Access to Dental Care and Health Disparities: The Digital Divide and Other
Divides in Dental X-Rays and Treatment

By

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1.0 BACKGROUND

In 2007, an African American twelve-year-old adolescent named Deamonte Driver died from complications of tooth decay in Prince George County, Maryland. An infection from an abscessed tooth spread to his brain, which lead to pain and eventually death. His family's Medicaid coverage had recently lapsed, but prior to the lapse, the family could not find a practitioner willing to remove the abscessed tooth. Death from tooth decay is generally not something that we find to be prevalent in modern society. However, there is growing recognition that the study of health disparities has under-recognized the role of dental health. This study will contribute to the understanding of dental health disparities by connecting it with the sociology of work and occupations.

As societies underwent industrialization, improvements in medical care and public health contributed to an overall improvement in population health and to the epidemiological transition to chronic diseases such as heart disease, diabetes, cancer, and obesity. Dentistry is one example of a medical innovation that had significant contribution to the decline of mortality and morbidity beyond improvements in sanitation. For example, dentists were able to provide relief and prevent other health complications by extracting or treating decayed teeth. Although industrialization advanced public knowledge of dental health as well as the practice of dental care, it also increased oral-health risk factors, such as refined sugar and processed foods manufactured within urban manufactories. Many of the diseases associated with epidemiological transitions were also associated with processed foods and refined sugars. At first the negative consequences of industrialization, such as refined carbohydrates, were felt by the relatively advantaged, who had the means to purchase luxuries and goods (Wilkinson 2011). Chronic diseases also began to affect the poor and disadvantaged, but unlike the rich, they lacked the access to compensatory health-care. Thus, Driver's death is consistent with the general problems of oral health disparities even in wealthy countries, where despite increases in absolute income for both the rich and the poor, health outcomes still vary by class, race, and other measures of inequality (Qi 2012).

In a 2012 report, the U.S. Department of Health and Human Services named poor oral health as a silent epidemic among the poor, with risk factors such as low income, low education, poor health behaviors, non-insurance status, and lack of access to care (Hudson et al 2007; Stewart et al 2007). Moreover, the USDHHS stated that tooth decay in childhood is a chronic condition that is completely preventable. The overwhelming burden of disease of tooth decay is experienced by a fraction of the population of children only. From this perspective, structural factors such as race and class, rather than simply individual health choices, affected the chances that Driver would die from an infected tooth. Furthermore, a troubling aspect of the Driver case was the refusal of medical professionals to intervene before the death occurred.

The influences of social structures continue to pervade healthcare institutions, even as society has progressed towards a service economy. In Arlie Hochschild's *The Managed Heart*, she examines the ways in which organizational structures have commodified emotions in the work environment. Her primary data sources are from observations of flight attendants and tax collectors. She determines that service oriented economies require individuals present emotional, as well as body work, as sellable human capital assets. Emotional work translates feelings into social practices affecting organizational values and norms for workers in all labor fields. (Kang 2010; Lewis 2012). Undoubtedly, emotional work has influenced the medical field, but very differently than the work, Hochschild's describes of flight attendants. As health provision has become more of a managed care system, physicians are increasingly charged with the tasks of juggling treatment with reimbursement. Because different patients mean different reimbursement schedules, the current service economy has delineated varying standards of health for different parts of the populations, which results in differences in service provision (Friedman 1966; Kornrich 2009). Arguably, physicians today must portray less emotions/feelings when treating patients in order to maximize their own profit.

I choose to examine the supply side of health care and explore the ways in which social structures influence delivery of services in dentistry. This sort of approach is not predominant within the literature on oral health disparities. Boyce and his colleagues (2010) state:

Earlier acquisition of oral cariogenic bacteria, greater intake of dietary carbohydrates, exposures to environmental toxins, such as lead and tobacco smoke, differences in enamel calcification, lack of fluoridated water, and inaccessibility of dental health care have all been explored as possible sources of the excessive caries incidence found among low income children. Despite such evidence for multiple causal pathways in the social partitioning of childhood caries, a widespread assumption is that low SES and minority group parents, preoccupied with the exigencies of disadvantaged lives, are less attentive to the dental hygiene of their children and that disparities in dental health are principally attributable to parental neglect of hygienic practices.

The purpose of this study is to approach oral health disparities differently than parental and victim blame as described in the excerpt above.

1.1 Oral Health Disparities between Black and White Americans

America's racial history has strong ties to stratification and social positioning. Racism and slavery were capitalist attempts to justify the complete exploitation of labor for a given population group. Institutional racism stratified African Americans and whites along class lines. Du Bois (1899) revolutionized the way in which African American health outcomes are understood by calling attention to the close association of race and SES. Du Bois was one of the first scholars to recognize and document the degree to which racial health disparities are tied to social structure. Before Du Bois, scientists explained differences in health outcomes as symptoms of biological variations between races.

Although the issue of race and health disparities is now well recognized in the epidemiological and sociological literatures, similar research on oral health receives inadequate attention compared to other health outcomes, although oral health is one of the strongest indicators of relative disadvantage. The health of teeth serve as a direct indicator of one's social positioning, and vast disparities exists between the health of the advantaged and disadvantaged groups even in a wealthy country such as the U.S. Oral health generally is not highly prioritized in the policy setting, at least in comparison with other health indicators, but it is a very sensitive indicator of health-care quality and the health-care safety net (Castañeda et al. 2010; Fisher-Owens et

al., 2008; Horton & Barker, 2010). The hypersensitivity of oral health to health-care coverage and quality is evident by its comorbidity with other conditions and its casual implications in others.

Dentition does have cosmetic value, but the health of teeth and gums have direct and indirect effects on other measures of health. Attractive and healthy dentition contributes to both social and psychological well-being, and some research finds that attractive teeth are directly correlated with upward social mobility. (Hudson et al 2007; Linn 1966). Other than cosmetic qualities, poor oral health and dental decay have both psychological and physiological consequences. From a mental health perspective, poor oral health is correlated with low or poor self-image, which has strong ties to depressive symptoms, depression and other forms of (affective) mental disorders and illnesses. Infections in the teeth and gum can cause the release of pathogens in the blood that ultimately leading to such extreme outcomes as death. Poor dental and oral health can lead to an array of other physiological consequences, such as cardiovascular disease, cerebral ischemia, and difficulty chewing. The latter outcome can in turn affect health behaviors and dietary choices (Castañeda et al 2010; Hudson et al 2007; Linn 1966; Mulligan et al 2011; USDHHS 2012).

Even in the early days of social science, researchers have called for the need for dentistry to be more closely tied to the medical field. Oral health is cumulative, progressive and has far more implications outside the oral cavity. Moreover, dentists are charged with the sole responsibility of oral health, which is far more extensive than the health of gums and teeth (Freidman 1966). Dental health research traditionally lags a generation behind research on other forms of health outcomes (Davis 1981; Linn 1966). The emergence of theory-driven dental health research—where poor oral health is framed as a chronic condition—did not begin to emerge until the mid-20th century. Research in dental health did exist prior to this time, but the focus was directed more towards an infectious model. Flexner and McKay (Davis 1981) were among the first to analyze the effect of fluoridation on dental health in the public. They showed that fluoride in the public water system would serve as a protectant against tooth decay and provide the most benefit to the poor.

One of the most popular theoretical frameworks within the literature of health disparities is the influence of institutionalized inequality as it operates on social structure. Williams and Sternthal (2010) define social structure as "enduring patterns of social life that shape an individual's attitudes and beliefs, behaviors and actions, and material and psychological resources" (p. S19). They go on to point out how residual race effects on health exists at every educational level—the concept of "double jeopardy"—the condition that arises as blacks experience stigmatized racial identity and have higher rates of exposure to poverty and low SES. Presently, race continues to be closely intertwined with SES. On average African Americans have less income, less wealth, less education, and fewer forms of other financial and social resources than white Americans typically have. African Americans have significantly higher risks of experiencing poverty than white Americans at some point over their lifetime. Even relatively advantaged African Americans are not immune to racial discrimination and its impact of social structure. Therefore, elements of social structure as they intertwine with the economic market may facilitate differential practices in dental care that may directly contribute to the morbidity difference in oral health between black and white Americans.

On average and across all age levels, African Americans report more tooth decay and more missing services than non-Hispanic whites do. Moreover, evidence from a longitudinal study of practices reveals that blacks have fewer teeth at baseline (before initial visits to dentists) than other racial groups, especially white Americans (Gilbert et al 2002, 2006, 2007; Gilbert and Shelton 2003; Hudson et al 2007). Black-white health disparities in physical health measures are most profound before and during middle adulthood. The prevalence and higher incidence rates of chronic conditions (up to middle adulthood) for African Americans are the most significant contributors to differences in mortality and morbidity rates. After age 65, physical health disparities begin to converge for blacks and whites, perhaps due to universal health-care coverage under Medicare. In other words, African Americans who reach late adulthood are essentially no different from whites in terms of physical health (Castañeda et al 2010; Geronimus 2000; Hayward et al 2000; Sorlie 1995).

