

Oral Health Disparities:
A gradient remedied through educational
programs
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Introduction

Dental health in the context of larger health in the United States is a vital area of research as it has a direct impact on overall health, equality of opportunity in the work force, and generational dental health. This research will play a direct role in the formation and implementation of policy to alleviate the oral health disparities across the socioeconomic gradient. Various factors have been analyzed as key contributors to this gradient including food and beverage choices, dental anxiety, access to reparative treatment, and general education about prevention and maintenance of good oral health. However, many of these options have been shown to have short-term effects. Because of barriers like access, cost, and time for dental visits, this paper will focus on dental and oral health education as a primary course change towards a healthier nation. Educational programs in countries outside the United States have had varied results, but with persistence and the appropriate combination of education and practice, the oral health gradient can be lessened significantly, especially for the lowest socioeconomic communities.

Defining Poverty and Measuring Disparities by Income, not Racially

The term poverty is the controversially characterized as the state in which people below the nationally set poverty line are living. This state is often tarnished with inadequate education, poor health, crime, unemployment, poor family dynamic and a lack of social participation. In the mid-1960s, the federal government, through the U.S. Department of Agriculture, set an official “poverty line” as the fiscal amount a family of a given size needs to receive to maintain an adequate level of nutrition. This number was then taken and multiplied by three because an average family’s total expenses were three times its food budget, in the 1960s. Since then, the poverty line has only been updated by multiplying the 1965 line – of \$3,500 for a family of four

– by the increase in the Consumer Price Index and does not change according to state or location. The poverty line was set at an estimated amount “to be necessary for minimal economic survival and social participation” (Blank 10). As of 2011, 100% of the poverty line is set at \$22,350 for a family of four; 200% of the poverty line is therefore \$44,700 for a family of four. In 2009, the national poverty level was estimated to be 14.3% based on 100% of the poverty line and 33.0% for 200% of the poverty line (FHCE).

Research shows these low SES communities are at the highest risk for cardiovascular disease, obesity, depression and anxiety and, in general, significantly diminished health as compared to their wealthier counterparts. However, much of the data collected in the United States on national health focuses on racial and ethnic groups rather than socioeconomic status itself. In addition, the little work that has been published on socioeconomic status usually looks at three socioeconomic levels: the poor – below 100% of the poverty line, the nearly poor – 100% - 200% of the poverty line, and the non poor –200%+ of the poverty line. In contrast to our primarily racially based comparisons, the United Kingdom examines five socioeconomic levels and many other European countries examine six or more presenting more detailed and accurate data on the health status of their citizens. Because understanding differences in health helps us understand the nature and causes of inequality, it is vital to have the most accurate system available for national analysis. Analyzing health disparities are also of significant importance in policy-making. For example, if a particular health problem is found to be localized among the poor, a “disease of the poor,” while the problem is not prominent among other income levels, this may suggest deprivation like poor housing quality or hazardous working conditions; deprivation suggests the need for policy directed at those at the lowest income levels. On the other hand, if a particular health problem is found among all income levels but in a gradient such

that the lowest income communities experience a problem significantly more often than the highest income communities, policy needs to be designed as to increase equality of opportunity for those in the lowest income sector.

Establishing Health Inequalities

In an effort to identify the source of health disparity among income groups, some authors have suggested access to resources, educational attainment, racial and ethnic background, genetic disposition and more as causes of the health gradient. In a study by Braveman et al. (2010), educational attainment and income were used as measures of socioeconomic status in analyzing five childhood health indicators (infant mortality, health status, activity limitation, healthy eating, and sedentary adolescents) and six adulthood indicators (life expectancy, health status, activity limitation, heart disease, diabetes, obesity). For childhood health, a significant socioeconomic gradient was found for all health indicators except for activity limitation, where there was only an income gradient. In other words, the most significant health problems were seen in the least educated and lowest income families and with increased education and income, health problems decreased. For adults, education and income as indicators of health became significantly more complicated. Both income and education created a gradient for life expectancy at age 25, activity level, health status and diabetes; income alone was associated with coronary heart disease, while education alone created a gradient for obesity. The more intertwining nature of education and income suggests that, by adulthood, negative health behaviors from childhood, for example an inactive lifestyle and poor nutrition, may be strongly established.

Poulton et al. (2002) explored the association between socioeconomic disadvantage during childhood and adult health later in life. In the study, researchers studied 1000 randomly

chosen children in New Zealand at birth and 3, 5, 7, 9, 11, 13, and 15 years old. The same individuals were assessed again at age 26 for body-mass index, waist to hip ratio, blood pressure, cardiorespiratory fitness, dental caries, plaque scores, gingival bleeding, periodontal disease, major depression, and tobacco and alcohol dependence. Poulton found that children who grew up in low socioeconomic households had significantly poorer cardiovascular health, cardiorespiratory health and higher body-mass indices and waist to hip ratios (all indicators of poor health). Significant differences in oral health were found for all measures. Children who grew up in low socioeconomic families had a three-fold increase in both caries and periodontal disease compared to their high socioeconomic status counterparts (32.2% vs 9.9% and 31.1% vs 11.9%, respectively). Interestingly, mental health and substance abuse did not fit into the socioeconomic gradient. Rather, depression, alcohol and tobacco dependence were more strongly associated with adult socioeconomic status. The most devastating finding was that upward mobility did not mitigate or reverse the adverse effects of growing up in a low socioeconomic household. These results suggest policy must be formed and implemented to protect children in low SES families against the negative health consequences of life in a low SES family. Poulton and colleagues concluded that the suggested social-origins hypothesis was the most accurate description of the association of childhood socioeconomic status and adult health. That is, regardless of adult socioeconomic status, children who grew up in low socioeconomic status households should have poorer health in adulthood than those who grew up in high socioeconomic households.

