A CRITICAL LITERATURE SYNTHESIS OF LOW-INCOME ORAL HEALTH DISPARITIES IN THE UNITED STATES AND INTERVENTIONS FOR IMPROVED ACCESS TO CARE

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Over a decade ago the United States Surgeon General released a report about oral health in America which highlighted the disparities that exist between high and low-income populations. The current rates of untreated dental disease in adults and children remain higher in low-income populations. This literature review examines low-income oral health disparities in the United States and the interventions that have been completed to increase access to dental treatment. An unequal distribution of dental providers and high costs for treatments contribute to the access issues that low-income individuals experience. This paper examines interventions at the individual, community, and policy levels. Innovations such as making changes in the dental workforce and expanding the role of mid-level dental providers are discussed. Evidence from the literature suggests that changes in government sponsored insurance policies have had the greatest impact on access to dental care. Behavioral interventions have been successful at changing oral health behaviors but further research needs to be done on how to best change the behavior of seeking dental treatment. Increasing the role of primary care providers was identified as an interdisciplinary collaboration to increase access for children. Finding ways to increase access to dental care to treat the dental disease of low-income populations is a significant public health problem and further research needs to be done to determine the most effective innovations and interventions to increase access to care.

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1.0 INTRODUCTION

In the United States oral health disparities exist for a number of underserved populations. Those disadvantaged by social, economic, and health conditions are the most likely to suffer from oral health disparities (Edelstein, 2010). Over a decade ago the United States (US) Surgeon General released a report about oral health in America. The report discussed many of the disparities that exist in the US, including the differences between high and low-income populations (Oral Health in America, 2000). Today the overall oral health of low-income individuals in the US remains poorer than that of high income individuals. This is often a result of lack of treatment for existing dental disease.

Low-income individuals are more likely to suffer from untreated dental disease. The National Health and Nutrition Examination Survey (NHANES III) showed that low socioeconomic (SES) individuals were nine times more likely to be missing teeth and four times less likely to have visited a dentist within the past 12 months (Drury et al., 1999). Low SES individuals are also 7.2 times more likely to have untreated root decay and 6.1 times more likely to have untreated coronal decay (Drury et al., 1999). Children who live in poverty are three times more likely to have dental decay (Edelstein, 2002). Preschool children from low SES families have 4.8 times more decayed teeth than children from high SES families (Edelstein, 2002).

Oral health is linked to general health and well-being. Studies have shown that periodontal disease can be associated with diabetes, cardiovascular disease, stroke, and adverse

pregnancy effects (Oral Health in America, 2000). Dental disease can also have a negative impact on quality of life. Without treatment the pain of dental disease can affect an individual's ability to eat and sleep (Oral Health in America, 2000). The psychosocial impacts of dental disease include low self-esteem and avoidance of social contact due to a change in appearance (Oral Health in America, 2000).

The prevalence of untreated tooth decay remains higher for those living below 200 percent of the federal poverty line compared to those living above 200 percent (Hilton and Lester, 2010). Low-income individuals in the US utilize dental services at about half the rate of those in high income groups (Edelstein, 2010). Low-income children have a greater prevalence of untreated caries, a higher number of untreated carious lesions, and more dental pain. Low-income children also make fewer dental visits and receive fewer preventive services (Edelstein, 2002).

Oral health disparities in untreated disease have been linked to a lack of access to adequate dental treatment (Guay, 2004). Many factors contribute to the limited access to dental services experienced by low-income adults and children. Access can be limited by personal barriers, such as motivation to seek to treatment, as well as barriers created by the dental health care system, such as the unequal distribution of dental providers. Interventions to improve access have had varying success. Interventions have been done at the individual, community, and system levels. Hilton and Lester (2010) argue that interventions at all three levels are necessary to truly have an impact on the current oral health disparities. Improving access to dental services will require changes in workforce models and dental education throughout the US. Many changes could be made in dental care financing, the dental education system, and state and federal policies (Garcia et al., 2010).

Though there is a clear shift in the orientation of oral health promotion from providing direct dental services to changing oral health behaviors, education and motivation have not been fully proven to improve oral health behaviors (Tolvanen et al., 2010). Health promotion is especially important in children and adolescents because health-related behaviors are often learned early in life (Brukiene and Aleksejuniene, 2009). Understanding the successes and failures of oral health interventions is important in developing future interventions to improve access to care.

A Designated Dental Health Professional Shortage Area (DHPSA) is defined as a geographic area having a population to dentist ratio of at least 5,000:1 (HRSA, 2009). An area with a population to dentist ratio of less than 5,000:1 but greater than 4,000:1 is also designated as a DHPSA if the population has an unusually high need for dental services (HRSA, 2009). There are currently 4,230 DHPSAs in the US. Within these shortage areas there are an estimated 49 million people (Garcia et al., 2010). The idea of increasing the dental workforce has been explored as a solution to the shortage problem. Several new dental schools have opened within the past few years (Hilton and Lester, 2010). However, it must be recognized that an increased number of dentists will not necessarily overcome the uneven distribution of dental providers.

This literature review discusses the barriers to care that directly lead to many of the oral health disparities in untreated disease experienced by low-income populations in the US. Understanding the barriers to care is important for increasing access to preventive and restorative dental care. Increasing access to care can improve the oral health of low-income individuals by increasing the treatment received for dental disease. A large number of interventions are done to improve low-income disparities. Some of these interventions focus on individual level factors while others intervene at the system or policy level. Both behavioral and system level

interventions are explored to better understand the impact of both health promotion and policy change. Low-income children and adults face different kinds of problems; therefore, this review recognizes that different methods of intervention should be used for different age groups.

The central research question is: What interventions have the greatest impact on low-income oral health disparities in untreated disease in the US? Several underlying questions are also addressed to help better understand the basis of interventions and the differences between low-income adults and children. These underlying questions include: 1) What are the most critical barriers to access for low-income populations? 2) What policy and dental system innovations could improve low-income disparities in untreated disease? 3) What are the most important oral health needs of low-income adults and children? and 4) What future innovations could lead to better oral health for low-income populations in the US?

This literature review will present an overview of the barriers to oral health care experienced by low-income individuals and the interventions that seek to reduce these barriers. Behavioral, primary care, policy, and workforce interventions will be discussed. Current interventions from the literature will be presented and important findings and similarities will be analyzed. Recommendations for future interventions to improve low-income oral health disparities in the US will be made based on the findings of the interventions discussed.

