

A Review of Global Oral Health

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Author Biography

My name is Renee Jia, and I am an 11th grader based in Atlanta Georgia. I am interested in pursuing biology and public health in college with a goal of becoming a dental professional. Outside of academics, I am an artist and a pianist, and I frequently host piano workshops for beginners.

Abstract

The oral cavity and the structures within are essential to life processes such as eating, speaking, and breathing. Main components of the oral cavity include the tongue, teeth, gums, and oral microbiome. The health of the oral cavity has strong bidirectional associations with overall health, and frequent oral manifestations of systemic diseases gives the mouth strong diagnostic potential. With an estimated burden of over 3.5 billion cases, oral diseases are considered a public health crisis. There is a strong and consistent association between socioeconomic status and the prevalence and severity of oral diseases, establishing a disproportionate burden. Factors that can impact the integrity of the oral cavity include age, nutrition, and genetics. Modifiable risk factors include diet, quality of oral hygiene, unhealthy lifestyle choices, and their underlying social determinants. Challenges preventing access to oral care include high expenses, lack of insurance, lack of perceived need, unavailability of dental offices, transportation issues, fear of dental treatment, and scheduling difficulties. These barriers have varying impacts on individuals, but especially impact marginalized communities, and stretch beyond physical health to include mental health challenges. The role of healthcare workers in community based oral health awareness programs is discussed and emphasized. There has been some evidence to show that oral health promotion programs are more effective when delivered by healthcare professionals and targeted towards parents and children under the age of 6.

Keywords: Oral health, systemic health, oral microbiome, oral cavity, field study, oral healthcare, oral health promotion

Introduction

The oral cavity, or mouth, plays an integral role in many bodily functions and quality of life. There has been research to suggest connections between oral diseases and the presence and severity of systemic conditions, and the mouth is often used as a surface level diagnostic tool due to the frequent oral manifestations of systemic diseases. Although largely preventable, oral diseases are some of the most prevalent conditions worldwide, and various barriers to oral healthcare cause large percentages of oral diseases to go untreated. This percentage is seen to increase in marginalized communities.

This paper is split into three sections. The first section will discuss the anatomy and physiology of the oral cavity, while the second will analyze the connection between oral and systemic health and the subsequent diagnostic potential of the oral cavity. The third section aims to examine the global burden of oral diseases, the barriers obstructing oral healthcare, and the efficacy and variables surrounding oral health promotion programs.

Methodology

For this paper, Google Scholar was used to find peer-reviewed resources, and the World Health Organization (WHO), Harvard School of Public Health, National Cancer Institute (NIH), Cleveland Clinic, and Centers for Disease Control and Prevention (CDC) were utilized to obtain additional literature. Literature used included data from all age groups. Peer-reviewed papers were filtered from 2000 and chosen based on inclusion of key terms and relevance to this paper's topic. In researching on Google Scholar, 77 articles were reviewed, 56 were included in the research for this paper, and 21 were omitted for various reasons.

Literature Review

Anatomy and Physiology of the Oral Cavity

The main structures within the oral cavity (mouth) consist of the tongue, gingiva (gums), lips, teeth, and the hard and soft palates (roof of the mouth)

(National Cancer Institute, n.d.). The mouth also houses the oral microbiome, a diverse and unique community of microorganisms (Sedghi et al., 2021).

Maintaining the health of the oral cavity is crucial for an individual's quality of life. For this section, the oral microbiome, tongue, teeth, and gums will be discussed.

The Oral Microbiome

The oral microbiome is a collective genome of microorganisms in the oral cavity. Harboring over 700 species of bacteria, it is the second largest microbial community in humans. Different surfaces in the mouth have unique combinations of microbes (Deo and Deshmukh, 2019). The buildup of these microbes forms microbial biofilms (Bertolini et al., 2022) on surfaces such as teeth and the inside of the cheeks. The biofilm protects microorganisms from host defense factors and antibiotics, and harbors both commensal and pathogenic bacteria (Maddi and Scannapieco, 2013). When in equilibrium, the oral microbiome works to maintain the oral health of an individual (Sharma et al., 2018), and is a vital supportive component in protecting teeth, gums, and mouth linings (Curatola, 2013). Interactions within the microbiome also protect the body from invasion of undesirable outside stimulants (Gao et al., 2018). However, disturbance of this equilibrium can lead to onset of various oral and systemic diseases (Sharma et al., 2018).