Generational Poverty, Focusing on the Children

Adults who have experienced poverty for two or more decades and are considered a part of what is called generational poverty. Generational poverty is often described as having its own

culture, rules, beliefs and assumptions and results from the inability to overcome inequities in education, income, medical care, etc. Many children are affected by generational poverty and move into adulthood without the skills necessary for upward mobility. In 2009, 20.7% of children under the age of 18 were living below the official poverty line, a 5% increase from 2000; another 21% of children are living between 100-200% of the poverty line, also a 5% increase since 2000, resulting in almost half of all children in poor households (NCCP 2009). Education and social support have been suggested as necessary resources for the upward mobility of children by many scholars, but the deep-rooted “culture” of generational poverty must be addressed too. With an understanding of generational poverty, it seems reasonable to focus policy on preparing children in low-income households with the resources for upward mobility and the intention of ending this poverty cycle. In the context of health, specifically oral health, the gradient has been identified and can be quantitatively and qualitatively demonstrated, but a specific cause or source of the gradient has yet to be determined making particular policy formation difficult.

Magnitude and Significance of the Gradient in Oral Health, Head Start Programs

The first step in the formation of policy to address health disparities is to find at what point the disparities appear. One of the easiest ways to approach this area of study is to start with large groups of young children in low-income, low SES communities. Head Start programs across the nation have been a significant source of much of this data. The Head Start childcare programs in New Hampshire were used to collect baseline data about dental prevalence and severity between 2007 and 2008 (Anderson, 2009). It was found that, among 607 children aged 3-5 years old, 40% had experienced dental caries and at least 31% had a minimum of one untreated decayed tooth. About one quarter of the children were in need of dental care, but less

than 1% needed urgent care. Similar findings were found a larger group of Ohio Head Start students. Among the 2,555 children in 50 Head Start centers, 38% had experienced dental caries, and 28% had at least one untreated decayed tooth (Siegal, 2004). While a reported 85% of the children had visited the dentist in the last year, 10% had never been to the dentist. This data was then compared to the Head Start Program Information Reports (PIR) from 2002-2003. In this report, Medicaid covered 62% of Ohio Head Start children, 71% had visited a dentist within the past 12 months, and 21% who had had a dental exam needed follow-up care for untreated caries. These statistics, however, are only relevant in the context of the general population. According to the Center on Disease Control (CDC) Health Data for All Ages reports (2007), the national prevalence of dental caries in primary teeth significantly increased from approximately 24% to 28% among 2-5 year olds. The national percentage of young children with untreated primary teeth is about 21%, as opposed to the 28 and 31% found in Ohio and New Hampshire Head Start centers. This data reports a 40% different in experience of caries and a 44% different in untreated caries between the national rates and those of low-income Head Start children.

In Manhattan, children enrolled in urban Head Start programs and day care programs in the Washington-Heights and Central and East Harlem communities were studied for associations between low-income and poor dental health as determined by the number of decayed and filled surfaces, decayed and filled teeth, and a few other representative factors. Albert et al. (2002), found the percentage of decayed of total decayed and filled surfaces to be significantly higher, 91% in this population, than the national population (76%). Researchers suggest that the higher rates of decayed teeth and lower rates of filled teeth may be due to a lack of access. They report that this area is a designated dental health manpower shortage area and that pediatricians are the primary contact for these children. Additionally, the researchers suggest “economic factors,

education about dental health, cultural views on primary teeth, baby bottle use, and diet as well as attitudes toward seeking dental treatment” as other causes of higher rates of dental decay among the northern Manhattan children (Albert, 2002).

The specific linkage of socioeconomic status and health becomes important when considering the social implications of inequality. As argued by Norman Daniels, health inequalities are inevitable, but become of significant concern when opportunity is unequal. It is taught as young as elementary school that food, water, and shelter are required for life; but to live, one needs much more than this. The economic and social requirements for life are called the social determinants of health and include, among others, education, health services, income and social status, and life skills. When one or more of these social determinants are not equally distributed in a population, opportunity is diminished. David Shipler illustrates this inequality of opportunity in the context of oral health disparities when he describes Caroline Payne. Caroline is a hard working, dedicated, loyal, educated woman who moves from job to job, hidden in the back of the store unnoticed. Caroline no longer has any teeth. She has a set of dentures, but they are not fitted properly leaving her in pain. Her dental problems are not a priority, however, when compared to the needs of her disabled daughter. With a two-year associates degree, Caroline has the educational background to work above minimum wage, but with her lack of dental services and the social stigma of having no teeth, she is severely limited in job opportunities.

Socioeconomic Mobility in the Oral Gradient?

In a study conducted in New Zealand by Thomson et al. (2004), researchers sought to untangle the childhood causes of adult oral health. More specifically, researchers wanted to determine whether oral health in adulthood is affected by changes in socioeconomic status and whether adult oral health is a result of childhood oral health or childhood socioeconomic status.