Interestingly enough, disparities in oral health do not behave the same as disparities in other chronic conditions throughout the life course. Across all age levels, empirical evidence shows that African Americans have more dental caries and missing tooth surfaces than other racial groups, whites especially (Gilbert and Shelton 2003; Hudson et al 2007; Quandt 2009). Dental decay often begins in childhood and maintains associations with negative outcomes well into adulthood. In middle adulthood, individuals who self-reported poor oral health are significantly more likely to report other chronic conditions. Because black-white variations in oral health persist even into late adulthood, oral and dental health disparities serve as an indicator of relative depravity throughout the life course. African Americans still report significantly poorer oral health than white elderly individuals do. Additionally, older African Americans are more likely to have fewer teeth than older whites do. Poor oral health in old age is associated with mortality and functional decline, as well as impaired cognitive functioning (Hudson et al 2007; Quandt et al 2009; Stewart and Hirani 2007; Wu et al 2011).

Scholars realize that the consequences of social positioning begin very early in life; thus, numerous studies focus attention on the oral health disparities between black and white children. Poor dental health in childhood is associated with a number of other physical conditions as well as pain and poor academic performance. Risk factors for poor oral health in children include being of minority race, low income, uninsured, and having parents with a less than high school degree. These risk factors are negatively correlated with the frequency of preventative care visits (Brickhouse et al 2006; Kaylor et al 2010; Dye et al 2011).

Parental oral health is also a significant predictor of the level of oral health for children. Arguably, individuals are susceptible to risk to oral health before birth. Empirical evidence supports a strong link between maternal oral health and pregnancy outcomes. Mothers reporting poor oral and dental health have elevated risks of delivering pre-term or having a low birth weight baby. Even after pregnancy, oral health of mothers is strongly correlated with the health of a child. Children whose mothers report dental caries are three times more likely to have dental caries than children of mothers free from tooth decay. Most research on parental influences has focused on the consequences of mother's oral health. Other mechanisms by which parental oral health

affects outcomes on children will be discussed in the section on the influences of SES (Dye et al 2011; Grembowski and Milgrom 2007; Guillen 1991; Kaylor et al 2010)

Disparities in oral and other measures of health are situated in varying social factors that shape contexts of lived experiences. One factor of social contexts established within the literature to contribute to racial disparities is quality of care (Chen and Land 1986; Hayward et al 2000; Hudson et al 2007; McCall 2004; Schnittker and McLeod 2005; Williams and Sternthal 2010). Assumptions about the social positioning of African Americans and stereotypes have led to disparities in quality of care. Physicians make decisions and allocate care based on these assumptions of class and race that stigmatize African Americans as a less than ideal patient base for entrepreneurial practitioners (Kornich 2009). Dental care providers can seek to avoid the disadvantages associated with a black patient base all together, or they can use cost reduction strategies to maximize revenue despite the risks that coincide with an African American client base.

1.2 The Sociology of Work and Health Disparities

In an exploratory study on the role of work and health disparities, Lipscomb et al. (2006) described how various aspects of work contribute to the dispersion of health disparities. They emphasized that the approach does not seek to blame health-care providers; rather, the approach uncovers the ways in which institutions shape behaviors and characteristics of workers. Thus, segmentation within physician markets can reproduce structural inequalities that lead to health disparities. I build on this approach by seeking to understand how the stratification of providers in the dentistry profession contributes to race and class disparities in health-care practices and technologies.

Prior to industrialization, barter pay was not an atypical form of payment for services accepted by community physicians. Physicians often accepted barters in apples, animals, grains, and other goods produced by local residents in exchange for their health services. By the late nineteenth century, job growth in the

industrial and manufacturing sectors coincided with rapid urbanization. Laborers sold working hours for wages,

and the occupation of physicians evolved with the times by shifting to a fee-for-service structure. Over the

course of the twentieth century, the introduction of public and private health insurance affected the incentive

structure of physicians and health care providers. Health-care professionals increasingly came to view patients

as clients in the urbanized, industrial economy, and these changes reinforced rather than reduced disparities in

the treatment of minority populations (McCammon and Griffin 2000). Additionally, public insurance presented

the dichotomy of the public patient versus the commercial patient. With commercial patients, physicians

maintained relatively more discretion to determine revenue and profit; however, even in the U.S., where public

health insurances was highly limited, commercial physician enterprises still worked with government insurance

schemes for some categories of patients (Doherty et al 2008; McCall 2004).

Segregationist practices of the factory age created noticeable disparities between black and white

(workers), which eventually led to variations in quality of services delivered to and demanded by black

consumers.   Producers weigh costs and benefits to determine service delivery. Entrepreneurial physicians and

dentists are presented with incentives to maintain health at a minimum cost to maximize benefits for both

themselves and third parties. Minimal levels of health maintenance emerge from cost benefit analysis.

Inequalities attributable to social structure may precipitate a substandard minimum of health for African

Americans. (Gilbert et al 2008; Kornrich 2009; Lee 2000; McCall 2004).

The activation of stereotypes may be one way in which physicians arrive at decisions about the

allocation of services. Physicians do not operate in a separate bubble outside American society with a long

history of cultural racism. Based on an Institute of Medicine report in 2003, approximately 70% of physicians

hold biases against African Americans. Biases tend to be enacted in situations characterized by time pressure,

anxiety, cognitive overload, quick decision-making, complexity and fatigue. Many of these characteristics

often occur in the contexts of doctor-patient interactions of dental appointments. Physicians use group

characteristics when treating a patient and these broad assumptions are problematic and counterproductive to

the maintenance of individual health (van Ryn 2003). For example, in a study on heart medication, researchers found that physicians associate drug effectiveness with race as a social, not biological, characteristic. Doctors in the study who served blacks were more likely to prescribe one drug over the other, and this decision was informed by beliefs about differential drug effects by race. On the other hand, empirical evidence supported that for both drugs effectiveness showed for more within group variation than between racial groups. Therefore, prescribing medication by race is a disservice compared to assessing individual patient profiles (Williams 2013a, b).

A sociology of work perspective can be brought together with work on health disparities by drawing attention to the relationship between occupational practices and oral health. For example, research in occupational geography and spatialization has shown that dental care providers have an increased concentration in affluent communities, which also tend to be areas where preventative care is not needed the most. Some researchers refer to dental care providers in affluent areas as offices of caries prevention care, largely because competition among dentists in affluent areas subsequently leads to less tooth decay. Therefore, services such as fluoride treatments and sealants are marketed to the affluent—that is, to those least in need of preventative intervention. Research in residential segregation conveys that affluent and suburban areas are generally predominantly white (Gilbert et al 2008; Grembowski et al 2007; Riley et al 2010). In contrast, the lower concentration of dental providers in low-income neighborhoods is reflected in lower levels of preventative care; in effect, these neighborhoods become social spaces akin to food deserts.

Rationing of services is also common among providers with less than ideal patient bases. Tooth extractions and root canals are both services provided to treat tooth decay. The first requires the removal of the tooth, is cheaper, and is less time consuming. On the contrary, root canals are a more costly procedure and save the tooth from extraction. Tooth extractions may directly contribute to poorer oral health. Tooth loss not resulting from injury or accident is commonly used as an indicator of poor oral health and tooth decay in data collection.

Gilbert and colleagues (2002, 2003, 2006, 2008) find that the number of tooth extractions is positively correlated with higher proportions of black patient bases for dental care providers. Moreover, patients within practices with high proportions of African American patients are more likely to experience a tooth extraction regardless of the patients' race. They also find a positive association between race (black) and tooth extraction regardless of income. Blacks also report that they are less likely to have an alternative presented to them before extraction takes place. In terms of root canals, blacks are less likely to receive and be offered this service (Gilbert et al 2006, 2008; Tilashalski et al 2007). African Americans are less likely to receive preventative procedures (such as fluoride treatments and sealants) and are at higher risks of experiencing tooth extraction without discussion of possible alternatives (Gilbert et al 2003, 2008). Moreover, blacks are less likely to be granted appointments with dentists, and they wait significantly greater periods to schedule appointments and in waiting rooms at dental offices. Additionally, African Americans are also more likely to be seen by hygienists and other secondary medical professionals (Gilbert et al 2008; Grembowski et al 2010; Grembowski and Milgrom 2007; Okunseri et al 2007). Oral cancer has higher prevalence and incidence rates for African Americans, and black men have greater risks of incidence and mortality from cancers of the mouth and throat relative to other women and other racial groups (Shiboski et al 2007).

Another aspect of the sociology of work involves technological differences among workplaces. This new area has not been studied in the dental health disparities literature. One potentially important disparity in dental health technology is the quality of x-ray equipment. New, digital equipment offers the benefit of clearer imaging and lower radiation dose. Digital equipment has less than 1/3 the exposure of traditional film x-rays. Collimation (round, which scatters x-rays, versus rectangular, which restricts the x-ray spread to a smaller region of the head) is also an important factor, as is the speed of the film when film x-rays are used. Thus, there is a range of x-ray exposure based on collimation, film speed, and film versus digital technology.

Susan Preston-Martin of the University of Southern California and several colleagues were among the first to address the potential elevated cancers risk that may result from dental radiography. In a series of studies

in the 1980s, she analyzed the link between occurrence of cancers and diagnostic dental x-rays. In samples of Los Angeles men and women, dental diagnostic x-rays did show some association with meningiomas. The association was strongest with full mouth series x-rays and when diagnostic X-rays were performed during childhood. The age of the equipment is repeatedly underscored as important in the association between cancer risks and dental x-rays (Preston-Martin et al 1980; Preston-Martin et al 1988). They also found that five or more full mouth series before the year 1945 was directly associated with meningiomas for men in Los Angeles County (Preston-Martin et al. 1983). Similarly, for women, full mouth series before 1960 posed as risk factors for both meningiomas and cancer of the parotid glands. Associations were commonly found to be dose related and increased the risk of both malignant and benign tumors (Preston-Martin et al 1988; Preston-Martin et al 1985).