2.0 BACKGROUND

Oral health disparities exist for both low-income adults and children in the US. Low-income refers to families with a household income at or below the US Department of Health and Human Services (HHS) poverty guidelines of $22,350 for a family of four (HHS, 2011). The problem of oral health disparities cannot be solved easily. In order to improve the overall oral health of low-income populations we need to lower disease incidence and prevalence of untreated disease. We also need to increase utilization of preventive services and decrease utilization of emergency services (Garcia et al., 2010). Low-income oral health disparities have been linked to poor distribution of dentists, lack of insurance, and a need for an expanded dental workforce (Garcia et al., 2010). All of these factors affect access to care.

Access to oral health care is a complex issue and can be affected by factors that are external or internal to the individual seeking care. External factors include those related to the dental care system, such as the size of the dental workforce and the cost of care. Internal factors are patient-based and include the patient's perceived need for care, cultural barriers, and language barriers (Guay, 2004). Other internal barriers include low-quality education and lack of transportation. Gaining access to care is important in reducing oral health disparities in untreated disease. Both external and internal factors must be addressed when considering access. The internal barriers to care are sometimes easier to overcome than the external. On the other hand, it is estimated that 26% of the US population self-identifies a need for dental care but do not seek

care due to high costs (Edelstein, 2010). This shows that that the external barrier of cost of care plays a very important role in oral health disparities.

Guay (2004) recognizes a triad of factors that are essential to the success of improving dental care of underserved populations: effective demand for care, an adequate dental work force able to respond to the demand, and an economic environment that supports patients and providers so that they can participate in dental programs. This triad addresses both the internal and external barriers to access.

Access to oral health care can be limited due to the high costs associated with dental services. Based on data from National Health Accounts (NHA) the National Institute of Dental and Craniofacial Research (NIDCR) estimated the annual per capita cost of dental care to be $201.80 (NIDCR, 2002). Even when dental coverage is available, there are costs associated with directly obtaining dental care. Acquisition costs such as the cost of transportation to a dental provider's office and time away from work for receiving dental care can add up for low-income individuals (Edelstein, 2010). Many low-income populations live in communities without dental professionals. If no dental services are located within a low-income community, residents may be forced to travel long distances to access dental care (Edelstein, 2010). If access to a dental professional is not possible, many low-income patients seek treatment in emergency departments of local hospitals. The cost of this can be considerablely higher than receiving direct dental care (Edelstein, 2010). Treating dental disease in emergency departments leads to a higher cost to the healthcare system. For example, Wisconsin's average expense for services in an emergency department in 2005 was $6,227 (Shortridge & Moore, 2009).

It is important to understand the dental delivery system, insurance policies, preventative services for children and current interventions in order to identify barriers to dental treatment for low-income population.

2.1 THE DENTAL DELIVERY SYSTEM

In the US dental services can be delivered through private practices and the dental safety net. Many low-income individuals receive dental treatment through the dental safety net, but receiving dental services through a private practice can help to build a reliable dental home (Graham et al., 2004).

2.1.1 The Dental Safety Net

In order to overcome the many barriers to care, a dental safety net exists throughout the US. The dental safety net includes the facilities, providers, and payment programs that provide dental care for underserved populations throughout the country (Edelstein, 2010). This safety net is meant to provide care for those without access to expensive private practice dental care and provides access to dental services for underserved populations (Edelstein, 2010). The dental safety net relies heavily on dental clinics located throughout communities. These clinics are often found in community health centers, hospitals, public health departments, public and parochial schools, and dental schools (Bailit et al., 2006). While private dental practices may also play a role in caring for the underserved, they are not included in the dental safety net (Bailit et al., 2006).

2.1.2 Creating a Dental Home

Many low-income families lack a permanent dental professional, or a dental home. Not having a permanent dental office leaves low-income families with no place to receive preventive care and much needed treatment for dental disease. Many low-income patients cannot access private dental practices and therefore find it difficult to establish a dental home. Dental disease worsens without treatment, and this often results in low-income individuals seeking emergency care at various clinics or hospitals (Graham et al., 2004).

Some research has been done on factors that prevent underserved populations from establishing a dental home. Graham et al. (2004) used a telephone survey to determine the sociodemographic characteristics of people who reported having a regular dentist. The study randomly selected 1,005 low-income residents in Florida to determine whether trust, education level, race/ethnicity, and perceived health status predicted having a dental home. Education level and race/ethnicity were found to be significant correlates to having a dental home. Respondents with less than a high school education were less likely to have a dental home than those reporting more than a high school education. Respondents reporting their ethnicity as black, Hispanic, or other/nonspecified were less likely to have a dental home than white respondents (Graham et al., 2004). While 72.5% of white respondents reported having a dental home, only 59.0% of blacks, 41.4% of Hispanics, and 45.3% of other/unspecified respondents reported having a dental home. Perceived health status also showed a significant association with having a dental home, with 67.4% of those reporting excellent health having a regular dentist and only 38.5% of those reporting poor health having a dental home (Graham et al., 2004).

Findings also showed that trust in dental health providers is a significant predictor of having a dental home and is independent of the other variables. Survey respondents with low

trust were 54% less likely to have a regular dentist than those with high trust (Graham et al., 2004). This lack of trust may be due to low-income families' perception of the behavior of health professionals. The dental professional's behavior may be seen as judgmental, disrespectful, or discriminatory by patients on public assistance (Dasanayake et al., 2007).

2.2 INSURANCE POLICIES

The high cost of dental services makes dental insurance very important for receiving care. It is estimated that 43% of the population lacks dental insurance. Government-sponsored programs are the primary source of dental coverage for low-income adults in the US (Hilton and Lester, 2010). Many low-income adults rely on public insurance such as Medicaid for their health care. Most states do not offer full adult dental coverage under their current Medicaid programs (Hilton and Lester, 2010). Nineteen states provide limited dental services for adults, 16 provide only emergency services, and seven states provide no dental adult dental benefits through Medicaid (Edelstein, 2010). Therefore, many low-income adults must pay out of pocket for dental services or rely on the dental safety net to provide low cost dental care.

Finding a dentist to provide care is difficult for those who receive dental insurance through government-sponsored programs. The majority of dentists in the US are in private practice and do not accept government-sponsored dental coverage such as Medicaid. With 84% of US dentists in private practice, it can be a challenge for low-income individuals to find a dentist willing to accept their government-sponsored insurance (Hilton and Lester, 2010).