After controlling for childhood oral health, researchers found there were significant oral inequities in 5 year olds that persisted through adulthood. Interestingly, New Zealand provides state funded dental care for those under the age of 18, but until entering school (usually age 5), there are social differences to access and care. Researchers also found a significant increase in the loss of permanent teeth due to caries after age 18, when “universal dental healthcare” switches to self-funded care (<1% vs 10% by age 26). When exploring poor adult oral health as a result of poor childhood oral health, and controlling for socioeconomic status, having high disease in childhood resulted in greater disease in adulthood. When analyzing changes in socioeconomic status, the data generally supported the social-origins hypothesis for dental caries, tooth loss from caries, average number of missing teeth, and plaque score. However, the upward mobility hypothesis, which says that rising in the socioeconomic hierarchy from childhood to adulthood has health benefits (low SES → high SES, “low-high”), and the downward mobility hypothesis, which predicts a detrimental effect of moving from higher socioeconomic status to lower (high SES → low SES, “high-low”), had some support. The ‘low-high’ cohort was second to ‘high-high’ (remaining in high SES status for childhood and adulthood) in the fewest dental problems. Researchers found that, in general, disease at 26 years old increased in the following order: ‘high-high’, ‘low-high’, high-low’, to ‘low-low’. In other words, people who grew up in low socioeconomic communities and stayed there had the highest incidence of dental disease and those who grew up in high socioeconomic and stayed had the lowest. However, it was found that moving from low socioeconomic status to high socioeconomic status produced fewer incidences of oral disease than growing up in high socioeconomic communities and moving to lower socioeconomic communities. Oral health is, therefore, directly affected by low socioeconomic

status; however, being raised in high socioeconomic communities does not completely prevent poor oral health in the future either.

Consequences of Poor Oral Health: Social, Psychological and Physical

The consequences of poor dental hygiene are significant, age dependent and often overlooked. The physical and social implications of poor oral health for children were explored in a study by Vargas *et al.* (2005) where the results from the Survey of Oral Health Status of Maryland School Children were analyzed for 2,411 kindergarten and third grade children. Overall, 11.8% of children reported dental pain, and of children who had previously had a cavity, 28.5% reported dental pain. When looking at families who were eligible for free/reduced lunch, parents with less than 12 years of education, or families who were covered by Medicaid or had no insurance, rates of dental pain were significantly higher. Dental pain is currently being explored in relation to academic performance as it decreases children's ability to focus in school.

Another study by Gherunpong *et al.* (2004) looked more specifically at the social and psychological affects of poor dental health on children ages 11-12. Gherunpong found that dental impacts affecting 1-4 of 8 daily performances (eating, speaking, cleaning teeth, relaxing, smiling, studying, emotional state, and interpersonal contact) in the past 3 months were present in 89.9% of 1,126 children surveyed in Thailand; 15.2% of children reported 5-8 performance impacts. After a dental examination, it was determined that 43.1% of the children had no cavities, but only 5.4% were categorized as having good oral health. Moderate oral hygiene was reported for 69.1% of the children and 25.5% were characterized as having poor oral hygiene. Of the performances affected, eating was the most affected (72.9%) followed by emotional state (58.1%), cleaning teeth (48.5%) and smiling (40.1%). When severity was taken into consideration, smiling (3.2%) and eating (5.5%) were reported as "very severe" impacts. The

most common causes of the impacts were a sensitive tooth (27.9%), oral ulcers (25.8%), and toothache (25.1%). Regarding appearance, 20.0% of children said the position of their teeth affected their performances and 16.2% said the color of their teeth affected performances.

While attitudes towards dental hygiene and health are constantly changing, an article from the 1960s (Linn, 1966) demonstrates the attitude of a nation towards dental appearance before Crest Whitestrips and veneers. Linn opens his article with, “personal appearance does count.” Interestingly, when respondents were asked about the reason for brushing teeth, the highest ranked answer among men and women, white or black, was “protects, preserves teeth from decay” (~55%); “makes teeth look good” was ranked 4th on average (~15%). When giving a reason for taking care of teeth a gums, 56% ranked “keeping your teeth as long as possible” and 23% ranked “to prevent other illnesses” first of 5 options. This data suggests the respondents were well informed about the reasons for practicing good oral hygiene. In general, Linn found that attitudes value of dental appearance did not change among education, age, race or marital status, but when analyzing respondents’ personal dental state, education, race and age were relevant. Most importantly, when asked about four situations (dating among young people, making friends, getting a job and running for office), the majority of respondents reported dental appearance “very important.” Overall, 15% or less said dental appearance “does not matter” or is “hardly important.”