The Tongue

A healthy tongue should have a rounded, symmetrical shape. Its color can vary between shades of pink and red. A thin white coating is normal and comes from keratin, a protein that protects the tongue from getting injured when eating. The surface of the tongue is covered in tiny bumps called papillae which contain taste buds, sense temperature and touch, and assist in chewing and swallowing food (Harvard Health Publishing, n.d.). Tongue muscles are very complex, allowing for independent movement of separate parts of the tongue (Sanders et al., 2013). The movements of the tongue are used in speaking and eating (Hiimae et al., 2002).

The Teeth and Gums

Teeth play an essential role in digestion by working with the tongue to break down and shape food into a swallowable ball (bolus) (Cleveland Clinic, n.d.). Healthy teeth have no untreated tooth decay and are firmly attached to the gums. Brushing and flossing should not cause pain or bleeding. Teeth are usually a uniform color and appear off-white (Harvard T.H. Chan, n.d.). Adult humans have 32 teeth, though this can vary slightly, and young children have deciduous teeth that are eventually replaced by permanent adult teeth (Cleveland Clinic, n.d.). Gums surround the base of the teeth while protecting and holding them in place (Koller and Sapra, 2023). Healthy gums are pink or red but can vary in shade. They are firm to the touch and should not bleed when flossing or brushing. Gums should be firmly attached to the teeth with no gaps (Cleveland Clinic, n.d.).

Oral Health and Systemic Health

The oral cavity is closely connected with overall health and quality of life. The mouth is also a useful surface-level diagnostic tool as signs of systemic disease frequently manifest in the mouth (Koller and Sapra, 2023). An estimated over 100 systemic diseases and 500 medications have oral manifestations (Kane, 2017). This involves the oral microbiome, other structures within the mouth, and impacts mental health.

Oral Microbiome

When in equilibrium, the oral microbiome is crucial to maintaining oral health (Curatola, 2013). But triggers in the oral cavity such as poor oral hygiene can cause the bacterial, viral, and fungal species in the oral microbiome to become pathogenic (Avila et al., 2009). This can then trigger an onslaught of oral diseases (Sharma et al., 2018). For example, dental caries (cavities) occur when sugars from the diet fuel the growth of oral pathogens and acidification of the oral biofilm, leading to acid damage to the tooth tissue (Bowen et al., 2017). Periodontitis is also associated with imbalances between pathogens and microorganisms (Sharma et al., 2018). Since the oral cavity is a major gateway to the esophagus, sinuses, middle ear, lungs, etc., pathogens in the mouth may invade these areas (Dewhirst et al., 2010). Sharma et al., (2018) notes that there are many studies reporting

a direct relationship between the oral microbiome and major systemic diseases such as cardiovascular diseases, preterm birth, and diabetes (p. 44).

The oral microbiome is a crucial area to study when diagnosing and treating systemic disease as the oral microbiota plays a major role in systemic disease development and aggravation (Thomas et al., 2021). The bidirectional connections between the oral microbiota and overall health make the mouth a great diagnostic tool for systemic diseases.

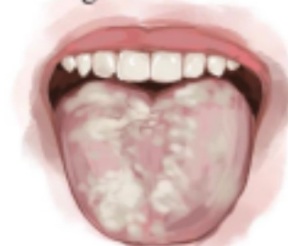
The Tongue

The tongue can quickly reflect the state of health or disease in the body. Scanning the tongue is a noninvasive complement for the diagnoses of several diseases and allows for long-term monitoring prospects. Since subjective inspection of the tongue has a low reliability index, procedures to analyze the lining of the tongue have been developed (Casu et al., 2021). Each part of the tongue is related to a certain internal organ, and the tongue's color, form, motion, and coating are observed for diagnosis (Jung et al., 2012). For example, thick white patches or sores on the tongue can signal an overgrowth of yeast in the mouth (oral thrush). Oral thrush can be accelerated by conditions such as HIV and diabetes. A bright red tongue can indicate a vitamin B12 deficiency or scarlet fever (Harvard Health Publishing, n.d.).

Figure 1



Figure 2



This illustration by Renee Jia depicts the difference between a healthy tongue (Fig. 1) and a tongue affected by oral thrush (Fig.2).

The Teeth

Dental caries (tooth decay) involve the destruction of tooth enamel and dentine by acids produced by the microorganisms in the oral cavity when supplied with high levels of sugar or other stimulants. It is a very common disease and affects 35% of the global population (M. Wilson and P. Wilson, 2021). Tooth loss and chewing difficulties have some impact on restricted dietary choices and can lead to poor nutritional status of individuals (Kossioni, 2018).