A related body of research focused on health risks associated with radiation exposure for health-care workers. In the period from 1950 to 1980, Chinese medical x-ray workers had a 50% higher risk of developing breast, skin, and thyroid cancers and leukemia than other medical specialists had in China (Wang et al 1988). Subsequent research provided further evidence of elevated cancer risks to dental professionals. For example, Wingren et al (1997) found a significant increased risk of cancer for dentists and dental assistants. Gender may act as an additional contributor to cancer risk. One Swedish case-control study showed that women who worked as dentists and dental assistants had elevated levels of risks for certain cancers. While later research does not necessarily contradict the previous findings, some scholars find that increased cancer risks are largely dependent on time spent in the occupation and the age of the equipment used (Wingren et al 1995; Zabel et al 2006).

Following the 1980s, several studies either supported or challenged the association between cancer risks and dental diagnostic x-rays. Neuberger et al (1991) found that dental x-rays reported by patients were significantly associated with the occurrence of brain cancer. Ryan et al (1992) found an association with meningiomas and dental full mouth radiography and panorex. Both Wingren et al (1993, 1997) and Hallquist

(1993, 1994) found increased risks of thyroid cancer associated with dental x-rays. On the contrary, other studies did not find such correlation between dental x-rays (Rodvall et al 1998; Inskip et al 1995). In one study, increased cancer risks were not even associated with radiation exposure for dental personnel who had consistent exposure to dental x-ray radiation (Eklund et al 1990).

Recent studies still suggest potential biologic harm from the stochastic effects of radiation exposure, and they continue to find associations between dental diagnostic x-rays and meningiomas. Moreover, associations have been found between cancer risks and bitewing x-rays in addition to the panoramic and full mouth x-rays, which showed causal effects in the decades before the 21st century (Brooks 2008; Longstreth et al 2004). Research in the 2000s continued to find significant and positive associations between dental x-rays of cancer risks of the thyroid (Memon 2010). Research on the links between dental x-rays and thyroid cancer is still in its nascent stage, and some research cast the association between dental radiography and risk to thyroid in a questionable light. For example, Buch et al (2009) found that only very low doses of radiation are transmitted to the thyroid as a result of panorex x-rays. Interestingly enough, the same study found that dental x-rays transmit radiation to the uterus. This finding corresponds with earlier research indicating a correlation between low birth weight infants and dental radiography (Hujoel et al 2004).

The American Dental Association considers film x-ray equipment not in best practice for use in dentistry. However, the dental industry—which is not as regulated as other fields of medicine—has no authority that forces dental care providers to transition to new x-ray technologies. A potential digital divide in x-ray equipment has implications beyond that of dental health. Research on the presence of film equipment within current practices is sparse, if not nonexistent.

1.3 Social Class and Oral Health

Within sociology, class is commonly referred operationalized as a variable of socioeconomic status (SES; Williams and Collins 1995; Williams and Sternthal 2011). Individuals near the lower rungs of society have less access to resources, which have implications on health outcomes throughout the life course. The influence of social structure and oral health is consistent with the literature of its influence on other health outcomes. Higher SES is correlated with better oral health outcomes.

Low SES poses structural hazards that can influence behaviors associated with dental health. Poor health behaviors correlated with poor dental and oral health are commonly associated with socially disadvantaged groups of people. For example, poor diet, smoking, underutilization of dental services, and infrequent brushing are more prevalent within lower SES positions. Additionally, dental care practices of parents are strongly associated with children's health-seeking behaviors, and this relationship exists even when accounting for insurance status (SOURCE). Transfer of parental health behaviors is one mechanism by which dental decay and poor oral health contribute to the cyclical and intergenerational determinants of health for people of low SES. Numerous studies conducted in industrialized countries find that individuals of low SES utilize medical services significantly less than more advantaged individuals (Guillen 1991; Hjern and Grindefjord 2000; Hudson et al 2007). Additionally, individuals with low SES have significantly higher probabilities of never having visited a dentist at all. The lower rates of utilization within disadvantaged population do not coincide with need. For African-American low SES patients, especially, distrust may underlie some of the difference in utilization rates (Chen and Land 1986; Choi 2011; Gilbert et al 2002, 2003; Kaylor et al 2010; Tilashalski et al 2007; Williams et al 2008;)

Presently, race in the U.S. continues to be closely intertwined with SES. African Americans are less likely to be able to pay for dental-care bills. On average, African Americans have less income, less wealth, less education, and fewer forms of other financial and social resources than white Americans typically have. In a study that oversampled Medicaid enrollees, SES completely explained the relationship between poor oral health and race for African American and Mexican American elementary age children (Pourat and Finocchio 2010).

Another found that SES explains up to 71% of the variation in oral health outcomes among black, white and

Hispanic children (Guarnizo-Herreno and Wehby 2007). Conversely, in studies of older populations, such as

the one conducted by Wu and his colleagues (2011), measures of income did not explain much of the variation

in oral health within elderly populations, but race still had a significant and negative effect on oral health and

dental outcomes.

Using income as a measure of SES can be problematic when researching group differences in both

physical and mental health. In addition to nonresponse bias, reverse causation may explain differences in health

and income between blacks and whites. Moreover, in a review of research on health disparities, Williams and

Collins (1995) found that income is a volatile measure, and income's effect on households is dependent on a

variety of factors. These factors include resources such as wealth and other means by which individuals can

generate funds in times of need. Blacks and whites at similar income levels are likely to have substantial

differences in wealth. Based on Pew Research Center (2010) statistics, this gap has increased between the years

of 2005-2009. Additionally, the debate between relative income and absolute income confounds the problem

associated with using income as measure of SES (Wilkinson 2008).

Current research in dentistry divides common services provided by dentists and other specialize into

three levels: primary, secondary, and tertiary preventions. Primary prevention is commonly the focus of most

research on oral health. These methods are primarily done outside of the dental care provider's office. These

factors have both public dimensions, such as the contributions of fluoridated water and meso- and micro factors

attributed to social structures and personal habits. Some primary prevention is performed in office, such as

fluoride treatments, sealant application, and general cleanings.

Secondary treatment is the most common type of prevention practiced by dental care providers.

Secondary preventions are designed to screen for and detect disease early. Secondary preventions also mitigate

the progression of disease or the onset of others. Lastly, tertiary prevention involves treatments such as for

periodontal disease or restoring and replacing teeth. In this study, I will examine the effects of race and other

variables on types of treatments that fall within all three categories.

2.0 DATA AND METHODS

Silversin and Coombs (1981) describe three mechanisms by which institutions shape individual level

variation in preventative dental care: predisposing characteristics, enabling factors, and reinforcing factors.

These three mechanisms will help inform my selection of variables and will aid in their description.

Predisposing characteristics are social characteristics, generally immutable to the individuals. Examples of

predisposing characteristics are race, gender, age, and in adult samples, education. These factors predispose an

individual to certain social relationships. Enabling factors create opportunities for individuals, and include

common proxies of SES, such as income and wealth. Finally, reinforcing factors are external to the individual

and describe the strength and dynamic of social relationships with others.

The phenomenon of stereotype bias has not been explicitly explored in relation to the allocation of

dental services. What may be especially problematic is if certain types of preventions are targeted to certain

groups based on the superficial characteristics of race and perceived class. Moreover, if physicians both

consciously and unconsciously differentiate races by procedure, dental providers may be directly contributing to

poorer health outcomes for African Americans and other socially disadvantaged groups. The following

hypotheses aim to measure the elusive concept of stereotype activation, primarily activated by the predisposing

characteristic of race. By including such measures as the presence of infection as controls, I hope to capture a

broader underlying social sentiment that leads to differences in services.

2.1 Preliminary Mail Survey

The smaller data set used in this analysis was a preliminary mail survey. A written, mail survey was

sent to all dentists practicing in Davidson County, estimated at 315. Situating the sample within Tennessee was

of general interest, because Tennessee is one of six states that do not provide any dental reimbursement of individuals above age 21 who are ineligible for Medicare.

The survey contained approximately 25 questions on three pages and took 5-10 minutes to answer. The survey was piloted with a dental faculty member from Meharry College, and IRB approval was obtained. To ensure that some of the dentists in the sample were minority dentists, we oversampled from that population in the county, and all identifiers were destroyed. The scope of the project was limited and exploratory; therefore, only one round of mail-out surveys was conducted, but there was a follow-up fax to non-responders. Our goal was to receive a minimum of 50 responses; we received only 41 respondents that were complete cases. Of these respondents, about a third of the dentists identified as black or African American. The data gathered from this survey yielded interesting preliminary information, but they were too small for multivariate analysis. Instead, I present descriptive statistics and some bivariate analyses.

2.1.1 Variables

The first group of variables in the preliminary mail survey was patient demographics: race, age of patients, number of patients in practice, class of patients, number of patients with dental insurance. The second group was practice demographics: size, frequency of patient visits per year, number of different types of treatment, practitioner race/ethnicity, practitioner gender, staff social and professional demographics, and revenue. I also gathered information on x-ray machine type (digital versus film) and other information on x-ray machine characteristics and the frequency of x-rays.