Poor oral health also has been associated with problems in overall health. Specifically, gum disease, cardiovascular health, pre-term pregnancy and low birth weight, diabetes, HIV/AIDS, and low childhood weight have been studied among many others. Meurman *et al.* (2004) looked at articles concerning the association between cardiovascular disease, atherosclerosis and oral health and found that periodontal disease may increase the risk of

cardiovascular disease by 20%. While the risk ratio between periodontitis and peripheral vascular disease is estimated to be between 1.41 and 2.27, the risk ratio of periodontal disease and stroke is estimated to be between 2.85 and 1.74. The oral cavity provides a unique environment in that hard tissue breaks through soft tissue creating a perfect opportunity for bacteria and viruses to enter the system. This is described in the article by Chapple and Hamburger (2000), when the authors explain that, with increased ulcers from gingival/periodontal diseases or trauma, viruses like HIV may pass into the system much easier increasing one's chances of infection. A literature review by Lamster *et al* (2008) examined the interaction of diabetes and periodontal disease, and among many findings, found that treatment of periodontal disease had a beneficial effect on the treatment of glycemic control. Additionally, there was a demonstrated relationship between complications of diabetes mellitus and poor periodontal health. One study reported kidney damage was 2.0 to 2.6 times greater in those with moderate or severe periodontitis.

Food and Drink Choices as a Source of Inequality

Sugary beverages and soda have been examined extensively, and in combination with poorer food choices and hygiene behaviors among the poor, has been suggested as a significant cause of the oral health gradient. In a 2008 article by Llana and Forner, the association between caries experience and cariogenic foods was analyzed among children ages 6 to 10 in Valencia, Spain. Researchers found that sweet snacks, soft drinks and industrial breads increased caries while nuts and cheese were negatively correlated to oral caries. Specifically, semi-hydrolyzed starches and sugary liquids, which stay in the oral cavity longer than sugary foods, increased the chances of developing caries by 1.05 to 1.13 times. Marshall *et al.* (2003) found similar results in a study of 642 children ages 1-5 years old. Recent dietary changes like decreased milk intake and

increased 100% juice and soda pop ingestion were analyzed for an association with dental caries, and researchers found that increased consumption of regular (sugared) soft drinks, powdered beverages and 100% juice, to a lesser extent, increase caries occurrence. Children with caries at age two and three consumed less milk on average than did other carry-free children of the same age. Inadequate intake (vs low adequate or high adequate) of riboflavin, copper, vitamin D, and vitamin B12 were associated with increased caries; low adequate intake of vitamin B12 and vitamin C were associated with decreased number of caries suggesting a minimum amount of nutrient required for decreased caries incidences.

Another study by Kolker et al. (2007) analyzed dental caries rates and dietary patterns in 436 low-income, three to five year old African American children. Dietary analysis was performed using the Block Dietary Data Systems and children with “serious errors” were considered as such when mothers reported less than 3 solid foods consumed in a day or more than 17. Of the 436 children, 9.4% were considered to have serious errors in food consumption. Of the families represented, 86% of caregivers were mothers, 60% of caregivers were unemployed, 44% had incomes less than \$10,000, and 45% did not graduate from high school. The most commonly consumed “solid” foods were (in ascending order) ketchup, bologna, bread/toast, sliced cheese, potato chips, and cold cereal. Nearly all of these foods are carbohydrates, which are the first food group to be broken down digestively and the only type of food that can be broken down in the mouth via saliva. The most consumed vegetable, green beans, was ranked 33rd on the list of solid foods. The top five sources of sugar all came from beverage consumption and soda in particular accounted for 11% of sugar consumption. Of the children in the study, 75% had dental caries. Soda consumption rates of children, especially those in lowest SES communities, are of significant importance. With children as young as 2 or 3

years old with numerous treated and untreated dental caries, the future oral health of these children is threatened and may lead to significant health and financial problems in the future.

Additionally, a lot of attention has been drawn to low-income families in rural areas of Appalachia through the media's spotlight on what is now termed, "Mountain Dew Mouth." In one article, authors Gray and Diaz write, "It's a stereotype rooted in a terrible fact. Central Appalachia is No. 1 in the nation in toothlessness. According to dentists, one of the main culprits is Mountain Dew soda. With 50 percent more caffeine than Coke or Pepsi, Mountain Dew seems to be used as a kind of anti-depressant for children in the hills" (Gray and Diaz, 2009). Americans are consuming unfathomable amounts of soda, 15 billion gallons in 2000 amounting to at least 12 ounces per day for every person living in the United States (Squires, 2001). As of 2001, 56% of 8 year olds drank at least 12 ounces of soda a day, and 33% of teenage boys drank 36 ounces. Nearly two thirds of all private and public schools sell soda at school making soda consumption incredibly available and unsupervised. This high sugar, high caffeine beverage is increasing obesity, caffeine dependence, weakened bones and tooth decay nationwide and some of the most significantly affected populations are the low socioeconomic communities where preventative and reparative measures are not available. While fixing these children's teeth is a priority and Pepsi Co. has expressed interest in working with dentists in Eastern Kentucky to help alleviate the problem, ceasing soda consumption is unlikely. Diet control is not a feasible option from a policy making standpoint, though efforts could be made to limit the amount of soda sold in schools. Educating these communities on the consequences of such significant levels of soda consumptions seems to be a more reasonable and attainable approach. Dr. Smith, the dentist featured on Sawyer's episode was quoted by Gray saying, "It's a generational thing, I think... Grandma had dentures, mom had dentures, it's just inevitable that I'm going to end up

with dentures, is the way some of these kids feel. I really believe we have to do a better job educating."