2.3 PREVENTING DECAY FOR LOW-INCOME CHILDREN

Low-income children face barriers to care that are different from those of low-income adults. When considering low-income children and adolescents, it is important to note that while they have the highest rates of dental insurance, they also have the lowest frequency of dental visits (Edelstein, 2002). Low-income children are insured through the government-sponsored Child Health Insurance Program (CHIP), but very few private dentists participate in the program (Edelstein, 2010). A study done by Siegal et al. (2005) found that only 7% of general dentists and 29% of pediatric dentists accepted Medicaid patients without limitations. Access to preventive services is extremely important, considering that tooth decay is the most common disease of childhood in the US (Lewis et al., 2005; Pierce et al., 2002).

2.3.1 Early Childhood Caries Prevention

The development of early childhood caries (ECC) is very common in low-income children (Rozier et al., 2003). The American Academy of Pediatric Dentistry (AAPD) defines ECC as the presence of one or more decayed, missing, or filled tooth surfaces in any primary tooth in a child aged 71 months or younger (AAPD, 2008). The impacts of childhood tooth decay are both immediate and long term. The negative consequences associated with ECC include pain, damage to forming permanent teeth and infection. Dental disease can also cause behavioral problems when the pain interferes with a child's ability to eat, sleep, or play (Edelstein, 2002). Children with ECC are also much more likely to suffer from future dental caries in permanent teeth (Weinstein et al., 2004). The pain and suffering caused by ECC can be prevented if

children receive preventive dental services. Therefore, primary prevention of tooth decay is the most realistic approach to preventing dental disease in children (Rozier et al., 2003).

The development of caries is caused by the interaction of cariogenic bacteria and a cariogenic diet (Palmer et al., 2010). Cariogenic bacteria that have been associated with ECC include *Streptococcus mutans, Streptococcus sobrinus,* and *Bifidobacteria*. Consuming foods and beverages containing sugar and using bottles containing juice are risk behaviors for the development of caries (Meurman and Pienihakkinen, 2010). Beverages that contain retentive sugars and starch/sugar combinations increase the risk of developing ECC and shouldn't be placed in a child's bottle before putting them to bed (Palmer et al., 2010). The frequency of consumption and consumption patterns are also important when considering the impact of cariogenic foods and beverages (Palmer et al., 2010). Severe ECC has been associated with more frequent eating and drinking and with consuming food or beverages before bed (Palmer et al., 2010). Preventive treatments can help to protect teeth from decay, but proper oral health education is important for daily prevention of risk behaviors.

2.3.2 Preventive Services

Preventive measures can help delay or halt the caries process in children (Meurman and Pienihakkinen 2010). Fluoridation of public water supplies is an important step in the prevention of childhood tooth decay (Kagihara et al., 2009). Preventive oral health services include oral health education for parents and children, oral health screenings and the application of sealants and fluoride varnish treatments (Lewis et al., 2005). Children can receive the preventive treatments at regular dental visits (Edelstein, 2002). Sealants have been proven effective to prevent caries, yet those most in need of sealants are less likely to receive them (Aleksejuniene et

al., 2010). To prevent tooth decay dental sealants are applied to children's teeth. Dental sealants involve the bonding of plastic-like coatings to the chewing surfaces of molars because molars are the sites most susceptible to dental caries (Tomar & Reeves, 2009). Sealant programs most often target children in the 2nd grade, when the first permanent molars erupt, and children in the 7th grade, when the second permanent molars erupt (Tomar & Reeves, 2009). Fluoride varnish is a topical agent with a high concentration of fluoride and is usually used for young children at high risk for ECC (Tomar & Reeves, 2009).

2.4 INTERVENTION OVERVIEW

Many interventions have been conducted to improve access to treatment for low-income groups. Most of these interventions focus on increasing access to dental services. Some interventions focus on changing oral health behaviors and attitudes, which tend to focus on barriers to care that are internal to the patient. Workforce and policy interventions place more focus on the external barriers to dental care that are associated with dental delivery system.

2.4.1 Primary Care Interventions

Many efforts have been made in the US to overcome the various barriers that low-income children face when seeking preventive dental care. One way in which children can gain access to basic preventive services is to involve primary care providers. The extent to which pediatricians are involved in the oral health of their patients varies throughout the country. Pediatricians can perform important preventive services such as risk assessment screenings, application of fluoride

varnish, and referrals to dental professionals (Kagihara et al., 2009; Lewis et al., 2005; Pierce et al., 2002; Rozier et al., 2003).

The pediatric office is a convenient place to provide preventive oral health services. Some of the barriers to preventive services that children face can be bypassed by integrating primary care with dentistry. Parents bring their children for well-child visits on a regular basis, and the health care providers at these visits are often easier to access than dental professionals (Kagihara et al., 2009). Children are much more likely to see a primary care provider at the age of their first tooth eruption than they are to see a dentist. Due to the nature of ECC it is important that preventive dental services be provided as soon as primary teeth erupt (Rozier et al., 2003).

The American Academy of Pediatrics currently recommends that the first caries risk assessment by a child health professional be done at six months during well-child visits with the pediatrician (Kagihara et al., 2009). It is also recommended that a referral be made for the formation of a dental home at the eruption of the first tooth and no later than age one (Kagihara et al., 2009). Primary care providers can identify high caries-risk children and refer them to a dental professional to help prevent future decay (Kagihara et al., 2009).

2.4.2 Behavioral Interventions

Recent work has been done to determine the social, cultural, environmental, and psychological determinants of oral health behaviors (Finalayson et al., 2007). These behaviors can have a direct impact on the oral health outcomes for children and adults in low-income families in the US. Many of these interventions are theory driven and attempt to change self-efficacy, perceived severity, and perceived susceptibility.

Education and increasing motivation to seek dental treatment have not improved oral health behaviors (Tolvanen et al., 2010). There are many challenges when trying to change the oral health behaviors of children because the intervention is often for the parents rather than the children themselves. It is often easier to change attitudes and beliefs about oral health than it is to change actual oral health behaviors. Improvements in knowledge and attitude have not been shown to always lead to improvement in health behaviors (Tolvanen et al., 2010). Improving the oral health behaviors of low-income individuals can help to increase their likelihood of seeking treatment for dental disease.

2.4.2.1 Behaviors Related to Children's Oral health

A large number of behavioral interventions are focused on children and their parents. In order to improve the preventive and restorative services that low-income children receive it is important to recognize the roles of both parents and providers in oral health. There have been many theoretical constructs examined and various theories applied to change the oral health behaviors of children and parents (Tolvanen et al., 2010). Different health promotion strategies have been used, and they have focused on populations of various income levels, races, and ages. The lack of access to professional preventive sources increases the need for changes in parental and child oral health preventive behaviors. Actively involving parents in their child's oral health is an important aspect of changing oral health behaviors and increasing the amount of dental treatment accessed.