Systemic diseases have also been observed to lead to tooth loss. It has been observed that tooth loss was significantly associated with systemic diseases such as cardiovascular disorders, anemia, high blood pressure, etc.. Unhealthy lifestyle habits such as smoking and drug use were risk factors for both tooth loss and periodontitis (Haq et al., 2015).

The health of the teeth impacts overall quality of life as well. Higher numbers of missing teeth reflect poorer oral hygiene (Chin et al., 2010). Reports have additionally linked the level of periodontal detachment and loss of teeth in cardiac patients to higher mortality (Linden et al., 2012). Individuals with less than ten teeth remaining have a seven times higher mortality risk than those with more than twenty five remaining teeth (Holmlund et al., 2010).

The Gums

The relationship between gum diseases and systemic diseases is bidirectional. There are many risk factors associated with periodontal disease (gum disease) such as smoking, poor oral hygiene, age, etc., (Nazir, 2017). Periodontal disease is a chronic inflammatory disease and a main cause of tooth and gum loss (Sedghi et al., 2021). There is a strong association between periodontal disease with systemic diseases such as diabetes. Patients with diabetes showed a 24% increase in the incidence of periodontal disease, and patients with periodontitis had a 26% increase in developing diabetes (Stöhr et al., 2021). Periodontal diseases are linked to an increased risk of various cancers and cardiovascular diseases. The neuroinflammation of neurological diseases such as Parkinson's is possibly linked to periodontal diseases, with periodontitis-induced neuroinflammation affecting cognitive function as well. The bidirectional

associations observed between periodontal diseases and various systemic conditions are believed to be linked to inflammatory processes, microbial imbalances, and intertwined risk factors, but more research is needed to fully understand the relationship (Martinez-Garcia and Hernandez-Lemus, 2021).

Mental Health

Clinical studies have suggested that stress may play a role in the development of periodontal disease (Reners and Brex, 2007). Individuals going through a stressful period may be more likely to smoke, neglect their normal oral hygiene routine and miss routine dental appointments, all of which increase their risk of periodontitis and other oral diseases. There is also evidence to suggest there is a relationship between stress and periodontitis surrounding the immune response of the body (Hudson et al., 2021). There were oral signs and symptoms noted in individuals with severe COVID-19 stress and illnesses. Reports noted rapid loss and breakdown of teeth and implants, fracture of teeth and implants, as well as increased clenching and grinding of the teeth (Zinko, 2020). The presence and severity of depression is significantly correlated with oral health related quality of life, and individuals with poorer oral health tended to have more severe depression (Oancea et al., 2020).

Oral diseases have been reported to have a significant negative impact on self-esteem and oral health related quality of life (Shamim et al., 2022). Khadri et al. (2020) note that studies have reported a positive correlation between good appearance and arrangement of teeth and the self-confidence of children and young adults. For adolescents and young adults particularly, the characteristics and appearance of the face play a crucial role in self-perception, self-esteem, and quality of life (Militi et al., 2021). Children with poor oral health are at risk for diminished self-esteem and social interactions and may experience reduced academic performance due to dental pain (Crall and Vujicic 2020).

Challenges To Improving Oral Health in the Context of Global Public Health

Oral diseases have remained the most dominant and widespread conditions globally since 1990, with the combined number of oral disease cases being one billion higher than the next five most prevalent noncommunicable diseases combined (World Health Organization, 2022). The World Health Organization estimates that globally, close to 3.5 billion people are affected by at least one form of oral disease. Worldwide, and across all socioeconomic and age groups, dental caries (tooth decay) remains the most prevalent condition amongst 313 global diseases (Murtomaa et al., 2022; National Institute of Dental and Craniofacial Research, n.d.). Oral diseases are the fourth most expensive condition to treat (Murtomaa et al., 2022). Oral diseases disproportionately affect the poor and socially disadvantaged members of society and there is a very strong and consistent association between socioeconomic status (income, occupation, and education level) and the prevalence and severity of oral diseases [World Health Organization, n.d.).