The outcome variable is the presence of film x-ray equipment. The first independent variable for was race of the patient composition of participating dentists. Dentists were asked to specify racial composition, for example, by estimating the percentage of black patients served. Estimated percentages of black patients and estimated percentage of white patients formed the two race used in the following analyses. Race of dentist was also reported and used for descriptive purposes.

The second independent variable, class of the patients, was broken down into two groups: poor and working class, and middle and upper class. The focus on class used in analysis with the Davidson County survey addresses the perception of the patients' class by the dentist. Dentists were asked to specify the percentage of patients they believed were poor, working class, middle class, and wealthy[1]. These four categories of social class stratification each formed their own variable. I combined poor and working class to create the lower status variable used in the following description and analyses.

2.1.2 Hypotheses

My central research question in this preliminary study was based on the goal of breaking new ground in the study of oral health disparities by determining if there was any preliminary evidence in support of the hypothesis that there is a "digital divide" in dental radiography equipment based on race and class. Thus, two hypotheses were tested:

Hypothesis 1: Providers who serve African American patients at proportions higher than the mean will be more likely to use film equipment when compared to providers with lower proportions of black patients.

Hypothesis 2: Providers who serve low status patients at proportions higher than the mean will be more likely to use film equipment when compared to providers who serve lower proportions of low status patients.

2.2 The Medical Expenditure Panel Survey Analysis

The second study was based on the Medical Expenditure Panel Survey, a panel survey conducted each year by the Agency of Healthcare Research and Quality. Every year, a new panel is selected and participants are followed for two years. Over this period, data are collected from participants five times. The MEPS is a subsample of respondents from the National Health Interview Survey (NHIS). Data are collected from in-person interviews using computer assisted personal interviews (CAPI). Because my analysis is cross-sectional, I use data collected for 2010, which includes individuals from panels 14 (2009-2010) and 15 (2010-2011).

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[1] See Appendix 1 for the exact phrasing of the perceived SES question.

Respondents in panels 14 and 15 were interviewed and screened in 2010. Using the MEPS data set, logistic regressions were performed to determine associations between certain social characteristics and treatment outcomes recorded in dental events. These are some of the same outcomes that scholars in using data from California and Florida found associations with race and class.

2.2.1 Variables

The dependent variables for the MEPS study were extractions, root canals, sealants, fluoride treatments, the likelihood of seeing a dentist, and the likelihood of seeing a hygienist were dichotomized to make inference to the odds associated with a dental outcome. Again, race and class were the independent variables. For analysis using this dataset, race is given in the household component of the survey, and it represents the race of the participant associated with the dental event. Blacks and whites were the only racial group comparison in the logistic regressions that follow.

Income inequality between the rich and poor has steadily increased since the 1970s, whereas absolute income during this time period may have increased for poorer populations. Relative income may be a significant factor in racial disparities, and a simple income measure does not account for this phenomenon (Williams and Collins 1995, Schnittker and McLeod 2005). My review of the literature on dental health indicates that many scholars prefer to use poverty comparative level indicators as opposed to income. For example in a study by Hudson et al, to assess health behaviors and oral health outcomes a wave of the NHANES selects the poverty ratio indicator as a proxy for SES. For class, I choose to use categorical distinctions derived from the ratio of family income to poverty level. The categories were below poverty (poor),

near poverty/low income, middle income, and high income. Moreover, the category proxy for income is consistent with analysis of data from the Davidson county survey.[2]

Several other variables served as controls: education, insurance status, gender, age, and number of dental check-ups. Education is positively correlated with oral health across multiple studies, and it acts as a significant contributor to variations in both self-reported and actual oral health measures (Grembowski et al 2012). However, education measures are vulnerable to the same fallacies presented with income. Education is commonly measured in terms of years or by degree attainment. Research in social structure, physical health, and mental health consistently shows that education does not function equivalently for all groups. In other words, the value and quality of education received by black and whites may be too different to compare simply using a measure of years. At varying education levels, blacks are unemployed at higher rates and make less than whites of similar educational statuses are (Williams and Collin 1995). Education is measured in years of attainment at the first year that respondents enter the study.

Major medical insurance plans rarely include coverage for preventive dental services and care. Still, insurance is positively associated with better oral health. Disadvantaged populations are disproportionately uninsured or underinsured, and they tend to lack provisions for dental care even when they have medical coverage. Preventative and routine care associated with maintaining dental health is heavily dependent upon income and wealth, because dental care is typically associated with more out-of-pocket expenses. Moreover, dental coverage provides lower reimbursement allowance schedules than other medical procedures and treatments. (Robbins and Padavic 2007; Williams and Collins 1995; Williams and Jackson 2005).

In the household component section, respondents were asked to indicate whether they had medical insurance coverage for the year of 2010. I created a dummy variable to indicate whether respondents were

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[2] I did perform the analysis using the poverty level continuous measure as the purchasing power proxy. Since results were substantively no different, I chose to report the categorical effects to maintain internal consistency within descriptions of results and analysis.

insured in 2010 for use in this analysis. In the same section, MEPS includes a question about dental. Similar to the insurance measure, this variable was dummy coded to be included as a control in the analysis.

Gender and age are used as control variables because there are important interactions with race. In a study conducted by Kaylor and her colleagues (2010), forty percent of women within lower and middle class statuses lacked dental coverage as compared to twenty-six percent of higher-class individuals. Young African American women are at especially high risk for insufficient or lack of health insurance. In comparison to whites, blacks are less likely to work for employers who provide insurance coverage. African Americans are also less likely to have supplemental plans like dental coverage. As blacks climb the social ladder and move outside the qualifications for public health insurance, a positive and linear effect on health outcomes is not always likely.

The relationship between race and socialized health insurance also drives disparities in relation to health-care coverage. A high proportion of African Americans—relative to proportions of whites—qualify for public funding and receive publicly funded insurance coverage for both medical and dental services. Medicaid and supplemental state plans are unwieldy animals for a number of reasons. In the first place, dental Medicaid is chronically underfunded. Secondly, Medicaid payments have much lower reimbursement rates than out-of-pocket and privately insured dental rates. Additionally, providers have to wait significantly longer periods for Medicaid reimbursement as opposed to other forms of payment. Another caveat of the Medicaid and public insurance machines is that states have some rights in the allocations of funds. Moreover, some states have completely opted out of providing dental coverage for certain Medicaid recipients. The effects of dental Medicaid examined within the literature have yielded inconsistent findings. Some studies find positive correlations between coverage and seeking preventative care for both adults and children. Despite a correlation with increased visits, Fisher and Mascarenhas (2009) find that within a sample of Medicaid children, those insured had no better oral health than children eligible for Medicaid but not enrolled. Moreover, Medicaid

patients consistently present more dental decay and missing surfaces than individuals who do not receive public insurance (see also Casteneda et al 2010; US Department 2012).

In the dental screening section of MEPS, respondents were asked the amount in 2010 charged for dental expenses. Subsequent questions ask for the dollar amount paid by Medicare, Medicaid, out-of-pocket, private insurance and other sources for dental care. Indicators of percentage paid by Medicare, Medicaid, out-of-pocket, and private insurance are included as controls. These measures were calculated by dividing each payment entity by total expenses for the year.

Finally, I use the frequency of dental visits as a control variable, because much of the literature on dental disparities, as well as health disparities more broadly, finds a clear relationship between race and frequency of health care visits; and SES and the frequency of visits. This measure is a continuous variable in which respondents were asked about the frequency of dentist visits in 2010.

2.2.2 Hypotheses

My hypothesis for this study is that there are differences in dental workplace practices based on race and class, even when controlling for enabling and predisposing characteristics. This study breaks new ground because of the supply side approach instead of concentration on health behaviors associated with health disparities. For the next set of hypotheses, I will be looking at providers through encounters with patients. These encounters will be referred to as dental events. Dental events provide details into the types of services received by the patient at the time of observation.

In addition, previous studies have been focused on a single region or city. The MEPS allows a more comprehensive, national evaluation. Moreover, most studies on dental health use behavior models to explain differences in utilization and outcomes. I instead choose to explore the ways in which both predisposing and enabling characteristics influence service delivery.

My hypotheses are as follows:

Hypothesis 3a: A negative bivariate relationship will exist between primary level prevention performed during dental events and race. Again, the primary level preventions used are fluoride treatments, sealants, and cleanings. Thus, African Americans will be less likely to receive fluoride treatments, sealants, and cleanings during dental events.

Hypothesis 3b: The negative relationship between the receipt of primary level prevention is attributable mainly to the disproportionate representation of blacks/African Americans in lower and working classes; therefore the race effect will be explained away—or at least significantly reduced—when controlling for the social class (enabling resources) of the patient.

The effects of patient characteristics on secondary level prevention will not be as unidirectional as expected in primary level prevention. In other words, provider bias may influence the allocation of services by social or economic characteristics. For example, root canals and tooth extractions are two ways to deal with tooth decay. However, providers may be predisposed to offer one service over the other.

Hypothesis 4a: Based on bivariate statistics, blacks/African Americans will be more likely to experience a tooth extraction than whites.

Hypothesis 4b: When accounting for enabling resources, the relationship between tooth extractions and being black/African American will be explained away.