Children naturally develop the ability to understand the relationship between oral health behaviors and good oral health around 13 or 14 years of age (Tolvanen et al., 2010). Therefore, it is important to develop interventions at appropriate times through a child's development. Based on the premise that knowledge and attitudes are changed first and behavior changes will follow,

Tolvanen et al. (2010) used oral health education in schools to improve the toothbrushing frequency of fifth and sixth grade children. The authors found that oral health promotion should be a continuous process rather than a single, short-term intervention.

2.4.3 Workforce Interventions

Increasing access to dental treatment for low-income populations cannot be done solely through interventions to change oral health behaviors and attitudes about seeking treatment. Increasing access to care requires interventions within the dental delivery system (Hilton and Lester, 2010). There has been a great deal of discussion about improving the dental safety net, increasing the dental workforce, and enacting policies regarding delivering dental services to underserved populations (Edelstein, 2010). By improving the dental workforce and the policies within the dental framework, many external barriers to care could be overcome.

Changes can be made to the dental workforce by increasing the number of dental practitioners. Several workforce models have been developed that include advanced dental hygiene practitioners, dental therapists, nurse practitioners, and community dental health coordinators in the delivery of dental services. These practitioners have varying levels of clinical training and can provide certain dental services under the supervision of a licensed dentist (Garcia et al., 2010).

Dental therapists can provide preventive, restorative, and minor surgical treatments for underserved populations and most often work with children covered by government sponsored insurances (Friedman, 2011). The dental therapist model has had success in many other countries, including reports of high patient satisfaction (Friedman, 2011). The dental therapist model is in place in 53 countries including New Zealand, Australia, and Great Britain (Friedman,

2011). In the US, the dental therapist model was deployed in Alaska in 2005 to increase the native Alaskan population's access to dental treatment. In 2009 Minnesota authorized the training of dental therapists to reach underserved populations, and Connecticut approved a pilot project for training dental therapists (Friedman, 2011). Integrating the dental therapist model into the dental delivery system in the US would require many policy changes as well as the support and acceptance of current dental practitioners.

2.4.3.1 Government Sponsored Insurance Interventions

Government sponsored insurance interventions involve innovations that change the policies of government programs such as Medicaid and CHIP (Hilton and Lester, 2010). Medicaid dental benefits policies are determined by each state, and therefore each state has the ability to tailor its own programs (Edelstein, 2010). There have been relatively successful interventions to overcome the economic barriers and low reimbursement rates of public insurances in Michigan (Guay, 2004). The Healthy Kids Dental (HKD) program gave children enrolled in government sponsored insurance access to the Delta Dental Plan of Michigan (DDPM) (Eklund et al., 2003). The children could therefore receive dental treatment from any dentist that accepted DDPM, regardless of whether they accepted government sponsored insurance (Eklund et al., 2003). This intervention increased access to dental treatment by increasing the number of dentists available.

Interventions have been done to increase the number of private practice dentists accepting government sponsored insurance. This can be done by increasing the reimbursement rates and developing programs to help dental professionals and low-income patients navigate the Medicaid or CHIP programs. Dental case management interventions, such as the dental case management program (DCMP) in New York, provide support for dentists and Medicaid enrollees (Greenberg

et al., 2008). The DCMP in Tompkins County, New York, links patients and providers, coordinates transportation for patients, provides appointment reminders, and reduces the administrative burden of participating providers (Greenberg et al., 2008). Dental case management has been shown to successfully increase the participation of dental professionals in government sponsored insurance.

3.0 METHODS

The search engine PUBMED was used to search for peer reviewed articles. Articles from journals on dentistry, oral health, public health, and health policy were included in the literature review. Articles discussing low-income oral health disparities within the United States and interventions to improve access to dental care for all age groups were included. The terms were searched separately and then combined in an advanced search to ensure all relevant articles were included and results were specific. Review articles and original research articles were included.

Inclusion criteria are as follows: articles had to be published in the last 20 years, available in full text, published in English, and address low-income oral health disparities in the United States. Articles were discarded if they did not specifically address low-income disparities or did not meet the criteria described above.

The literature search included the terms “oral health disparities” (n = 545), “low-income” (n = 20,482), and “United States” (n = 2,575,631). After combining the three search terms, a total of 47 articles were found. Articles that focused only on racial or ethnic disparities were discarded. After discarding articles that did not fit the inclusion criteria and including any relevant references listed in the included articles’ bibliographies, a total of 23 articles were used for the Background section. For the Results section a similar search strategy was used. Five of the articles used in the background were also included in the results. A total of 18 articles were used for the Results section.

The problem of low-income oral health disparities is extremely complex. Low-income populations are often linked to other underserved populations such as racial and ethnic minorities and rural communities. Therefore, the literature that covers low-income disparities also focuses on other populations that experience oral health access issues. It also must be recognized that system level interventions are rare and difficult to complete. Because of this, many of the policy and workforce innovations in the literature are only suggestions that have yet to be tested. Due to the large amount of literature on overall health disparities, the review focused on interventions that were carried out to improve access to dental treatment.

4.0 RESULTS

The results section reviews 18 articles. The interventions can be divided into four categories: family-based behavioral interventions, primary care interventions, community-level interventions, and system-level interventions. Family based behavioral interventions (n = 5) include interventions that change the oral health behaviors of parents in order to improve a child's overall oral health. Primary care interventions (n =5) expand the role of primary care practitioners in the oral health of young children. Community-level interventions increase access to care for entire communities (n =2). System-level interventions (n = 6) make changes at the policy level and affect the financial and workforce aspects of dental care delivery.

4.1 FAMILY-BASED BEHAVIORAL INTERVENTIONS

4.1.1 Parent and Child Interventions

Finlayson et al. (2007) sought to determine the social determinants of oral health. They did so by looking at how maternal health beliefs, behaviors, and psychosocial factors were related to young children's ECC in lower-income African Americans in Detroit. The cross-sectional study used a survey with health belief scales to examine mothers' self efficacy, feelings of fatalism, and knowledge of appropriate oral hygiene habits for children. Dental examinations

were done on 719 children between the ages of one and five to determine their ECC status. Findings showed that mothers' oral-health fatalism and poor knowledge of children's oral hygiene knowledge were positively associated with ECC in their children. Higher education, high levels of oral hygiene knowledge, and higher parenting stress were protective factors and resulted in lower rates of ECC (Finalayson et al., 2007). Similar results regarding parenting stress as a protective factor were found by Litt et al. (1995) in low-income preschool children. A possible explanation for the protective nature of stress is that the high stress parents are hyper-vigilant (Litt et al., 1995).