For children aged two to five years, 17% of children from low-income households have untreated cavities in their primary teeth, three times the percentage of children from higher income households. Children five to nine from low-income households are twice as likely to have untreated cavities compared to children from higher income households. About 40% of adults with low-income or no private health insurance have untreated cavities. Low-income adults are twice as likely to have one to three untreated cavities, and three times as likely to have four or more untreated cavities compared to adults with higher incomes. Adults with less than a college education are almost three times as likely to have untreated cavities compared to those with a college education (Centers for Disease Control and Prevention, n.d.). Due to its high prevalence and disproportionate burden on disadvantaged populations, oral diseases are qualified as a major public health problem (Petersen, 2008).

There has been an observed connection between untreated oral disease and quality of life. Oral diseases often limit the ability to chew, eat, and communicate (Khadri et al., 2020). In 2008, over 34 million school hours were lost in the US due to unplanned urgent dental care. Over forty-five billion is lost in productivity in the US because of untreated oral

diseases. Nearly 20% of working adults and 30% of those with lower incomes report that the appearance of their mouth and teeth affects their ability to interview for a job (Centers for Disease Control and Prevention, n.d.). As children reach adolescence, aesthetic motives for good oral health increase, showing correlation between oral health and self-esteem (Kallestål et al., 2006). Children who have both poor oral health and general health are more likely to have poor school performance (Blumenshine et al., 2008).

Causes of Poor Oral Health

Oral health includes many factors, each exerting varying levels of influence. The factors involved in oral health are multifaceted and have varying degrees of effect. This section gives a broad overview of the main risks and lifestyle habits associated with oral diseases.

The oral state of an individual is impacted by many factors including age, education, nutrition, genetics, and income. Systemic variables such as periodontitis, cardiovascular diseases, obesity, and diabetes are all factors of oral health, particularly in tooth loss (Roohafza et al., 2014). Oral diseases are caused by a range of modifiable risk factors common to many noncommunicable diseases (NCDs) which include sugar consumption, tobacco use, alcohol use, and poor oral hygiene (World Health Organization, n.d.).

Poor nutrition and unhealthy habits can affect the integrity of the oral cavity which allows for the progression of oral diseases. Numerous oral pathoses are related to lack of nutrients in the diet. Calcium deficiencies can lead to tooth mobility and premature tooth loss. Protein malnutrition can have implications on antibacterial defense due to its effects on salivary gland function. Individuals living in poverty, developing countries, vegans, and patients undergoing long hospitalization are most at risk for this type of malnutrition. The presence or excess of certain substances such as acidic foods and sugar sweetened beverages contribute to issues within the oral cavity. Unhealthy habits such as tobacco use have oral manifestations such as darkening of the enamel (Pflipsen, 2017).

Barriers to Oral Healthcare

High expenses, lack of insurance, lack of perceived need, unavailability of dental offices, transportation, fear of dental treatment, and scheduling difficulties are some of the most common barriers to oral healthcare seen throughout various studies and surveys (Almalki et al., 2023; Garcha et al., 2010; Sabbagh et al., 2022). The impact of these barriers varies by individual, but they tend to impact marginalized communities more.

Various social and cultural factors act as barriers to accessing and accepting health or dental care. A cross-sectional survey conducted in India by Garcha et al. (2010) revealed that over half of respondents (54%) felt less demand to seek dental care due to the existence of home remedies and other self-care options. 57% of respondents also noted that they only seek treatment when the dental pain becomes unbearable. This study also shows work and time pressure has been shown to inhibit dental attendance. Dental treatments for more severe oral ailments are complex and usually involve multiple appointments. Individuals in the two lowest social classes (partly skills worker class and unskilled worker class) reported that having to take time off to go to appointments acted as an access barrier. For lower classes, missing one day of work means losing one day's pay, making them less willing to go to the clinic. GARCHA These results were also observed in a study by Sabbagh et al. (2022).

Case Examples

Sabbagh's survey was conducted in Saudi Arabia, where the burden of dental caries is very high and has been steadily increasing, with an estimated prevalence of 70% among children. The study involved a questionnaire with 1722 parent respondents. The most common reasons reported by parents for the inability to visit the dentist were the expenses of the appointment (9.9%), inability to make an appointment (9.8%), and fear of COVID-19 (6.6%). Paternal education was a significant predictor of the inability to visit the dentist, and binary regression analysis showed that inability to visit dental clinics when needed was significantly greater amongst children with lower paternal education. Parents with lower education are typically in lower classes and need to work daily; taking time off to take their children or themselves to the dentist would be difficult to arrange or lead to a

loss in earnings. This observation and reasoning agree with the findings by Garcha et al. (2010). However, it contrasted a study by Obeidat et al. (2014) who found that age and education level did not make any significant differences in the use of dental services. The difference in results may be attributed to the fact that the studies were all done in different countries (Obeidat's study was conducted in Jordan), further showing that these barriers are not universal.