Dental Fears as a Source of Inequity

One newer area of study in dental research has focused on fear and anxiety of dental medicine stemming from the dentist himself, the office, the feelings of being out of control, etc. It is well known that those living in and around the poverty level have more stressors, be they physical, emotional or interpersonal, and some suggest that people living in low SES communities may have higher rates of dental fear than those in higher SES communities. It is estimated that within the general population, somewhere between 5 and 15% of people experience some form of dental fear and 5-10% of those may be considered dentally phobic (Schuller, 2003). Whether there is a higher rate of dental fear and phobia among the lower SES communities is still yet to be strictly determined, but in my experience at the Rockbridge Area Free Clinic (RAFC), I have seen and heard the stories of grown men and women who are truly terrified of the dentist. One such woman arrived one day for her appointment with Dr. Bodley when my supervisor, Mary Jo, pulled me aside and explained to me this was Beth Ann's fourth appointment without any work. I assumed she might have meant the patient had missed appointments; but what I later understood and witnessed was an inhibiting fear of the dentist. Initially calm and collected, as soon as Dr. Bodley entered the room, Beth Ann immediately said she wasn't feeling well, excused herself and returned a few minutes later explaining she had gotten sick and must have had the flu. Beth Ann left without receiving treatment for the fourth time. Beth Ann was certainly not the only patient I witnessed at the free clinic that exhibited intense fear or anxiety, either. Another time, a friendly man named Bill arrived at the clinic for some work. When Dr. Devening came over, Bill was still friendly but became a little more

reserved, as if he was muting himself. He explained to Dr. Devening that he was pretty afraid of the dentist's office, but that he would be fine today. Dr. Devening began the examination but soon stopped. Inexperienced in the dental office, I couldn't figure out why. I learned shortly after that Bill had "self-medicated" before his appointment to calm his fears. As outlined in the expectations of the program, Bill could not receive treatment from the clinic that day because of potential drug interactions and the need for the patient to be fully alert and involved in treatment.

In a study by Armfield et al. (2007), the "cycle of fear" was explored along with the associated behaviors. Researchers proposed what they called a "vicious cycle of dental fear" hypothesis, which held that the consequences of fear perpetuate fear. In other words, dental fear leads to delayed dental visits, delayed dental visits then lead to dental problems, and dental problems result in symptom-driven treatments causing increased dental fear. A random sample of 6,112 Australian residents were tele-surveyed and more prevalent dental problems, assessed through the number of missing teeth, perceived need, social impact or self-rated oral health was associated with dental fear. Additionally, researchers found dental fear resulted in less frequent dental visits as measured by past behavior and established future appointment times. Finally, symptom-driven treatment was the most common reason for visiting the dentist for those who reported being "very afraid" of the dentist. However, based on the definition of phobia in the Diagnostic and Statistical Manual of Mental Disorders, researchers suggested these patients were probably not phobic because 56% of patients had visited the dentist within two years. Overall, researchers found 11.9% of respondents reported being very afraid of the dentist; of this group, almost 30% had delayed dental visiting, poor oral health, and symptom-driven treatment seeking suggesting there is, in fact, a cycle of dental fear where patients will eventually exacerbate their

fear by avoiding the dentist, creating more dental problems and being forced into symptom-driven treatment.

Another study (Schuller, 2003) corroborated the findings of Armfield et al. when they found that individuals with high dental fear engaged in more visitation avoidance (3+ years since last visit). This study, however, explored more physical consequences of dental fear. The number of decayed, missing, filled and sound teeth and surfaces of the patient determined “oral status.” The percentage of high dental fear ranged from 4.4 to 8.6% depending on the age group and averaged 6.6%. A reported 1.7 to 3.8% of people had extremely high fear, depending on age. There were no differences found in daily flossing or toothbrush use between the high fear and low fear groups, but women were statistically more likely to be in the high fear group. Not surprisingly, high dental fear patients had more decayed surfaces, decayed teeth, and missing teeth. Additionally, the high fear group had a lower number of filled teeth, filled surfaces, functional surfaces and functional teeth. Based on the findings that high fear patients in the 55-64 year age range had an average of 9.8 functional teeth, the authors concluded that there is a significant functional problem and probably a significant aesthetic problem in the high fear patients.

Access to Health Insurance

One of the most popular arguments for the oral health disparity is access to doctors and treatment for patients. While this argument certainly has merit for much of the population in low SES status, access depends on a large number of variables including location, transportation, payment source and more. It is more effective, then, to look at dental care options and utilization among low SES communities as representative of access. Currently, there are three primary sources of dental care for children and families: private health care (usually purchased through

one's employer or purchased individually), public health insurance (federally funded Medicare of Medicaid, State Children's Health Insurance Program [SCHIP], military benefits etc.) and other forms of healthcare coverage (non-profit organizations like the Rockbridge Area Free Clinic, disability income insurance, long-term care insurance) (discussed later). According to the US Census Bureau's 2009 report, the percentage of uninsured people in the US increased between 2008 and 2009 from 15.4% to 16.7%, which means 4.4 million people who lost insurance. The number of people with private insurance decreased from 201.0 million (66.7%) people in 2008 to 194.5 million (63.9%) in 2009. Additionally, the number of people using publicly supported health insurance increased from 87.4 million (29.0%) to 93.2 million (30.6%). More specifically, Medicaid patients increased from 14.1% (42.6 million people) to 15.7% (47.8 million people) between 2008 and 2009. In 2009, almost 1 in 5 people were without insurance of any kind (16.7%). This means that 50.7 million people were left to pay for healthcare out of pocket or received no healthcare. The rate of uninsured children was 11.0% nationwide, and 15.1% for children living in poverty.