Litt et al. (1995) looked at five domains to study the determinants of oral health: demographics, social status, dental health behaviors, cognitive factors such as self-efficacy and control, and perceived life stress. The authors concluded that the results of the study provided some support for the Theory of Planned Behavior (Litt et al., 1995). They found that self-efficacy was a good predictor of dental health behavior but found that a sense of control was not necessarily correlated to good oral health. They also concluded that it was likely that education and health promotion lead to an increase in mothers' self-efficacy and therefore improved their ability to care for their children's and their own oral health.

In order to target parent motivation to prevent decay in their children's teeth, Weinstein et al. (2004) carried out a study using motivational interviewing for parents. Counselors were trained to help parents identify motivation for preventing decay in their children's teeth and then support the changes in behavior that the parents chose to make. The counselor emphasized choice and provided the parents with options. Findings showed that motivational interviewing showed promise when working with the parents of low-income, high-risk children (Weinstein et

al., 2004). Actively involving parents in their child's oral health is an important aspect of changing oral health behaviors.

Weinstein et al. (2004) recognized the stages of change in trying to bring about behavioral changes in parents. They found that most parents were in the precontemplative or contemplative stage regarding oral health behaviors. Based on this theory they developed a health promotion program for parents that provided information over a period of time. The program used an initial visit to establish rapport and discuss options. Phone calls and postcard reminders were used as cues to action and to provide reinforcement of positive changes that had already been made. The children of parents who received motivational interviewing and follow-up calls and postcards showed slowed progression of decay, more dental visits, and more preventive care than the children who had parents in the control group (Weinstein et al., 2010).

4.1.2 Mother and Child Interventions

Weintraub et al. (2001) studied a low-income Hispanic community to determine if a mother's oral health behavior is a predictor of her children's oral health behaviors. The cross-sectional study found that maternal caries almost doubled the chance of childhood caries. The findings showed how important family-level behavior was for the oral health of children. Another study done by Grembowski et al. (2007) found that providing caries-preventive technologies and education to mothers effectively improved the oral health behaviors and overall oral health of both the mothers and their children.

Whether or not mothers have a regular source of dental care has been connected to whether children have a dental home. Grembowski et al. (2009) examined how low-income mothers with a regular source of dental care ranked their children's oral health compared to

mothers without a regular source of dental care. The study looked at the mothers of 108,151 children enrolled in Medicaid. The results showed that the oral health of children who had mothers with a regular source of dental care was significantly better than those who had mothers without a regular source. Mothers with a regular source of dental care rated their children's dental health higher than mothers lacking a dental home (Grembowski et al., 2009).

4.2 PRIMARY CARE INTERVENTIONS

Involving primary care practitioners in the oral health of young children is one way to increase low-income children's access to much needed preventive services. The cooperation and competency of pediatric care providers are often considered when evaluating primary care interventions. Lewis et al. (2000) conducted a national survey of pediatricians to assess their current knowledge, practice, and opinion on oral health promotion in the pediatric office. Their findings showed that pediatricians need education in oral health care. Lewis et al. (2000) recommend that this be done in medical school or during pediatric residency. They also recognized that pediatricians need to receive current guidelines for preventive oral health and that significant resources will need to be supplied. Another important finding was that pediatricians reported encountering dental decay regularly but found it difficult to make referrals to an available dentist for certain groups including children 12 months of age and younger (Lewis et al. 2000).

Studies have been done to evaluate the accuracy of primary care screenings in identifying at-risk children, whether or not dental referrals result in children going to the dentist, the appropriate use of fluoride treatments, and the effects of counseling on patient adherence to

preventive behaviors (Rozier et al., 2003). Pierce et al. (2002) compared oral screening results and referral recommendations of primary care providers with those of pediatric dentists. Their findings showed that after two hours of training pediatric primary care providers were capable of accurately identifying children with tooth decay. The study resulted in the recommendation that pediatric primary care providers can significantly contribute to the oral health of young children. A study by Lewis et al. (2005) about what primary care providers think about applying fluoride varnish found that the application of fluoride varnish can successfully be adopted into medical practice. In a 2009 study, Lewis et al. found that pediatricians were open to educating families about and assessing dental caries.

4.3 COMMUNITY-LEVEL INTERVENTIONS

4.3.1 The ForsythKids Program

The ForsythKids Program was developed and implemented by the Forsyth Institute in Massachusetts (Niederman et al., 2008). The program is based in elementary schools and is a comprehensive caries prevention program for children. Elementary schools in which more than 50% of the students participate in the federal free and reduced-cost meals program are eligible for the program (Niederman et al., 2008). Students must be in families whose income is at 185% or less of the federal poverty guidelines to qualify for the free and reduced-cost meals program. Dentists and dental hygienists provided dental examinations and comprehensive preventive care in the elementary schools. Niederman et al. (2008) evaluated the short-term effectiveness of the community-based program by comparing results of the initial dental examination with those of a

second examination that was done six months later. The results showed that there was an overall decrease in the amount of new decay found in permanent teeth. The authors concluded that ForsythKids Program's care model was successful in overcoming multiple barriers to care relatively quickly (Niederman et al., 2008).

4.3.2 Community-Service Learning

Community service learning (CSL) in predoctoral dental education may be helpful to teach students to be socially responsible, culturally competent, and aware of the needs of underserved populations (Aleksejuniene et al., 2010). Aleksejuniene et al. (2010) evaluated the use of CSL for increasing the prevalence of sealants in underserved populations. The authors aimed to evaluate the reasons for low sealant use among dentists, develop an appropriate use of sealants in a community setting, and identify best practice guidelines. After review the authors determined that involving dental students in CSL through school-based sealant programs increased the number of high-risk children receiving sealants and increased the dental students' knowledge and skills.

4.4 SYSTEM LEVEL INTERVENTIONS

4.4.1 Government Sponsored Insurance Interventions

4.4.1.1 Policy Interventions

Interventions which lead to changes in Medicaid occur at the policy level and are usually analyzed after several years. The effect that expanding Medicaid reimbursement had on the number of dentists participating in Medicaid was analyzed by Mayer et al. (2000). They looked at the probability that a dentist would participate in Medicaid after the state of North Carolina increased Medicaid reimbursements to dentists by 23% between 1988 and 1991. North Carolina also experienced doubled enrollment through eligibility expansions from 1985 through 1991. Mayer et al. (2000) looked at the North Carolina Medicaid dental claims from January 1, 1985, through December 30, 1991, for people younger than the age of 21. The findings of this study showed that increasing reimbursement rates and expanding eligibility were only marginally effective in increasing Medicaid recipients' access to dental care.

