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"The Root of the Problem: Dental Health Disparities in New Mexico"

The Root of the Problem: Dental Health Disparities in New Mexico

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Abstract: Factors that contribute to general health disparities also contribute to dental health disparities. Using postmortem CT scans from the New Mexico Decedent Image Database, we investigated dental health among recently (2010-2017) deceased New Mexicans. We predicted that race/ethnicity, substance use, and rural living are associated with poorer dental health. The sample (n = 305) represents 32 of the 33 counties in the state, with equal representation of sex and race/ethnicity (European American [EA], Hispanic/Latinx [HL], and Native American [NA]). Data included presence/absence for missing teeth, restorations, abscesses, and decayed teeth. Analyses incorporated logistic regression, odds ratios, and probability plots. Missing teeth correlated with sex and race/ethnicity (HL and NA, compared to EA). Females were 3.8 times more likely and NA decedents were 4.4 times more likely to have missing teeth. High drinking decedents were 1.6 times more likely, and females were 1.7 times more likely to have restorations. Severely decayed teeth and abscesses correlated with race/ethnicity (HL and NA). Our study revealed that high drinking status, sex (female), and being NA or HL negatively affect dental health among New Mexicans. These same factors relate to health disparities in general and indicate long standing issues with health equity in New Mexico.

Introduction

Health can be defined many ways, but is most often considered a combination of physical, mental, and social wellbeing and not merely the absence of disease (WHO, 2008). Individuals' sociodemographic interactions may lead to changes in overall health status depending on their access to resources. An important component of health needs more attention in analyses of health disparities: dental health. The cultural decoupling of dental health from overall systemic health is especially evident in the discrepancy between the number of individuals with only medical insurance (90.3%; Cohen et al., 2021), and those who also have dental coverage (50.2%; Blackwell et al., 2019). Below, we outline the connections dental health has to social predictors such as socioeconomic status (SES), sex, race/ethnicity, substance use (alcohol, tobacco, and illicit), and residential location. As a case study, we investigated the social predictors of dental health in New Mexicans. We used postmortem computed tomography (PMCT) scans to investigate dental health among recently deceased New Mexicans to find: 1) whether there are dental health disparities among New Mexicans; and 2) the social predictors of dental disease.

The relationship between poor dental health and overall systemic health results in a reduced quality of life. In addition to everyday pain and suffering, poor dental health relates to diseases such as diabetes, nutritional deficiencies, infections, cancer, respiratory and cardiovascular disease, and adverse pregnancy outcomes (Genderson et al., 2013; Jeffcoat et al., 2014; Stephens et al., 2018). Due to a lack of medical or dental care access, some individuals do not interact with the healthcare system until a negative symptom, such as pain, is experienced (Kane, 2017). These negative consequences of poor dental health may be treated by a primary care doctor (Stephens et al., 2018). However, the root of the problem, dental disease, may never be addressed. Because of the lack of available care, dental diseases are considered one of the most pressing public health concerns (Peres et al., 2019; Edelstein, 2006; Gaskin et al., 2021; Stephens et al., 2018; Koppelman & Singer-Cohen, 2017; Reda et al., 2018; Fischer et al., 2017; Lenaker, 2017). This paper investigates the relationship between sociodemographic factors and their impact on dental health in a sample of New Mexicans.

Background

Dental Health Disparities Research

Health disparities are systemic differences in one or more aspect(s) of health across social, economic, demographic, or geographic groups. The differences in the quality of healthcare received can exacerbate the divide between groups (Starfield, 2011; Starfield et al., 2012; WHO, 2008). Structural and social constraints are two primary determinants of health. Structural determinants are necessities like income, goods, and services (Tellez et al., 2014). Social determinants include economic stability, education and health care access and quality, and residential environment (US Department of Health and Human Services, 2021). Social determinants create a gradient in health which is closely related to the economic and social position of the individual or group. The individual or group's place in the social gradient of health determines "health-enhancing" or "health-damaging" conditions in life (Tellez et al., 2014; Lee & Divaris, 2013).

Dental health can be defined as "a comfortable and functional dentition which allows individuals to continue in their desired social role" (Dolan, 1993). The mouth is at the intersection of dentistry and medicine (Kane, 2017). That is, professionals in dentistry and medicine share a common goal of improving the health and quality of life for their patients. Health-enhancing and health-damaging conditions affect dental health. With the benefits of good dental health ranging from economic, social, psychological, and physical health, dental health is a crucial element of an individual's overall health status (Kane, 2017). In fact, the risk factors that cause a decline in overall health and dental health are the same (Tellez et al., 2014; Williams, 2013). Dental diseases have the same risk factors as other noncommunicable diseases (cardiovascular, cancer, diabetes, stroke, etc.; Tellez et al., 2014). Diabetes and poor dental health are correlated. Periodontal (gum) disease, dental caries, dental infections, delayed wound healing, and more have been associated with diabetes (Ahmad & Haque, 2021; Hinnant et al., 2019). Native Americans (NA) are diagnosed with diabetes three times as often as all other races/ethnicities recognized by the US census (CDC, 2021; Sequist et al., 2011). This is an important consideration in New Mexico, where NA make up 10.6% of the population (U.S. Census, 2020). Sex, race/ethnicity, and geographic location are other important predictors of dental disease. The increased caries rates of females have been attributed to hormonal fluctuations, social roles within the family, and other causes (Ferraro and Vieira, 2010). Studies have also identified poorer dental health outcomes in racially and ethnically minoritized groups (Brockie et al., 2013; Gaskin et al., 2021; Schwartz et al., 2018). Rural living is associated with poorer dental health outcomes as well. Rural populations experience higher rates of caries, lower dental care use, higher rates of poverty, lower rates of insurance, and are more likely to become edentulous (Skillman et al., 2010; Vargas et al., 2002).