In addition, transportation and lack of availability of clinics are also large barriers to receiving oral care. The National Survey of Adult Oral Health (2004-2006) showed that tooth loss, mean decayed, and number of Decayed, Missing, or Filled [DMF] teeth were higher outside capital city locations. Dental attendance patterns were less frequent in rural and remote locations. Patient perception of the impact of travel costs are major drivers restricting access for individuals (Curtis et al., 2008). These findings agree with observations in the Colgate Bright Smiles Bright Futures (BSBF) program, an American based program involving traveling by van to lower-income and rural areas to spread dental education and provide basic dental hygiene checks on children 9 and under. The participants are then listed under Categories I, II, and III, with I. representing overall good oral health, and III being the worst. It has been observed that in rural areas there is a significantly higher percentage of category IIIs compared to more urban areas. Dental hygienists and healthcare workers in this program attribute this to the unavailability of dental clinics and significant lack of dental education in more rural areas.¹

The costs of dental treatment and lack of insurance are also significant barriers. According to the US Center for Disease Control and Prevention, in 2015, 29% of people in the US did not have dental insurance, and 62% of older adults did not. Many low-income adults did not have public dental insurance. In another part of the world, a Canadian population-based study (5,586 participants) observed that nearly one out of five respondents reported cost barriers to dental care. 17.3% of respondents had avoided a dental professional due to cost within the previous year, and 16.5% had declined recommended dental treatment due to cost. Respondents with lower incomes and without dental insurance were over four times more likely to avoid a dental professional due to cost, and over two times more likely to decline

recommended treatment due to cost (Thompson et al., 2014). This was similarly observed in India by Garcha et al (2010). Individuals that experience a dental cost barrier had overall poorer oral health and more treatment needs compared to those who do not (Thompson et al., 2014).

Lastly, fear of dental appointments and procedures have also been shown to inhibit dental attendance. According to Almalki et al. (2023), “fear of dental procedure is a dental services utilization barrier among the elderly. The same results were reported by some studies” (p. 10). Almalki et al. notes that their results contrasted those of Nitschke et al (2015), who reported that fear was seldom reported as a reason for not visiting the dentist.

This section included studies conducted in various parts of the world and included data from all age groups. Some of the studies agreed with one another, while others reported contrasting results. This may be explained by the fact that while these barriers are present globally, they do not affect all individuals to the same extent. Factors such as the economic state of the country, the country’s emphasis on dental health, the respondent’s age and education level etc. can all impact how relevant these barriers

I have been involved in the Colgate BSBF program as an active dental health educator and assistant to the dental hygienists since August 2023. Everyone’s unique living circumstances also affect how much barriers to oral healthcare will affect them.

Role of Healthcare Workers:

According to the World Health Organization, most oral diseases and conditions share behavior-related risk factors with other Non-Communicable Diseases [NCDs]. As a mostly behavioral condition, individuals are expected to play active roles in maintaining their oral health. To support good oral health habits, it is necessary to provide sufficient oral self-care knowledge and provide an enabling environment (Murtomaa et al., 2022).

Good oral health requires a commitment to practicing healthy oral habits, which can be more doable if taught from a young age. According to Fraihat et al. (2019), numerous studies on the clinical effectiveness of Oral Health Promotion Programs

[OHPPs] have observed that health promotion programs including promoting health and tooth decay were clinically effective in children under six years old, and less clinically effective for children older than six. The length of the programs is also a factor; longer durations are associated with more favorable outcomes. Results also varied based on the countries in question.

Another factor to consider are the individuals delivering the programs. A field study done in Zimbabwe evaluated the effectiveness of an OHPP on grade 2 and grade 4 children over 3.5 years. Results showed that the one-time training of teachers in aspects of oral health was ineffective in lowering plaque levels over the period (Frencken et al., 2001). The poor outcome of the program despite its length could strengthen the argument that OHPPs are less effective when delivered to children older than six as most of the children in the study would be older than six. The results also suggest the possibility that healthcare professionals delivering OHPPs would lead to more favorable outcomes than non-professionals. That assumption is supported by a study by M B Kowash et al. (2000), in which the efficacy of a long-term OHPP for mothers with young children received regular home visits by trained dental health educators over a period of three years. This program was shown to be effective in preventing nursing caries as well as improving the oral health of the mothers. The assumption that the early start of oral health programs that include parental education are more likely to produce favorable results is also supported by a study by Wennhall et al., (2018).