Hypothesis 4c: Conversely, when considering the bivariate relationship between root canals and race, black/African American patients will be less likely to experience a root canal during dental events when compared to white patients.

Hypothesis 4d: Again, when enabling resources associated with class are considered, the negative relationship between root canals and race will be explained away.

I predict that for x-ray screenings, patient characteristics will behave in the same way as predicted for primary level prevention. Therefore,

Hypothesis 4e: A negative bivariate association will exist between x-ray screening and race. Thus, African American patients will be less likely to receive x-ray screenings.

Hypothesis 4f: The association between x-ray screening and being black/African-Americans will be accounted for when considering the effects of enabling resources.

3.0 RESULTS

3.1 Preliminary Survey

Table 1: Descriptives for Davidson County Sample of Dentists

	Practices with **high** percentages of **black patients**	Practices with **low** percentages of **black patients**	Practices with **high** percentages of **lower status patients**	Practices with **low** percentages of **lower status patients**
	mean	**mean**	**mean**	**mean**
% using film x-ray equipment	50.00	25.93	57.89	13.64
% black patients	50.21	11.59	33.74	71.36
% white patients	35.07	74.63	49.26	17.05
% men	32.86	35.48	34.95	34.27
% women	47.00	42.89	43.26	45.18
% children	20.36	21.63	21.95	20.55
% poor	19.43	8.93	24.63	2.05
% working class	42.93	28.52	48.00	20.86
% middle class	28.26	34.74	18.89	44.32
% wealthy	9.36	17.11	8.05	20.00
% insured	59.93	66.44	61.08	63.14
% with black dentists	64.29	14.81	47.37	18.18
% with white dentists	21.43	59.26	36.84	54.55
% lower status patients	71.43	33.33	-------	-------
% high black patients	-------	-------	52.63	18.18
	N=14	N=27	N=19	N=22

based on reported statistics only

Table 1 presents the descriptive statistics for the main survey questions. The forty-one observations were broken up twice. First, dental practices were separated by their racial composition. The mean of black patients for the entire sample is approximately 24.78%. This percentage is fairly close to the Census's 2011 description of the black population in Davidson County, estimated at 27.90%. I created a dummy variable with the sample mean as the cut-off point. Practices that had higher than the mean percentages of black populations

are considered practices with high black patient bases. Likewise, dentists who reported lower than 24.78% are considered practices with low black patient bases.

Practices were grouped by the percentage of lower status patients served using the same process. The mean score for the lower class status variable for the entire sample is 49.97%. Dentists who reported serving higher than this percentage were considered practices with high lower status patients and vice versa.

A dummy variable was also created for dentists who had a majority black patient base. For practices/dentists with high black patient bases, 42.86% reported a patient base of greater than fifty percent African American. For practices with high percentages of lower status patients, 26.31% reported serving predominantly black patients, whereas only 4.55% of practices with low percentages of lower status patients report serving a majority black clientele.

One of the first analyses performed was a one-tailed t-test to compare the likelihood of being served by a dentist with film equipment based on patient composition. The t-test is used to detect differences in means of black and white patients served between dentists who use film equipment and those who do not. When considering the percentage of reported black patients, the t-test statistic indicates a higher mean percentage of African Americans for dentists using film equipment than dentists using digital equipment. The mean percentage of African American patients for practices using film equipment is 33.86%. For practices with digital equipment, the percentage of black patients is 20.07%. The difference of 13.78% is significant (p=.0361). A higher mean percentage of African Americans see dentists who use film equipment than those who see dentists with digital equipment. Similarly, a difference is observed in the percentage of white patients within practices that use film or digital equipment. However, the relationship is reversed. Results indicate that a significantly smaller percentage of whites frequent practices that use film (mean of 50.07%) than the percentage in practices with digital equipment (mean of 66.85%). The p-value associated with this one-tailed t-test is .025.

Chi-square tests of significance were used to ascertain the potential relationship between certain characteristics of dental care providers and the likelihood of a practice using film. Categories are identical to those used in the descriptive table. The chi-square test comparing practices with high percentages of black patients and film equipment does not yield significant results. However, the relationship between lower status patients and the presence of film equipment tells a different story. This chi-square statistic does yield significant results, which indicates that not all individuals have equal exposure to film equipment when accounting for class measures. (See Table 1a.) The chi-squared statistic for this test is 8.881 (p=.003). Thus, poorer patients may be more likely to have higher levels of exposure to older, film-based technology.

Table 2.
Chi Square Difference Test of Low Status Patients and Film X-Ray

	No Film X-ray Equipment	Film X-ray Equipment
Practices with low percentages of lower status patients	19	3
Practices with high percentages of lower status patients	8	11

$\chi^2 = 8.881$ p=.003

Table 3.

Bivariate Associations (Pearson's r correlations) with Race

(African American/Black=1)

	r
Primary Prevention	
Cleaning	-.019 **
Fluoride	-.001
Sealants	.013
Secondary Prevention	
Extractions	.073 ***
Root Canals	-.009
X-ray screenings	-.004
Controls of Interest	
Income Category	-.168 ***
Education	-.053 ***
Married	-.125 ***
Insurance	.010
Dental Insurance	-.019 **
Number of Check-ups	.045 ***
Dentist Seen (Yes=1)	-.019 **
Percentage paid by Medicaid	.177 ***
Percentage paid by Medicare	-.006
Percentage paid by Self/Family	-.124 ***
Percentage paid by Private Ins.	-.056 ***

$p<.05*$ $p<.01**$ $p<.001***$

Table 4.

Incidence Rates for Primary and Secondary Prevention (Dependent Variables)

	Percentage of Sample (*Number of Observants*)
Primary Level Prevention	
Sealants	1.56%
	(*312*)
Fluoride	7.63%
	(*1529*)
Cleaning	51.68%
	(*10358*)
X-ray screening	26.64%
	(*5340*)
Secondary Level Prevention	
Extractions	5.51%
	(*1104*)
Root Canals	2.49%
	(*500*)

3.2 Medical Expenditure Panel Survey Analysis

Table 2 lists the bivariate associations between the prevention types and race. In line with the literature review, negative associations between being black and both primary and secondary prevention emerge. Cleanings and extractions are negatively associated with the status of African American, and initially other procedures do not demonstrate a significant relationship with race. Importantly, I do observe commonly documented relationships among proxies of SES and race; mechanisms that serve to differentiate individuals in

terms of health care[3]. Logistic regression techniques are used to unpack the possible pathways by which the

social status of race influences the delivery of dental care procedures.

Table 5.
Logistic Regression Point Estimate Results for
Fluoride (N=20,044)

Variable/Effect	PE	SE
Predisposing Characteristics		
Black or African American	-.201 *	-.078
Female	-.069	.056
Age	-.031 ***	.003
Education (measured in years)	-.060 ***	.008
Married	-.010	.089
Enabling Characteristics/Resources		
Income Category	.002	.027
Insurance	.279 *	.121
Dental Insurance	-.097	.073
Percentage covered by Medicare	-.370	.791
Percentage covered by Medicaid	-.582 *	.236
Percentage covered by Self/Family	-.274 *	.133
Percentage covered by Private Ins.	.005	.131
Utilization and Treatment		
Number of Dental Visits	-.501 ***	.065
Treatment of Abscess or Infection	-12.255	164.800
Dentist Seen (Yes=1)	2.121 ***	.122
Intercept	-2.197	

PE=Point Estimate
SE=Standard Error
p<.05* p<.01** p<.001***

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[3] Refer to Appendix 2 Table 17 for correlations between independent and control variables.

Table 6.
Logistic Regression Point Estimate Results for
X-rays (N=20,044)

Variable/Effect	PE	SE
Predisposing Characteristics		
Black or African American	-.121 **	.135
Female	-.034	.095
Age	-.006 ***	.003
Education (measured in years)	.007	.016
Married	.055	.102
Enabling Characteristics/Resources		
Income Category	-.014	.043
Insurance	-.054	.153
Dental Insurance	-.071	.117
Percentage covered by Medicare	.252	1.023
Percentage covered by Medicaid	.273	.465
Percentage covered by Self/Family	-.166 *	.205
Percentage covered by Private Ins.	.217 **	.225
Utilization and Treatment		
Number of Dental Visits	.005	.064
Treatment of Abscess or Infection	-.647 **	.224
Dentist Seen (Yes=1)	1.628 ***	.060
Intercept	-2.149	

PE=Point Estimate
SE=Standard Error
p<.05 p<.01** p<.001***

Significant relationships with race did emerge in multivariate analysis that did not exist in the previous bivariate associations. These procedures are fluoride treatments and x-ray screening. Race continues to be salient in predicting the likelihood of tooth extractions and cleanings. Only two of the prevention methods showed no multivariate relationship to race. Race does not appear to be a significant predictor of either the likelihood of root canals or sealants experienced during a dental event.

For primary preventative treatments, the status of being black significantly decreases the likelihood of experiencing x-rays and fluoride treatments. For x-rays, blacks are about 12% less likely to experience x-ray

screening at dental events when compared to white patients. Similarly, for fluoride treatments, African

Americans have decreased likelihood of receiving fluoride treatments when compared to whites (b=-.201

SE=.078). Disparities in primary prevention are troubling because these procedures aim to prevent tooth decay

rather than treat disease after dental health problems exist.