Private Dental Insurance

The most common form of health insurance is through one's employer and this, for full benefit employees, will include dental insurance. The employer will typically pay about 85% of the cost of dental insurance resulting in a monthly premium, of around \$50 a month, totaling \$600 a year (Fontinelle). However, this is dependent upon the size of the firm. In a report by The Kaiser Family Foundation and Health Research & Educational Trust (2008), the smaller the firm, the less likely dental benefits will be offered. For example, of all small firms (3-199 workers) only 43% provided dental benefits as compared to large firms (200+ workers) where 82% offered dental benefits. In a paper by Manski et al. (2002), it was demonstrated that dental

insurance has a significant impact on the quality of dental care and number of visits. It was found that poor and low-income people were less likely to have private dental insurance and that people, regardless of income, were more likely to report fewer dental visits when without insurance. Manski found that 14.4% of the poor population (<100% FPL) had private dental coverage as compared to 69.6% of high income (>400% FPL). Of the population considered to have some or no school, only 20.8% has private dental insurance; of college graduates, 71.2% had private dental coverage. In his second study, Manski found that, in 1996, 52% of children under 18 had private insurance and of this group, 56% had made at least one dental visit in the past year versus a mere 28% without coverage. Medicaid covered 56% of children under 133% of the FPL in 1996 and 28% of these children had at least one dental visit within the past year as compared to 19% of non-covered children. These articles demonstrate that while those who are insured visit the dentist more often than the uninsured, having dental insurance of some sort still does not guarantee visits to the dentist. Additionally, many people living in low SES communities and below or around the FPL are often not receiving dental benefits from their employers, if employed at all.

Medicaid Dental Coverage

One alternative to private insurance, for about 58 million people in 2007, was Medicaid coverage. Medicaid is a means-tested program that is federally funded and regulated by the state. Of the 58 million receiving Medicaid coverage, 49% (20 million or 25% nationwide) were children, 25% adults, 15% disabled and 10% elderly. Interestingly, however, only 20% of the \$300 billion in expenditures were allocated for children. Under current policy, eligibility requirements are complicated and being financially poor will not necessarily qualify one for

Medicaid. However, beginning in 2014, all citizens under 65 years old and living under 133% of the FPL will be eligible for Medicaid.

The Medicaid Act has certain requirements for health and dental treatment. Particular to dental coverage, early and periodic screening, diagnostic and treatment (EPSDT) services are required. The EPSDT has two operational components: assuring accessibility and availability for healthcare resources and helping Medicaid beneficiaries and guardians to use the given resources effectively. However, the periodicity, required content, and specific schedules for dental consultation are set at the state level leaving ample room for variability among states. The Medicaid Act generally describes dental services,

1) are to be provided at intervals that meet reasonable standards of dental practice, as determined by the state after consultation with recognized dental organizations involved in child health care; 2) are to be provided at such other intervals, indicated as medically necessary, to determine the existence of a suspected illness or condition; and 3) shall at a minimum include relief of pain and infections, restoration of teeth, and maintenance of dental health (Department of Health & Human Services, 2004).

Once of a certain age, usually between 1 and 3 years old, a dental referral is required. This referral is required for a number of reasons, but primarily to require a dental visit for preventative measures that are particularly necessary among the low-income communities. A final requirement under the Medicaid Act is health education and “anticipatory guidance” as part of the screening services (Department of Health & Human Services, 2004). This section of the act is designed for optimal parental preparation for future needs both in the home and in the dentist office. While these requirements seem sound and sufficient, maintaining high quality,

reliable, consistent care is more difficult than it sounds. One problem is with the State's ability to choose whether or not to provide oral health services if using a non-Medicaid program like SCHIP. In 2007, however, all states included some type of dental services in their benefit programs except Florida, Delaware and Colorado.

The biggest problem currently is in the number of dentists who will see Medicaid patients. As of 2001 under Medicaid and SCHIP, dentists were not required to enroll as providers for these programs and those who did were not required to see any minimum number of patients or any at all. In an article by Gehshan et al. (2001), a national survey by the National Conference of State Legislatures (NCSL) investigated the number of dentists per state who 1) were enrolled as Medicaid/SCHIP dentists 2) billed the state for dental services and 3) billed over \$10,000 (It was estimated that each child received about \$437 worth of dental care a year, so billing \$10,000 would have meant the dentist had seen 2 Medicaid patients a month minimum). Gehshan found that five states, Connecticut, Pennsylvania, Wisconsin, Alabama and Colorado, had less than 10% of dentists billing over \$10,000. On the other hand, six states, Oregon, Vermont, North Carolina, Nebraska and Alaska, had more than 40% of dentists billing over \$10,000 for Medicaid patients. However, when surveyed two years later, it was disheartening to see the significant decrease in the number of dentists receiving payment for Medicaid patients (27 states decreased while only 14 increased). On the other hand, 24 of 38 states increased the number of dentists receiving over \$10,000 reimbursement from the state indicating a specialization of dentistry where those who supply services for the poor are increasingly doing so. The most common reason for lack of participation in Medicaid and SCHIP programs is the low reimbursement rates and slow payment process. Because many dentists are less likely to participate in managed care systems, additional fees like leasing space, parking, staff etc. accumulate and make the low

reimbursement rates difficult to manage. It is estimated by the American Dental Association that up to 59% of dental fees are necessary just to cover the cost of delivery. Another fear from many dentists is the nature of providing health services for an unfamiliar community. That is, many Medicaid patients are not used to making and maintaining appointments and may have never been in a dental office before (also adding more severe, difficult work for the dentist).