A similar study looking at the effect of increased fees and administrative changes in Medicaid and the State Children's Health Insurance Program (SCHIP) on dentists' participation in Indiana was done by Hughes et al. (2005). The study compared the dentists' participation in Medicaid or SCHIP two years before fees were increased to the participation two years after the fee increase. Data were obtained through Medicaid claims and enrollment files provided by the Indiana Department of Family and Social Services Administration. The authors found that there was an increase in the number of Medicaid enrolled children, an increase in the number of participating dentists, and an increase in cost per child enrolled.

Michigan developed the demonstration program Healthy Kids Dental (HKD) after the Michigan legislature appropriated $10.9 million to address oral health disparities in the state. The program was initiated in 2000 for Medicaid-enrolled children and administered through a private dental carrier with private reimbursement rates (Eklund et al., 2003). Children currently enrolled in Medicaid from 22 counties in Michigan were automatically enrolled in Delta Dental Plan of Michigan (DDPM) and accessed DDPM-affiliated dentists. Eklund and colleagues assessed HKD 12 months after it was initiated to determine the effect of the Medicaid changes (2003). The enrollment and utilization data were used to compare access to dental care, dentists' participation, treatment patterns, and program cost. The authors found an overall increase in utilization (31.4%) and a significant increase in dentist participation. The distance that children had to travel to access care was also cut in half. The cost of the program was 2.5 higher than the previous Medicaid program (Eklund et al., 2003).

4.4.1.2 Dental Case Management

A dental case management program (DCMP) helps link Medicaid patients to dentists in order to increase access to care (Greenberg et al., 2008). A dental case manager recruits dentists to participate in Medicaid and maintains Medicaid records. In Tompkins County, New York, a DCMP was developed using a grant from the New York State Department of Health. In Tompkins County DCMP the dental case manager was responsible for the following:

- Maintaining a database of providers, provider capacity and people who are receiving treatment;
- Verifying patients' Medicaid eligibility;
- Screening and educating Medicaid clients on the appropriate use of dental services;
- Matching Medicaid clients and participating, dentists geographically or based on clients' needs;
- Reviewing patients' Medicaid claims histories to ensure eligibility for services;
- Providing participating providers with a roster of Medicaid clients in their practices;

- Coordinating transportation;
- Instituting an appointment reminder process using telephone and mailed reminders; and
- Creating a feedback mechanism for providers and patients to address program issues (Greenberg et al., 2008).

Greenberg et al. (2008) evaluated the level of dentists' participation in the DCMP and the Medicaid beneficiaries' use of services in Tompkins County. The authors found that after the DCMP was implemented the number of dentists accepting Medicaid patients increased from 28 to 145. They also found that the percentage of Medicaid beneficiaries receiving dental services increased from 9% to 41%. It was also found that the DCMP decreased administrative burden and increased oral health literacy and compliance of low-income patients (Greenberg et al., 2008). The program also reduced the rate of missed appointments to less than 3%. The program addressed the needs of both dental providers and those who use the dental delivery system.

4.4.2 Dental Therapist Intervention

Dental therapists are mid-level dental providers that provide basic dental treatments (Friedman, 2011). A dental therapist can provide preventive treatments such as sealants and fluoride applications. Dental therapists have also provided fillings, stainless-steel crowns, pulpotomies, and simple extractions with local anesthesia (Friedman, 2011). The treatments that dental therapists can provide vary by country and program. The training required to work as a dental therapist also varies. Dental therapists must work closely with licensed dentists. In countries where dental therapists are permitted to work independently dental therapists are required to work in consulting collaboration with a supervising dentist (Friedman, 2011). Even though the dental therapist model has been used in other countries for many years it is still developing in the US.

The dental therapist model was applied in Alaska to help reach the native Alaskan population (Bader et al., 2011). Like low-income populations throughout the US, the native Alaskan population suffers from lack of access to dental treatment. The Alaskan Native Tribal Health Consortium (ANTHC) collaborated with the Alaska Dental Health Aide Therapist Initiative to train dental health aid therapists (DHATs). There were 10 therapists trained in New Zealand to work in clinics and rural Alaskan villages (Bader et al., 2011). The therapists were trained to perform prophylaxis, restorations, and uncomplicated extractions while working under the supervision of a dentist (Bader et al., 2011). Bader et al. (2011) conducted a case study to evaluate the program and complete a clinical assessment. After evaluating a total of 206 clinical procedures the authors determined that the therapists were performing at an acceptable level.

5.0 DISCUSSION

Those who experience oral health disparities are likely to have very little access to dental treatment and preventive care. Interventions can address issues relating to cost, dentist availability, and individual behaviors. This section discusses the various types of interventions to improve access to dental services and the impact that each intervention category could have on low-income oral health disparities in the US.

5.1 LESSONS FROM INTERVENTIONS

5.1.1 Behavioral Interventions

Interventions to change oral health behavior have had positive results. Most of the studies focused on changing the behavior of parents in order to increase the overall oral health of families. Increasing parental involvement in a child's oral health can help to increase the likelihood of the child accessing preventive services and treatment for dental disease. Understanding the theoretical basis for health behavior was successful for several studies. Self-efficacy, self-motivation, and perceived control were all found to affect oral health behavior and attitudes. The Stages of Change Model and Theory of Planned Behavior were found to be successful in changing some of the oral health behaviors found in low-income populations.

Another common finding was that changes in oral health attitudes and behaviors were not enough to overcome all of the barriers to health care that low-income populations experience. This suggests a need for a more interdisciplinary and comprehensive intervention that brings about change at both the personal and policy level. Simply providing parents with educational materials about oral health did not appear to be enough to bring about change in oral health behaviors.

Behavioral interventions seemed to be successful shortly following the implementation of the intervention, but it was unclear whether changes in oral health behavior continued and were sustained by those who experienced the intervention. Reinforcing positive behaviors and providing reminders were strengths of the intervention done by Weinstein et al. (2004). The phone calls and reminder cards reinforced positive behaviors they were taught over a longer period of time. Personal oral health behaviors are important, but children and adults must also receive dental treatment and preventive dental services in order to maintain good oral health.

5.1.2 Primary Care Interventions

Involving pediatricians may be the most effective way to ensure that low-income children have adequate access to preventive oral health care. The studies involving primary care participation in oral health prevention were mostly aimed at educating primary care professionals (Kagihara et al., 2009; Lewis et al., 2005; Pierce et al., 2002; Rozier et al., 2003). Findings indicated that pediatric health professionals were able to adequately provide oral health screenings, fluoride varnish application, and dental referrals after receiving the proper training. There was also evidence that primary care professionals needed more education and training. There needs to be an increase in the number of primary care professionals participating in oral

health prevention and a greater amount of interdisciplinary communication and cooperation. Developing more in-depth oral health curriculum for medical, nursing, and physician assistant schools would increase primary care professionals' oral health knowledge and skills. Also, requiring oral health screenings and fluoride varnish applications at well-child visits would increase the number of children receiving preventive dental services.