Table 7.
Logistic Regression Point Estimate Results for
Tooth Extractions (N=20,044)

Variable/Effect	PE	SE
Predisposing Characteristics		
Black or African American	.602 ***	.076
Female	-.135 *	.065
Age	.010 ***	.002
Education (measured in years)	-.014	.009
Married	-.126	.078
Enabling Characteristics/Resources		
Income Category	-.202 ***	.027
Insurance	-.378 ***	.100
Dental Insurance	.165	.089
Percentage covered by Medicare	-.148	.448
Percentage covered by Medicaid	.370	.257
Percentage covered by Self/Family	.210	.134
Percentage covered by Private Ins.	-.167	.155
Utilization and Treatment		
Number of Dental Visits	.730 ***	.037
Treatment of Abscess or Infection	-.271	.308
Dentist Seen (Yes=1)	-.200 *	.080
Intercept	-3.132	

PE=Point Estimate
SE=Standard Error
p<.05 p<.01** p<.001***

Table 8.
Logistic Regression Point Estimate Results for
Cleaning (N=20,044)

Variable/Effect	PE	SE
Predisposing Characteristics		
Black or African American	-.098 *	.043
Female	-.052	.031
Age	-.005 ***	.001
Education (measured in years)	.000	.005
Married	.195 ***	.038
Enabling Characteristics/Resources		
Income Category	.010	.014
Insurance	-.001	.059
Dental Insurance	-.252 ***	.039
Percentage covered by Medicare	.642 **	.224
Percentage covered by Medicaid	.470 ***	.136
Percentage covered by Self/Family	-.058	.068
Percentage covered by Private Ins.	.909 ***	.072
Utilization and Treatment		
Number of Dental Visits	-.533 ***	.026
Treatment of Abscess or Infection	-2.564 ***	.332
Dentist Seen (Yes=1)	1.592 ***	.042
Intercept	-.637	

PE=Point Estimate
SE=Standard Error
p<.05 p<.01** p<.001***

Recall the discussion of tooth extractions in the literature review, because it is important to remember

that this procedure is peculiar in its repercussions. Tooth extractions, a secondary preventative procedure, can

directly contribute to poorer oral health. Extractions are an inexpensive way to deal with tooth decay; however,

loss of teeth not due to injury or accident is an indicator commonly used in measures of poor oral health. Using

a nationally representative survey and consistent with the evidence from studies conducted in Florida and

California (Gilbert et al 2006), I too find that African Americans are at greater risk for experiencing tooth

extractions in comparison to whites. Interestingly the relationship between race and tooth extractions exists

despite the salience of class in the prediction of tooth extractions. Therefore, despite the protective features of upward mobility, being black still exposes one to a greater risk of tooth extractions during dental events (b=.-601 SE=.076). Moreover, this relationship exists despite controlling for the presence (and treatment) of infections/abscess. The aforementioned indicates that severe gum disease does not explain the increase in likelihood of extraction for black patients.

Next, I performed logistic regressions to test whether SES (or class) moderates the relationship between prevention procedures and race. This set of testing was conducted to understand better the various ways in which class influences the effects of race on dental procedures. Moderation effects were tested for all of the primary and secondary preventative techniques.

Tables 12 through 16 found in the second appendix list the results of moderation analyses for procedures with insignificant interaction terms. Interestingly, for only one procedure is the interaction of race and class significant. This procedure was x-ray screening and table 9 shows these results. The interaction effect is graphed in Figure 2. This graph quickly reaffirms both bivariate and multivariate findings that blacks receive fewer x-rays at dental event than do whites. This trend holds for individuals at both low and high income levels. For both blacks and whites, social mobility is positively associated with more x-rays. For African Americans, the slope is steeper; thus, for African Americans the likelihood of receiving an x-ray increases at a faster rate as they climb the social ladder when compared to their white counterparts.

Table 9.
Logistic Regression Results for X-ray screenings
with interaction of race and class category

	PE	SE
Predisposing Characteristics		
Black	-.343 **	.115
Female	-.033	.033
Age	-.006 ***	.001
Education (measured in years)	.008	.005
Married (Yes=1)	.056	.041
Enabling Characteristics/Resources		
Income Class/Poverty Category	-.025	.017
Insured	-.053	.063
Dental Insurance	-.073	.042
Percent covered by Medicaire	.254	.250
Percent covered by Medicaid	.300 *	.148
Percent covered by Self or Family (out-of-pocket)		
	-.164 *	.075
Percent covered by Private Insurance	.220 **	.078
Utilization and Treatment		
Number of Dental Checkups	.003	.027
Dentist Seen	1.628	.060
Abscess Presence of Infection	-.644 **	.227
Interaction of Race and Class	.065 *	.031
Intercept	-2.110	

PE=Point Estimate
SE=Standard Error
p<.05 p<.01** p<.001****

This finding may be complicated by the differences in equipment used by dental care providers. In relation to the Davidson county study, since both blacks and whites of lower status receive less x-rays, they may be more likely to be exposed to film equipment also. Recall that in the preliminary Davidson county study, I find a positive association between those of lower status and the probability of exposure to film equipment. Therefore, the disadvantaged are more likely to receive x-rays are of lower quality and with less diagnostic

power. Moreover, if race is in fact a predictor in the type of x-ray equipment used, both high income and poorer

blacks may be at higher risk of film x-rays.

Figure 1. Graph of Interaction between race and class for x-ray screening
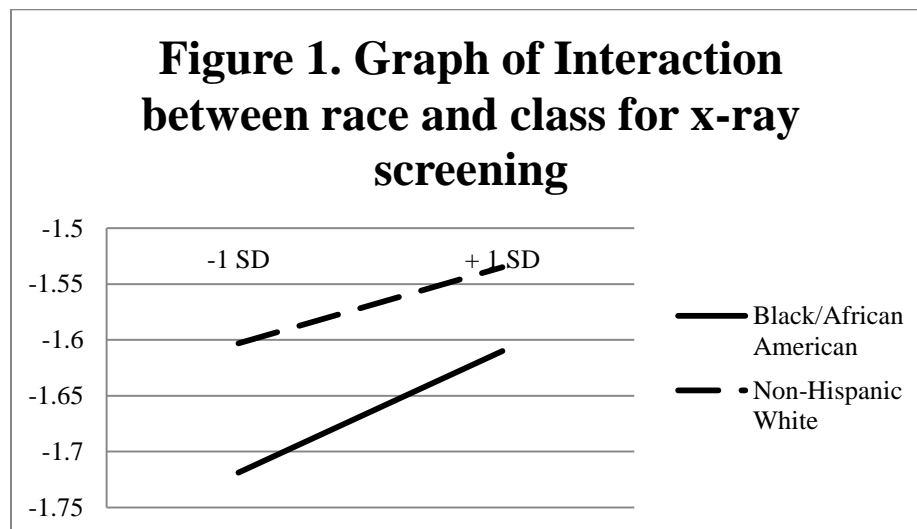
4.0 DISCUSSION

The initial chi-square test reveals no association between race and the presence of film x-ray equipment; therefore, I do not find support for the first hypothesis. However, the sample is small and cannot be presumed representative. Further exploration is needed in this area of dental care.

Hypothesis 2 is supported by the evidence presented. This preliminary Davidson county study indicates that there may be an association between class status and the presence of film equipment. This finding alludes to the existence of a digital divide by class. Since African American and other minority patients tend to be overrepresented within lower statuses, this divide may be complicated by other social characteristics such as race of the patient, and perhaps even race of the provider.

A bit surprisingly, only one method of primary prevention shows a correlation with race. Therefore, there is only partial support for hypothesis 3a. Black patients are less likely to receive cleanings at dental

events. Since cleanings ward off infection and disease, this decreased tendency may have important implications for understanding oral health disparities between blacks and whites.

Since neither fluoride nor sealants show a direct bivariate relationship to race, hypothesis 3b can be tested for dental cleanings only. In the logistic regression for cleanings, the effect of race is no longer significant. Moreover, the class variable is not significant, but other enabling factors such as dental insurance and the percentage of the dental event covered by Medicaid are important predictors in the occurrence of cleanings. Therefore, hypothesis 3b is partially supported. Interestingly, the direction of association for both dental insurance and percentage covered by Medicaid are not intuitive. Dental insurance is negatively related to dental cleanings while the amount of Medicaid coverage is positively associated with this procedure. It appears that cleanings may not be associated with characteristics associated with higher statuses.

Although 3b could not be tested directly, I regressed both fluoride treatments and sealants on the race and control variables. Interestingly, in the regression analysis race did emerge as a significant predictor for fluoride treatments, considering both predisposing and enabling controls.

Hypothesis 4a is supported. According to the statistics provided in Table 2, race does have a bivariate relationship with tooth extractions in the direction speculated. This finding is consistent with what other researchers have found using both regional and large scale samples. African American patients are more likely to experience a tooth extraction than are white patients. Additionally, I find partial support for hypothesis 4b in that enabling resources do not completely eradicate the greater tendency for African Americans to experience tooth extractions. Instead, enabling resources such as income category and insurance status may lessen the effect that being black has on experiencing tooth extractions at dental events.