Other Dental Care Options

Unfortunately for millions of people living in the United States right now, neither private insurance nor publicly insured Medicaid/SCHIP/Medicare are options. As mentioned earlier, the rate of uninsured was 16.7% nationwide and 15% for children living in poverty. When uninsured, there are few options available. The best place to receive treatment for many of these patients is a free clinic. Free clinics are 501 (c)(3) tax-exempt organizations that are “volunteer-based, safety-net health care organizations that provide a range of medical, dental, pharmacy, and/or behavioral health services to economically disadvantaged individuals who are predominately uninsured,” according to the National Association of Free Clinics (NAFC). The NAFC oversees over 1,200 free clinics nationwide. While most services at free clinics are free, eligibility is often seen as rigorous by patients, especially the immigrant communities. This, lack of transportation and limited hours may prevent potential patients from using these resources and force them instead to rely solely on hospitals and emergency rooms. Some free clinics, like the RAFC- Dental Clinic, may charge small fees (\$20) for appointments to help absorb the cost of running the organization. For many of the patients I saw at the RAFC, this \$20 fee was simply too much even though the work they received would have been valued at upwards of \$1,200 a visit. Additionally, not all free clinics offer dental services and certainly most hospitals do not. As a result, there is a large population in the United States that does not receive dental treatment

in any form. For this population, it is vital to recruit dentists, make clinics available and educate the general population about these opportunities.

Educational Gap

The final source of inequity is the educational gap. This source of inequity seems to be of the utmost importance, and yet has been examined very little by the health community. Many if not most policy has been designed to remedy the current health problems and disparities experienced by low SES families. However, I believe it is more important to focus on preventative measures as I find the only way to stop an ongoing problem is to stop the source. An analogy for this would be a leaky kitchen sink that is making a mess on the floor. Fixing cavities and dental problems is like cleaning up the mess on the floor without addressing the faucet. Educating children and adults on the consequences of poor oral health, proper hygiene habits and dietary decisions is like fixing the sink.

The first priority in dental education is the deliverance of information in an interesting and engaging way such that the children will remember what they have been taught. It is also important to consider repetition and application of the information. If dental education is approached in a way such that it is perceived to be a boring, one-time lecture, we are not going to be effective. In a field experiment run in the Netherlands in 1988 by Horst and Hoodstraten, adolescent children ages 12-14 years old were essentially quizzed on their knowledge, attitudes and reported behaviors immediately following and 2 months after (delayed) viewing a dental health film during class. A total of 20 classrooms were used, 12 experimental and 8 control, with a total of 425 children participating. Multiple conditions were created such that the students were randomly assigned to one of five conditions with a combination of a pretest, film viewing, 1st posttest (immediate) and 2nd posttest (+2mo). The questionnaire used in pre- and post-test had 21

knowledge questions about the causes, meanings and consequences of plaque, diagnostics aspects of dentistry, and prevention and consequences of periodontal disease. The seven attitude questions explored the respondent's opinion on the consequences of periodontal disease, preventative measures and nonuse of sweets. Finally, there were eleven questions on reported dental behavior. An important factor in this educational application was the way in which the film was presented. According to researchers, "the film follows a boy and a girl from the moment the rise in the morning to their date. Following the girl's observation that the boy has bad breath and might suffer from periodontal disease, she suggests a visit to her sister, who happens to be an oral hygienist..." (Horst and Hoodstraten, 1989). This approach is significant in that it is presenting information with which the audience can relate. When comparing pre- and post-test scores, researchers found that those who viewed the film had done significantly better on knowledge questions. In fact, for six questions including the definition of plaque and gingivitis, a 40% test score increase was seen. A small decline in knowledge scores from the immediate post-test to delayed post-test was observed, but not significant. Mean post-test scores showed a slight, but still statistically significant, increase in attitude. Behaviors were not changed between the immediate and delayed posttests. This data suggests that a 20 minutes film may significantly help knowledge about dental health, but that it is not significant enough to change attitudes and behaviors. However, this suggests the possibility of other approaches for behavioral and attitudinal changes to be used in combination with educational media for the most efficient educational experience.