5.1.3 Community-Level Interventions

Providing interventions within a community setting was successful for the two interventions discussed (Aleksejuniene et al., 2010; Niederman et al., 2008). When working in a community, school-based programs worked well and reached a large number of people. Developing school-based interventions is important because it allows a large population to be reached in a single location. It also allows the intervention to target the children at highest risk for developing dental disease. Programs can be developed for schools with high percentages of low-income students. Preventive services can also be targeted at the children they will benefit the most. For example, sealants programs can provide services for children based on when first and second permanent molars are most likely to erupt.

There was also the common use of local dental professionals or dental students within the programs. The ForsythKids Program was able to connect local dentists and hygienists with children in need of oral health care (Niederman et al., 2008). Many low-income populations are geographically isolated; therefore bringing care to the community helps to overcome transportation barriers and acquisition costs. There is also the possibility for community interventions to work within the clinics and programs associated with the dental safety net. There

was very little discussion about the cost-effectiveness of these programs and the feasibility of running such programs without a large funding source.

5.1.4 System Level Interventions

Policy level interventions were successful at the state level. Each state has the ability to decide the dental benefits of Medicaid. Increasing reimbursements rate was a very effective way to increase the number of private practice dentists accepting Medicaid patients. The Healthy Kids Dental Program in Michigan was extremely successful in increasing children's access to dental professionals by expanding the number of dentists who would accept them. The Healthy Kids Dental Program was even able to reduce the acquisition costs associated with dental care by reducing how far patients had to travel to get to a dental office.

Increased cost was associated with policy interventions that successfully improved access. Policy interventions required increased reimbursement rates in order to increase the number of dentists accepting Medicaid patients. In the studies discussed, the amount of money spent per child increased. If this were to happen in an unsubsidized Medicaid situation, it would put a great deal of strain on the Medicaid system. This highlights the need for further policy and economic reform.

Increasing the role of public health in dentistry may lead to a decrease in oral health disparities. The Dental Case Management system integrated the public health system with dental care to help improve the number of dentists participating in Medicaid (Greenberg et al., 2008). It also helped to connect those with trouble accessing dental care to those who could provide it. The strength of this program was that it used a multidisciplinary approach to address the problems of both dental professionals and their low-income patients.

Expanding the dental workforce through dental therapist or advanced dental hygiene practitioner models could help to increase access for low-income populations in the US. Dental therapist programs have been proven effective in other countries (Friedman, 2011) and current evaluation of a dental therapy program in the US showed promising results (Bader et al., 2011). Expanding the role of mid-level dental providers could help bring dental providers to areas experiencing shortages in dental professionals. Further research needs to be conducted to determine the most effective way to implement such programs in order to have the greatest impact and increase access to underserved populations.

5.2 GAPS IN THE LITERATURE

5.2.1 Interventions for Adults

There is a significant lack of research on the behavioral determinants of oral health for adults. A great deal of attention is paid to the oral health behaviors of parents in relation to their children, but no interventions were found that dealt with the behaviors of adults in regard to their own oral health. With the findings that self-efficacy and self-motivation play large roles in parents caring for their child's teeth, it would be helpful to understand how such theoretical constructs apply to how an adult cares for their own oral health. It could also be helpful in understanding how the behavior of seeking dental treatment can be changed in low-income individuals.

While policy changes in Medicaid were shown to improve children's access to dental care, few interventions focused on improving access for adults. Improving the dental benefits of

state Medicaid programs could have a large impact on adult oral health disparities. Greater access to dental professionals would allow for more treatment of dental disease.

5.2.2 Innovation Implementation

There are many innovative ideas about how to increase or change the dental workforce in the US, but there is very little evidence of these innovations being put into practice. The ideas of increasing cultural training in dental school, increasing the role of dental practitioners, increasing the dental public health workforce, and strengthening the dental infrastructure have all been discussed. These ideas need to be expanded on so that there is a clearer picture of how they directly affect the oral health disparities they are aiming to improve. There needs to be small scale programs done to test the innovations so it can be determined whether or not they are feasible on a state or national level. Research needs to be done to see which aspects of dental education need to be changed or amplified.

Increasing the cultural competence and sensitivity of dental professionals could be important for improving oral health disparities in the US. Improving cultural competence is not an easy task, but Hilton and Lester (2010) suggest increased cultural sensitivity training during dental education and an increase in racial and ethnic diversity within the dental workforce. The benefit of including sociobehavioral training also needs to be explored (Hilton and Lester, 2010). There is a need to move beyond the focus on technical skills to educating on the interpersonal social and behavioral, empathetic, ethical and professional contexts of care (Edelstein, 2010). Educating and motivating dental school faculty to understand social and behavioral contexts of dental care is an important step in changing the focus of dental education (Edelstein, 2010).

Tomar and Reeves (2009) argue that an increase in the number of Dental Public Health Residency programs could help to improve the oral health disparities in the US.

Several workforce models have been developed that incorporate the expanded use of dental practitioners. These models include the American Dental Hygienists Associations Advanced Dental Hygiene Practitioner (ADHP) Model. These practitioners can perform an expanded range of dental services such as placing temporary crowns, performing pulpotomies, and performing simple extractions (Garcia et al., 2010). Another model is the Dental Therapist Model which allows dental therapists to function as part of dental team in remote areas. They can provide preventive and restorative dental treatments under the supervision of a dentist (Garcia et al., 2010). The Dental Therapist Model is already in place in other countries, but a great deal of policy change would need to be done for it to expand throughout the US (Garcia et al., 2010).

5.3 IMPILICATIONS FOR FUTURE INTERVENTION

5.3.1 Creating Comprehensive Oral Health Interventions

Behavioral, primary care, community, and policy interventions have all been successful at helping low-income populations that suffer from oral health disparities. All of the interventions discussed focused on only one level of intervention. Developing programs which intervene at multiple levels may increase overall success. Improving the oral health behaviors and increasing access are both important in decreasing low-income oral health disparities. Therefore, changing an individual's self-efficacy and increasing Medicaid reimbursement would be helpful within the same intervention.