I do not find support for Hypothesis 4c. Black patients are neither more nor less likely to receive root canals when compared to whites. However, it is important to note other correlations that may speak to a potential disparity in the delivery of root canals. Consistent with the literature, the correlation between class status (and economic resources) and root canals is observed. Individuals of higher statuses are more likely to

experience a root canal than their counterparts are. African Americans are less likely to be represented within the upper categories of SES. To unpack this relationship further, logistic regression analysis still proved to be a helpful tool. Still, no race effect emerged.

Hypothesis 4e is not supported by the evidence provided here. Initially, race does not act as a predictor for x-ray screening in the bivariate analysis. Although I cannot test Hypothesis 4f directly—because of the lack of bivariate association—I performed a logistic regression analysis to ascertain important factors in the prediction of x-ray screenings. Of the predisposing characteristics, race and age are salient. Both have negative relationships with this secondary prevention method. The only economic resources that show association with x-ray screenings are the percentage paid out-of-pocket and the percentage of the dental event paid by private insurance. Greater out-of-pocket expenses are associated with a decrease in the likelihood of x-ray. Conversely, private insurance increases the likelihood of x-ray screenings. Thus, x-ray screenings, similar to other dental services, may be afforded to those of higher status more frequently than the individuals of lower status most in need of the procedure.

Additionally, the interaction effect between race and class for x-ray screenings explained in the results section show that blacks are less likely to receive x-rays at all income levels when compared to white patients. Even the most socially disadvantaged white patient is more likely to receive an x-ray than a higher status black patient living above the mean for class/SES indicators. The interactions between social statuses and the mechanisms by which x-rays are delivered to patient population, i.e. x-ray quality and type, still needs further exploration.

5.0 CONCLUSION

This study extends the existing literature on oral health disparities in several ways. First, the study links the analysis of oral health disparities to the sociology of work. It points to the underlying cultural scripts that

may influence physician perception of patients. The MEPS data analysis shows a relationship between tooth extractions, root canals, and race that is consistent with argument that differences in standards of care are directly contributing to oral health disparities between blacks and whites at all age levels. Thus, whereas much of the existing literature on oral health disparities focuses on rates of tooth decay in relationship to race and class, this project suggests disparities in the types of practices offered. It is consistent with the view that black patients may have higher levels of tooth extractions. The analysis of the MEPS data set also shows that the frequency of X-rays among black patients is lower than that among white patients. Moreover, this relationship exists at all levels of SES (or class).

The current MEPS data set does not provide any information on another potential health disparity: a digital divide in the quality of X-ray equipment offered to black and white patients. My preliminary data set suggests that there may be a higher level of more recent, higher-quality digital X-ray machines among practices oriented toward more affluent and more white patient bases. Because digital X-ray machines present lower X-ray doses and higher quality of images, there is some potential that a previously unrecognized health disparity might have been identified. Future research would have to determine if these preliminary patterns hold up in larger samples. The previous results can be viewed as intuitive since digital equipment is likely more costly than older x-ray equipment that uses film. This relationship suggests that practices serving large percentages of low-income, and perhaps minority populations may need subsidization to bring radiographic equipment up to the standards now available for many white, middle-class practices.

The sociology of work could also inform further exploration into differentiations in dental care experiences. Policy interventions often push black physicians into the public service. Just as Du Bois (1903) spoke of the talented tenth's obligations to the black poor class, policies attracting African Americans to medicine have also adopted such a focus. Black physicians are recruited into the public sector as a means of correcting "their own problems" (Kornrich 2009). Not surprisingly, evidence indicates that black doctors are more reliant than white doctors are on Medicare and Medicaid payments. In addition, blacks who choose to

enter the private sector face more challenges than their white counterparts' experiences. Black physicians and dentists generally have fewer resources for success within the private realm, and they face discrimination by more affluent white customers. Many sociologists who study work within the service sector agree that black consumers feel most comfortable in black establishments. Rapport between providers and patients of similar race tends to be higher. Thus, blacks may be more likely to seek out black caregivers (Gutek et al 2010; Kornrich 2009; Lee 2000; McCall 2004).

Differences in the work practices of black and white dentists therefore may be associated with differences in the type of dental remediation that is offered to patients (extraction versus root canal, frequency of diagnostic radiation, and type of diagnostic equipment). The study of oral health disparities would benefit from an expanded perspective that focuses on outcome variables other than oral health measures such as tooth decay or cancer. Instead, there are important potential disparities in the health-care practices and technologies that warrant further investigation.

PATIENT DEMOGRAPHICS

What percentage/proportion of your patient population would you consider to be in the following racial or ethnic categories?(Based on your general knowledge of your patients, please write in a rough guess of the percentages, such as 20 percent African American and 60 percent white/Caucasian.)
___ White (Caucasian) Non-Hispanic   ___ African American or Black
___ Hispanic (both white and non-White)   ___ Asian American
___ Other

Do you run any advertising that targets low-income and minority populations (such as newspapers, radio, etc. in Spanish or for African-American patients)?
____Yes   ____ No

Approximately what percentage of your patients are the following:
____ Adult men   ____ Adult women   ____ Children and adolescents

What is the average age of your clients/patients? (Please write a number value)
_____

About how many patients are in your practice? (Please write a number value)
_____ My own patients   _____Total practice with partners

What percentages of your adult patient population, by your estimate, fall within each category? (Please write in a rough percentage.)
____ Very poor, contingent jobs or unemployed
____ Working class (high-school education, secretarial, blue-collar, farming)
____ College-educated, middle class (e.g., management, teachers)
____ Wealthy professionals (doctors, lawyers, professors, business executives)

Roughly, what percentage of your patients carries dental insurance? (Please write in an approximate percentage)
_____

If your patients do carry insurance, what percent approximately use the following types of insurance?
_____PPO   _____HMO   _____TennCare/public coverage
[PLEASE GO ON TO THE NEXT PAGE]
By your best guess, on average, how far do your clients travel from their home to your/the practice? (Please check one)
____less than 1 mile   ____less than 5 miles   ____between 5 and 10 miles
____between 10 and 15 miles   ____between 15 and 20 miles____more than 20 miles

TECHNOLOGY
If you know the name and model of your primary x-ray machine, would you list it here?

_____

What year did you buy your x-ray machine?
(Please enter the approximate date)

_____

Does your x-ray machine use: (Please check one)
____ digital
____ film

If film, do you use (Check one):
___ F-speed   ___ D-speed   ___ Other   ___ Don't know

What type of collimation do you use? (Check one)
___ Round collimation (cone)   ___ Rectangular collimation   ___ Don't know/Not sure

For NEW patients in good oral health, what x-rays do you recommend? (please check one or more)
_____Panorex   _____Full-Mouth Series
_____Bite-wings   if so, how many? (please write a number) _____

For continuing patients in good oral health, what is your general practice for x-rays? (please check one or answer other and describe)
_____bite wings once per year   _____ bite wings every 2 years
_____bite wings every 3 years
_____Other: Please describe:_____

PRACTICE SPECIFICS
Please provide answers to the following questions in the spaces provided. If you need more room, please use the back of this sheet.

On average, how many patients does your practice serve per week? (Please write a number value)
_____

On average (by your best guess), how often does the average patient visit your practice? (Check one)
_____ Twice or more per year   _____ Once per year   _____ Once every two years
_____ Other

[PLEASE GO ON TO THE NEXT PAGE]

Of your appointments:
Approximately how many tooth extractions per week? _____
Approximately how many crowns per week? _____
Approximately how many fillings per week? _____
Approximately how many fluoride treatments per week? _____
Approximately how many sealants per week? _____

EMPLOYEES AND BUSINESS

What is your race/ethnicity? (You may check more than one.)
___ White (Caucasian) Non-Hispanic ___ African American or Black
___ Hispanic (both white and non-White) ___ Asian American
___ Other

What is your gender? _____ Male _____ Female

How many employees (including dentists, hygienists, and support staff) are there in the/your practice? (Please write a number amount)

_____

What percentages/numbers of employees (other than yourself) are: (Please write a percent value or number value for each category)
_____ White (Caucasian) Non-Hispanic _____ African American or Black
_____ Hispanic (both white and non-White) _____ Asian American
_____ Other

Of the employees (other than yourself), how many are (Please write numbers in the space provided):
_____licensed/practicing dentists _____licensed dental hygienists
_____licensed dental assistants
_____*employees that provide medical/dental care to patients*
   What other types of professions are employed by the practice? **(Please write all that apply)**

_____

On average, how many patients does your practice serve per week? (Please write a number value)
_____

By your best guess, what is the weekly revenue for the practice? (Please indicate a dollar amount) (Reminder: You have the right to skip any question.)

