgiveness and Repayment Programs includes opportunities for dentists and dental therapists (https://www.health.state.mn.us/facilities/ruralhealth/funding/loans/index.html).

Delta Dental of Minnesota Foundation, in collaboration with Minnesota Dental Foundation, awarded $2 million to 10 dentists to work in rural, underserved populations of Minnesota. http://www.dedicatedmndentists.org/grant-recipients/

New professional titles

As mentioned above, the creation of the dental therapist position has opened the door for those interested in providing dental care to become trained to provide many of the most common dental services at a much lower cost and with fewer years required for training. By addressing these barriers, the creation of this new professional title has the opportunity to attract those who have been interested in dental care work but unable to dedicate the time and money to attend dental school.

Diversification of the workforce

The demographics of the United States are changing; by 2050, about half of the population will be comprised of racial and ethnic minorities (Brunson, Jackson, Sinkford, & Valachovic, 2010). It is important for the dental profession to diversify to ensure that dentists and dental care providers reflect the communities they serve.

Dental schools are uniquely situated as gatekeepers of the profession; strategies to recruit and support new dental students are important in increasing the number of new dentists and dental care professionals. One program that has led this work in recruiting underrepresented minorities and low-income students specifically is described more fully below.

There has been a recent push by dental schools to diversify their student bodies (Catalanotto, 2017). One program, the Pipeline, Profession, and Practice: Community-Based Dental Education program (more commonly known as the Dental Pipeline Program), worked from 2001 to 2010 with 15 dental schools to expand community-based education and increase recruitment of underrepresented minority and low-income students (Geisz, 2013). They did so by actively recruiting students, providing financial aid resources (including connecting them with federal loans, public and private scholarships, and loan repayment programs), and supporting faculty development in this area ("Underrepresented Minority and Low-Income (URM/LI) Student Recruitment," n.d.).

This Dental Pipeline Program saw an increase in applications from underrepresented minorities by 77 percent and increased enrollment of underrepresented minority groups by 16 percent across the participating schools (Geisz, 2013). This program provided a helpful example of ways in which dental schools can work to actively recruit and support students who would not otherwise be able to pursue a dental profession; this is a promising example of a model, though more work needs to be done to understand the impact of this initiative.

Appendix

Methods

Wilder Research staff worked collaboratively with Delta Dental of Minnesota Foundation to identify topic areas for the literature review. Additionally, Delta Dental of Minnesota Foundation team members identified specific articles and resources for inclusion in the literature review.

Wilder Research library staff searched academic and gray literature (literature published outside of a peer-review process, including theses or dissertations, technical or evaluation reports, and working papers) for information on oral health care for low-income populations and related best practices, oral health care delivery and workforce models and related policies, dental therapy models, and integration of oral health care with primary and behavioral health care. The databases consulted include PubMed, Google Scholar, and proprietary databases accessed through the Saint Paul Public Library and University of Minnesota Libraries. Search terms included the following:

- (oral health OR oral hygiene OR dental health OR dental care OR oral care) AND (low-income OR underserved OR vulnerable population) AND (best practices OR what works OR promising practice OR evidence based)
- (oral health OR oral hygiene OR dental health OR dental care OR oral care) AND (uninsured OR public program OR public assistance) AND (improve OR increase) AND (access OR utilization)
- (oral health OR oral hygiene OR dental health OR dental care OR oral care) AND (emerging workforce models OR Service delivery OR delivery model OR payment model)
- Trends AND public health dentistry
- (dental students OR dental school OR dental education) AND (pipeline OR scholarship OR loan forgiveness OR post bac*)
- (occupational license/licensure AND policy/policies) AND (dental therapy/therapist OR dental therapeutics OR dental auxiliary/auxiliaries OR mid-level dental practitioner)
- (effectiveness OR cost benefit OR quality of care) AND (dental therapy/therapist OR dental therapeutics OR dental auxiliary/auxiliaries OR mid-level dental practitioner)
- (oral health OR oral hygiene OR dental health OR dental care OR oral care) AND (community health services OR community health worker)
- (oral health OR oral hygiene OR dental health OR dental care OR oral care) AND (portable care OR mobile care OR tele*)

- (mobile dental/dentistry) AND practice OR program OR service OR unit
- (oral health OR oral hygiene OR dental health OR dental care OR oral care) AND (behavioral health OR mental health OR primary care OR health care) AND (integrated OR integration)

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