5.3.2 Increasing Funding for Oral Health Programs

Many of the successful programs discussed required grant money or state funding in order to improve the oral health of a low-income group. Increased funding would help to fund more programs which aim to decrease oral health disparities. Specifically, state governments need to recognize that oral health is a priority and resources must be devoted to programs such as the Healthy Kids Dental program. Increasing the resources available to the dental safety net would also help for more interventions to be created within an infrastructure that already strives to serve the underserved.

5.3.3 Expanding Theory-based Behavioral Interventions

Behavioral interventions have been successful at changing the oral health behaviors of adolescents and parents. Multiple theories have been developed to better understand health behaviors and what leads to changes in these behaviors. Based on the literature, there is evidence that health behavior theories could be used to develop interventions to improve the access to dental treatment for low-income populations in the US.

The literature shows that the theoretical concept of self-efficacy is very important when dealing with oral health behaviors. Parents must feel confident that they can care for their children's oral health and find a dental professional for their children. Self-efficacy provides adults with the confidence needed to take control of their own oral health and work to overcome barriers to care. Increasing knowledge and skills and providing guidance on how to take action can help to improve an individual's self-efficacy and lead to behavior change (Janz, Champion, & Strecher, 2002).

5.3.3.1 The Health Belief Model

The Health Belief Model (HBM) could help to identify the best way to bring about changes in behavior. HBM includes the concepts of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (Janz, Champion, and Strecher, 2002). Table 1 shows how each of these concepts could be applied to changing oral health behaviors with the ultimate goal of increasing the individuals likelihood of accessing dental treatment. Specific actions would depend on the demographics (e.g. age, gender, race) of the population for which the intervention was developed.

Table 1. The Health Belief Model applied to oral health intervention

Concept	Application for oral health intervention
Perceived susceptibility	Education to increase knowledge about the prevalence of dental decay and gum disease
Perceived severity	Education on the overall health effects of dental disease, including association with diabetes, cardiovascular disease, stroke, adverse pregnancy affects, and psychosocial problems
Perceived benefits	Explanation of how dental treatment and preventative services can have a large impact on oral health and overall health
Perceived barriers	Identify the internal and external barriers to care and address them through intervention (increase transportation, find available dental professional, policy intervention etc.)
Cues to action	Provide reminders to care for oral health and to seek dental treatment
Self-efficacy	Provide training on good oral health habits Provide reinforcement for seeking dental treatment Reduce anxiety about receiving dental services

5.3.3.2 The Theory of Reasoned Action

According to the Theory of Reasoned Action (TRA), the most important determinant of an individual's behavior is an individual's behavioral intention (Montano & Kasprzyk, 2002).

TRA is concerned with the relationships between behavior, attitudes, beliefs, and intentions. Intention can be influenced by attitude towards a behavior and subjective norms. Attitude is influenced by an individual's behavioral beliefs and evaluation of behavioral outcomes. Subjective norms are influenced by normative beliefs and motivation to comply (Montano & Kasprzyk, 2002). Interventions could focus on increasing the behavior of seeking dental care.

For low-income individuals, seeking dental treatment may be influenced by their attitudes and beliefs. Table 2 shows how the constructs of TRA can be applied to oral health intervention. It is important that an individual believes that seeking dental treatment will change his or her oral health status in a positive way. They must also approve of the behavior and have motivation to carry out the behavior to access dental services. Interventions which provide education about oral health and how to find dental services could help change attitudes and norms about seeking dental treatment. Specific actions could also be taken within a low-income community to help increase the community's approval of the behavior.

Table 2. The Theory of Reasoned Action applied to oral health intervention

Construct	Application for Oral Health Intervention
Behavioral Intention	Receive dental treatment from a dental professional
Attitude	
Behavioral belief	Understand that receiving dental treatment will improve oral health and overall health
Evaluation	Have the desire to maintain good oral health and value oral health
Subjective Norm	
Normative Belief	Individual sees receiving dental treatment as a normal and appropriate behavior
Motivation to comply	Individual is motivated to seek dental treatment and take care of his or her oral health

6.0 CONCLUSION

This literature review has shown that low-income populations in the US have less access to dental treatments and therefore a greater amount of dental disease. Increasing access to dental treatment through intervention is important for improving low-income oral health disparities. Interventions at various levels have had different levels of success. Treating the dental disease of low-income individuals is extremely important because oral health can have such a large impact on an individual's overall health. The issue of access to dental treatment must be addressed before the treatment can be received.

Low-income oral health disparities continue to exist in the US even after the Surgeon General's Report brought attention to the need to decrease such disparities. The complexity of oral health disparities makes it difficult to identify one underlying cause. There are barriers to care at both the individual level and the system level. Policy also plays a large role in low-income oral health disparities. The greatest barriers to care were found to be related to government sponsored insurances, the dental workforce, and the dental delivery system. The literature revealed interventions that were focused at changing individual behavior, community health, and systems level policies and practices.

Government sponsored insurances such as Medicaid and CHIP need to increase reimbursement rates in order to increase the number of dentists willing to participate. There also needs to be administrative changes that make the programs easy to use for both the patients and

dental professionals. Programs such as dental case management help to break down both the financial and administrative barriers associated with Medicaid and help to bring low-income patients and dental professionals together. Further research needs to be done on how policies regarding dental education and the dental workforce could be changed to improve low-income access to dental services.

There are several limitations to this paper. This literature review focused on studies and interventions already conducted. The themes identified in the current literature lead to conclusions, but there was no new research or ideas added. All articles concerning low-income oral health disparities may not have been included in the literature review because search engines may not contain all published works. Therefore, important literature on the topic may have been left out of this review.

Changing oral health behaviors is important for increasing motivation to seek dental treatment, but that treatment must also be available. The interventions that seek to improve oral health behaviors through health promotion and education should also work to link health professionals with low-income individuals. Linking dental professionals with low-income families is very important in the formation of a dental home.

This literature review revealed that children remain a focus of most low-income oral health interventions due to the high rates of early childhood caries. There is great potential for the delivery of preventive services such as fluoride varnish and sealants through school-based programs. Involving families and parents in the oral health of children and changing oral health behaviors can also lead to an increase in oral health. Expanding the role of pediatricians could successfully overcome access barriers and bring important preventive care to children.

There is no simple intervention or innovation that will reduce the oral health disparities experienced by so many low-income groups throughout the US. Understanding the barriers to care and trying to break these down is the simplest way to approach the problem. Improving the dental safety net through increased funding and providing community based dental treatment could help in improving the oral health of low-income populations. Interdisciplinary work needs to be done between government officials, dental professionals, medical professionals, and public health professionals in order for low-income populations to receive the dental treatment needed to remain healthy.

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