Researchers in St. Joseph County, Indiana sought to define an appropriate approach to altering the behaviors of high school students as they pertain to oral health. In an article by Williford et al. (1967), researchers hypothesized that dental information needed to be presented

in an “authoritative and meaningful... question-answer teaching approach” rather than simply telling students to brush their teeth. Almost 200 students aged 13 to 15 were given an informal six-lecture series using slides, movies and textbooks by a local dentist. One-hour lectures were given during two successive days at one, two and three months. The general approach was to use one theme, “Why is it that 140,000 Americans are not getting dental treatment and how can we motivate them to learn about dentistry and good oral hygiene?” Utilizing this exploratory theme, etiology of dental diseases, preventative measures, fear of the dentist and other areas were studied by the students. Students were given an initial quiz and dental exam, a quiz and exam at 3 months and an exam at 6 months for comparisons. Concerning oral debris, the experiment students were found to have a significant decrease over the control subjects (experimental group: 30% improvement at 3 months and 53.9% improvement at 6 months; control group: 3.6% improvement at 3 months and 15% improvement at 6 months). The mean tartar score for the experimental group decreased at both 3 and 6 months, whereas the control group tartar scores increased (experimental group: 17.4% decrease in tartar at 3 months and 14.3% decrease at 6 months; control group: 100% increase in tartar at 3 months and 42.1% increase at 6 months). Similarly, oral hygiene scores also improved for the test group (18.4% improvement at 3 months and 45.5% improvement at 6 months), but the control group varied (15.4% decline in oral hygiene at 3 months but a 3.1% improvement after 6 months). The plaque index (PI) results were very good for the experimental group, which had a 17.4% decrease in plaque at 3 months and a 39.4% decrease after 6 months. The control group, however, had a 76.7% increase in plaque at 3 months and a 35.7% increase after 6 months. Finally, in the first 3 months, there was a 20.3% improvement in dental IQ for the test group in contrast to a 6.7% improvement in the control group. These findings that show persistent improvement between 3 and 6 months for the

experimental group suggest that this interactive lecture approach may be successful for high school students. It should be noted, however, this is an older study and teaching and learning techniques have changed since then. However, significant observations can still be made about the study. Researchers emphasize in their conclusions that the number of times students brushed their teeth increased for the experimental group and decreased for the control group. Additionally, the experimental group was taught how to brush their teeth properly making the efforts more efficient and effective even for those students who did not increase the number of times they brushed their teeth.

Remedies

One common response to remedying oral health problems has been fluoride treatments and dental sealants. In 2005, a fluoride varnish vs. sealant discontinuation experiment was conducted with six to eight year old children. Children were treated in one of three randomized groups: no treatment, sealant applied six times up to 36 months, and fluoride varnish applied eight times up to 42 months followed by 5 years of discontinuation for both treatments. Researchers found 76.7%, 26.6% and 55.8% of children from each of the three conditions, respectively, had caries after 9 years (Bravo, 2005). This indicated a 65.4% reduction in caries for the sealant treatment and 27.3% reduction for fluoride varnish treatment after 9 years. Interestingly, discontinuation of the fluoride varnish after the four-year treatment resulted in caries development similar to that of the no treatment control group and was therefore no longer effective. This research suggests that a sealant program may result in more long-term benefits, even if discontinued later, and the more inexpensive fluoride treatment would be much less effective if discontinued. According to the PEW Children's Dental Campaign, a fluoride varnish treatment currently costs between \$15 and \$30, while sealants cost between \$35 and \$60

(Consumer Guide to Dentistry, 2010). Another concern emerges when considering availability of these treatments. Both a sealant and varnish require visits to a licensed dentist, time and money—regularly. This study demonstrates the benefits of using either fluoride varnish or dental sealants in the prevention of dental carries, but also demonstrates the short-term effects of such a program. For long-term dental health, fluoride treatments and dental sealants may be minimally helpful used alone and rather, should be used as a supplement to other preventative actions.

Food and drink choices among children, and particularly among children living in the lowest SES communities, is poor and leading to vitamin deficiencies, malnourishment and severe oral health problems as early as age one or two. Unfortunately, as Dr. Smith pointed out on Diane Sawyer's 20/20 episode, the problem seems to be generational for many children creating a cycle of poor eating and drinking habits plagued with high amount of sugar and starch (the only food that begins metabolic breakdown in the oral cavity). Additionally, it seems many poor people rely on sodas as a type of antidepressant and are so addicted that simply removing sugary drinks from schools and homes alone would not solve the problem. Rather, we need to focus on educating these populations about the consequences of poor diets and perhaps present this information to parents in a cost-benefit analysis. By not purchasing soda, a family saves on that cost as well as the future healthcare needs. In addition to education, however, measures need to be made to make soda less available in schools and beverages like milk and water more available.

Research on dental fear and that of Armfield et al. suggests a need to address those patients with dental fear as they are at a much higher risk for reoccurring dental problems; and those with higher occurring dental problems are more likely to have dental anxiety. Based on this cycle of fear, one may suggest reaching out to help higher risk patients for preventative care in

an effort to inhibit the initiation of this cycle in the first place. To do this, education about the nature of going to the dentist office, good hygiene and the consequences of poor oral health would better equip this population with an understanding of the process to ease anxiety.

Finally, even with access to dental care, it seems patients are not seeing the dentist frequently. Based on this information, we must find a way to reach the populations who have the least access. Through early education, we can extend preventative measures essentially diminishing the current oral gradient. However, this education must meet particular requirements for the fullest efficiency. First, educational programs must be interactive and consistent. This means it cannot be a one-time lesson where a teacher is talking at students. Making lessons age appropriate and testing knowledge frequently will encourage children to pay attention and become involved. Secondly, using a dentist as the educator would seem to have great benefits in taking away the unknown and anxiety of going to the dentist's office. Third, educational programs should provide the necessary tools for proper hygiene like toothbrush, toothpaste and floss. Finally, knowledge, attitude and behavior should all be considered in dental health lessons as simply knowing does not necessarily lead to knowledge.

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