_____

Thank you for your participation. Please place the survey in the postage-paid envelope and mail it to Kanetha Wilson, Sociology Department, Vanderbilt University, Nashville TN 37235-1811

Table 10.
Logistic Regression Point Estimate Results for
Sealants (N=20,044)

Variable/Effect	PE	SE
Predisposing Characteristics		
Black or African American	.033	.150
Female	-.116	.116
Age	-.022 ***	.006
Education (measured in years)	-.116 ***	.018
Married	-.133	.220
Enabling Characteristics/Resources		
Income Category	.039	.053
Insurance	-.517 *	.207
Dental Insurance	.116	.164
Percentage covered by Medicare	2.020 *	.790
Percentage covered by Medicaid	.301	.462
Percentage covered by Self/Family	-.072	.270
Percentage covered by Private Ins.	-.195	.278
Utilization and Treatment		
Number of Dental Visits	-.065	.107
Treatment of Abscess or Infection	-12.018	312.400
Dentist Seen (Yes=1)	1.773 ***	.248
Intercept	-2.108	

PE=Point Estimate
SE=Standard Error
p<.05* p<.01** p<.001***

Table 11.
Logistic Regression Point Estimate Results for
Root Canals (N=20,044)

Variable/Effect	PE	SE
Predisposing Characteristics		
Black or African American	-.054	.135
Female	.236 *	.095
Age	.015 ***	.003
Education (measured in years)	.087 ***	.016
Married	.146	.103
Enabling Characteristics/Resources		
Income Category	-.001	.043
Insurance	-.667 ***	.153
Dental Insurance	.425 ***	.117
Percentage covered by Medicare	-1.563	1.028
Percentage covered by Medicaid	.827	.465
Percentage covered by Self/Family	.391	.206
Percentage covered by Private Ins.	-.159	.226
Utilization and Treatment		
Number of Dental Visits	.225 ***	.063
Treatment of Abscess or Infection	.715 *	.337
Dentist Seen (Yes=1)	-.674 ***	.105
Intercept	-5.168	

PE=Point Estimate

SE=Standard Error

p<.05* p<.01** p<.001***

Table 12.
Logistic Regression Results for Sealants with
interaction of race and class category

	PE	SE
Predisposing Characteristics		
Black	-.460	.340
Female	-.111	.117
Age	-.022 ***	.006
Education (measured in years)	-.117 ***	.018
Married (Yes=1)	-.126	.220
Enabling Characteristics/Resources		
Income Class/Poverty Category	.007	.056
Insured	-.518 *	.207
Dental Insurance	.108	.164
Percent covered by Medicaire	2.030 **	.788
Percent covered by Medicaid	.346	.461
Percent covered by Self or Family	-.056	.270
(out-of-pocket)		
Percent covered by Private Insurance	-.172	.278
Utilization and Treatment		
Number of Dental Checkups	-.071	.107
Dentist Seen	1.769 ***	.248
Abscess Presence of Infection	-12.013	313.800
Interaction of Race and Class	.163	.098
Intercept	-3.501	

PE=Point Estimate

SE=Standard Error

p<.05 p<.01** p<.001****

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Table 13.
Logistic Regression Results for Fluoride Treatments
with interaction of race and class category

	PE	SE
Predisposing Characteristics		
Black	-.479 ***	.186
Female	-.067	.056
Age	-.031 ***	.003
Education (measured in years)	-.060 ***	.008
Married (Yes=1)	-.006	.089
Enabling Characteristics/Resources		
Income Class/Poverty Category	-.012	.028
Insured	.280 *	.121
Dental Insurance	-.100	.073
Percent covered by Medicaire	-.364	.791
Percent covered by Medicaid	-.554 *	.236
Percent covered by Self or Family	-.268 *	.133
(out-of-pocket)		
Percent covered by Private Insurance	.014	.131
Utilization and Treatment		
Number of Dental Checkups	-.504 ***	.065
Dentist Seen	2.118 ***	.122
Abscess Presence of Infection	-12.250	164.900
Interaction of Race and Class	.086	.052
Intercept	-2.146	

PE=Point Estimate
SE=Standard Error
p<.05* p<.01** p<.001***

Table 14.

Logistic Regression Results for Cleaning with interaction of race and class category

	PE	SE
Predisposing Characteristics		
Black	-.057	.106
Income Class/Poverty Category	.012	.015
Female	-.052	.031
Age	-.005 ***	.001
Education (measured in years)	.000	.005
Married (Yes=1)	.194 ****	.038
Enabling Characteristics/Resources		
Insured	-.001	.059
Dental Insurance	-.251	.039
Percent covered by Medicaire	.641 **	.224
Percent covered by Medicaid	.465 ***	.137
Percent covered by Self or Family (out-of-pocket)	-.058	.068
Percent covered by Private Insurance	.909 ***	.072
Utilization and Treatment		
Number of Dental Checkups	-.533 ***	.026
Dentist Seen	1.592	.042
Abscess Presence of Infection	-2.564 ***	.332
Interaction of Race and Class	-.012	.029
Intercept	-.645	

PE=Point Estimate

SE=Standard Error

p<.05 p<.01** p<.001****

Table15 .

Logistic Regression Results for Root Canals with interaction of race and class category

	PE		SE
Predisposing Characteristics			
Black	.381		.374
Female	.237	*	.095
Age	.015	***	.003
Education (measured in years)	.088	***	.016
Married (Yes=1)	.147		.103
Enabling Characteristics/Resources			
Income Class/Poverty Category	-.016		.045
Insured	-.666	***	.153
Dental Insurance	.422	***	.117
Percent covered by Medicaire	-1.567		1.029
Percent covered by Medicaid	.863		.446
Percent covered by Self or Family (out-of-pocket)	.387		.206
Percent covered by Private Insurance	-.162		.226
Utilization and Treatment			
Number of Dental Checkups	.223	***	.064
Dentist Seen	-.673	***	.105
Abscess Presence of Infection	.717	*	.337
Interaction of Race and Class	.090		.095
Intercept	-5.116		

PE=Point Estimate

SE=Standard Error

p<.05* p<.01** p<.001***

Table 16.

Logistic Regession Results for Extractions with interaction of race and class category

	PE	SE
Predisposing Characteristics		
Black	.412 *	.166
Female	-.133 *	.065
Age	.010	.002
Education (measured in years)	-.014	.009
Married (Yes=1)	-.126	.078
Enabling Characteristics/Resources		
Income Class/Poverty Category	-.217 ***	.029
Insured	-.376 **	.100
Dental Insurance	.160	.089
Percent covered by Medicaire	-.148	.448
Percent covered by Medicaid	.389	.257
Percent covered by Self or Family (out-of-pocket)	.208	.133
Percent covered by Private Insurance	-.168	.155
Utilization and Treatment		
Number of Dental Checkups	.728 ***	.037
Dentist Seen	-.199 *	.080
Abscess Presence of Infection	.265	.308
Interaction of Race and Class	.063	.049
Intercept	-3.084	

PE=Point Estimate

SE=Standard Error

p<.05* p<.01** p<.001***

Table 17.

Bivariate Correlations between dependent variables, predisposing characterstics, enabling resources and utilitization

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1 Sealants																					
2 Fluoride	.119***																				
3 Cleaning	.011	.253***																			
4 X-ray screening	.050***	.239***	.356***																		
5 Extractions	-.009	-.048***	-.194***	-.039***																	
6 Root Canals	-.015*	-.045***	-.144***	-.051***	-.020**																
7 Black	.013	-.001	-.019**	-.004	.073***	-.009															
8 White	-.013	.001	.004	-.051***	-.073***	.009	-1.000***														
9 Income Class/Poverty Category	-.044	-.045***	.054***	-.021**	-.118***	-.073***	-.168***	.168***													
10 Female	-.017*	-.025***	-.016*	-.010	.015*	.004	-.040***	-.040***	-.042***												
11 Age	-.105***	-.200***	-.002	-.024***	-.006	-.009	-.095***	.095***	-.219***	-.042***											
12 Education (measured in years)	-.133***	-.212***	.023**	-.002	.021***	.020**	-.053***	.053***	.313***	.060***	.688***										
13 Married (Yes=1)	-.069***	-.112***	.073***	.015*	.072***	.072***	-.125***	.125***	.282***	-.029***	.503***	.506***									
14 Insured	-.014*	.027***	.063***	.000	-.030***	-.044***	-.010	.010	.144***	.072***	.017*	.070***									
15 Dental Insurance	-.021**	-.004	.001	.000	-.081***	-.029***	-.014*	-.013	.137***	.128***	.235***		.235								
16 Number of Dental Checkups	-.010	.046***	-.001	-.062***	.019**	.364***	.045***	-.045***	-.197***	-.008	.020**	.132***	.154***	.005	.045***						
17 Dentist Seen	.046***	.111***	.286***	.003	-.161***	.035***	.019**	-.019**	-.012	.002	.176***	.041***	.005	-.018*	.009	-.002					
18 Percent covered by Medicare	.001	-.023**	-.002	-.004	-.005	-.030***	-.006	.006	-.015*	.013	.140***	-.411***	.011	-.063***	.053***	.005	-.040***				
19 Percent covered by Medicaid	.073***	.084***	-.007	.037***	.053***	-.030***	-.177***	.177***	-.549***	-.024***	-.346***	.066***	-.296***	-.360***	.102***	-.062***	-.029***	-.372***			
20 Percent covered by Self or Family (out-of-pocket)	-.043***	-.097***	-.137***	-.077***	.031***	.051***	-.124***	.124***	.034***	.201***	.109***	-.143***	-.186***	.053***	.102***	.005	-.062***	-.029***	-.372***	-.501***	
21 Percent covered by Private Insurance	-.022**	.025***	.173***	.050***	-.082***	-.020**	-.056***	.056***	.378***	-.008	-.018*	.155***	.169***	.210***	.548***	-.016***	.074***	-.097***	-.396***	-.501***	
22 Abscess Presence of Infection	-.011	-.001	-.079***	-.021**	.012	.023**	.014	-.014	-.028***	-.001	.033***	.021**	.014	-.018*	-.016*	.075***	.007	-.007	-.004	.025***	-.029***

$p<.05$* $p<.01$** $p<.001$***

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