Conclusion

Overall, the relationship between oral health and systemic well-being is nuanced and often bidirectional. Studies suggest that oral bacteria and the inflammation associated with a severe form of gum disease (periodontitis) might play a role in some diseases (Sharma et al., 2018; Avila et al., 2009; Bowen et al., 2017; Thomas et al., 2021; Martinez-Garcia and Hernandez-Lemus, 2021). The presence of certain systemic diseases can lower the body’s resistance to infection, potentially making oral health problems more severe. Oral and systemic diseases are impacted by a range of factors such as genetics, age, gender, and lifestyle and have many shared risk factors

(Haq et al., 2015; Nazir, 2017; Martinez Garcia and Hernandez-Lemus, 2021; World Health Organization, n.d.). This makes it difficult to establish a definitive cause-and-effective relationship between the two. Additional research is needed to fully understand the extent of the association between the two (Martinez-Garcia and Hernandez-Lemus, 2021). However, the interconnectedness between the two systems is undeniable, and it is important to emphasize the importance of maintaining good oral hygiene practices for potential reduction in systemic disease risk and overall quality of life. Oral health and aesthetics have a significant impact on self-esteem and overall quality of life. (Kossioni, 2018; Centers for Disease Control and Prevention, n.d.); Kallestal et al., 2006; Blumenshine et al., 2008; Khadri et al., 2020). An individual's mental state can affect their oral health and oral maintenance, and vice versa (Reners and Brex, 2007; Hudson, 2021; Zinko, 2020).

Addressing the barriers to oral care is crucial to ensuring equal access to dental care. Most oral diseases are preventable and individuals are expected to play active roles in maintaining their oral health, so promotion of proper oral hygiene and other preventative measures can reduce the burden of oral diseases (Freihat et al., 2019; Murtomaa et al., 2022). It also may be helpful to promote seeking healthcare earlier in oral diseases. It has been observed that some individuals delay seeking healthcare in favor of trying home remedies or simply waiting until the pain becomes intolerable (Garcha et al., 2010; Sabbagh et al., 2022). This behavior may stem from the common perception that oral diseases are not immediately life-threatening, causing individuals to procrastinate seeking help (Dodd et al., 2014). However, this only increases the risk of the dental disease becoming more severe, which may ultimately lead to higher treatment costs (Murtomaa et al., 2022). Because oral diseases are largely preventable, community-based health promotion programs designed to address common risk factors and promote prevention of oral diseases are promising (Freihat et al., 2019). Studies have shown evidence to suggest that OHPPs are more effective when delivered by healthcare professionals and targeted towards parents and children under 6. (Frencken et al., 2001; Kowash et al., 2000; Wennhall et al., 2018). However, lack of oral hygiene resources and inaccessibility of oral healthcare remains a problem, especially in poorer countries. Recognizing the challenges and promoting preventative measures

such as maintaining healthy oral hygiene habits of brushing and flossing regularly are powerful first steps towards lowering the global burden of oral diseases.

The oral cavity is involved in many essential processes such as eating, speaking, and breathing (Hiemae et al., 2002; Cleveland Clinic, n.d.; Sharma et al., 2018; Gao et al., 2018). Oral manifestations of certain systemic diseases make the oral cavity a great noninvasive diagnostic tool (Koller and Sapra, 2023; Kane, 2017). Although most oral diseases are highly preventable, the estimated global burden of oral diseases is 3.5 billion, making it a global public health crisis (Petersen, 2008; World Health Organization, n.d.). The biggest barriers to oral health include high expenses, lack of insurance, lack of perceived need, unavailability of dental offices, transportation issues, fear of dental treatment, and scheduling difficulties (Almalki et al., 2023; Garcha et al., 2010; Sabbagh et al., 2022; Obeidat et al., 2014; Curtis et al., 2008; Thompson et al., 2014; Centers for Disease Control and Prevention, n.d.). The impact of these barriers varies by individual, but they especially impact marginalized communities and populations in poorer countries, with a strong and consistent association between socioeconomic status and the presence and severity of oral diseases (World Health Organization, n.d.; Centers for Disease Control and Prevention, n.d.; Petersen, 2008).

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