Reviews of current dental health disparities (Northridge et al., 2020; Lee & Divaris, 2014) suggest specific interventions and public policy changes to address disparities, such as improving dental health literacy and education (Henshaw et al., 2017; Mouradian et al., 2003; Horowitz & Kleinman, 2011) and cultural competency in dental health practitioners (Mouradian et al., 2003). In the current study, we draw on prior research and the novel application of PMCT to analyze

dental health disparities in New Mexico. This research will add to the small amount of existing knowledge on health inequity in the state as well as discuss ideas for possible intervention and improvement on dental health disparities.

Measures of Dental Health

Poor dental health maintenance, such as not routinely brushing teeth or not regularly receiving dental exams, can lead to a proliferation and accumulation of bacteria in the mouth. These bacteria live in a biofilm called plaque, and can erode enamel and lead to tooth decay, eventually resulting in caries or periodontal disease (Attin & Hornecker, 2005). Abscesses form when anaerobic bacteria accumulate around a tooth, eventually penetrating periodontal tissues and the tooth itself, and result in an infection in the root canal of a tooth. Abscesses can cause severe infections and life-threatening complications, becoming detrimental to not only dental health, but overall physical health (Siqueira & Rôças, 2013). Another common indicator of poor dental health is missing teeth, which can result from congenital defects, poor hygiene, dental disease, and trauma (Terheyden & Wüsthoff, 2015). Altogether, missing teeth, abscesses, and severely decayed teeth can be treated by several procedures. Restorations are placed to "restore the integrity of the tooth surface" which increases functionality as well as aesthetics (Ababneh et al., 2011: 395). Examples of restorations include fillings, implants, bridges, crowns, and dentures. Many prior studies have assessed dental health by the decayed, missing, and filled teeth (DMFT) index, which is an amalgamation of all these indicators calculated into one metric. This is a common method used to calculate overall dental health, which mainly focuses on caries (Gorji et al., 2021). These four dental health indicators can be used together as a proxy for dental health status.

Comparing sociodemographic factors to the four dental health indicators can shed light on the sociodemographic factors that cause poor dental health outcomes. Because PMCT image quality is not sufficient to detect small caries, the current research draws on a modified version of the DMFT index. For this study we examined missing teeth, restorations, and abscesses, and only included large caries (severe decay) that could be reliably scored from the scans. Further, rather than calculate a single index for each individual, we examined the presence/absence of each of these conditions as indicators of dental disease.

Dental Health in New Mexico

Large studies have been conducted on dental health disparities globally and nationally (e.g., Tellez et al., 2014; Gaskin et al., 2021, Kane, 2017; Fischer et al., 2017; Chattopadhyay, 2008). However, little research has focused on dental health specific to New Mexico (Chattopadhyay, 2008), and due to its demographic differences relative to the rest of the United States, this is an important factor in the push for more research into dental health in the state. With a population just over two million, New Mexico has a poverty rate of 16.8% and a median household income of $49,754, ranking 47th in income (US Census, 2021). Poverty is associated with disparities in education, SES, and a significant urban-rural divide in health care and access. Approximately 11% of New Mexicans do not have medical insurance, compared to 10.2% uninsured nationwide (New Mexico's Indicator-Based Information System, 2019). In 2004, 66% of adult New

Mexicans had seen a dentist and/or had their teeth cleaned during the previous year. These rates are lower than national averages in which 69% of adults had dental visits (Chattopadhyay, 2008).

New Mexico is a minority-majority state in which almost half (49.3%) of the population identifies as Hispanic or Latinx (HL), the highest in the nation, and 11% identify as NA (US Census, 2021). Approximately 37% identify as White non-Hispanic (or European American [EA]). Further, New Mexico is a sparsely populated state, with 42% of people living in dental health professional shortage areas, where the dentist to population ratio is >1:5,000 (Pew Charitable Trusts, 2017). Of the state's 33 counties, only seven are *not* considered dentist shortage areas. However, six of these counties have portions that are in shortage areas, meaning only one county in the state has appropriate access to dental care, given the size of its population (Rural Health Information, 2022). It is important to study dental health disparities specifically at state or regional levels to understand the variability present across the US population.

Predictions

We predicted that higher rates of poor dental health indicators would be present among individuals with: 1) lower SES; 2) HL and NA race/ethnicity; 3) the use of alcohol, tobacco, and illicit substances; 4) rural residence. These predictions were informed by Eke et al. (2015), Dye et al. (2015), and Gaskin et al. (2021), who showed that HL individuals were at a higher risk of having poor dental health than EA individuals. Other research indicates that NA and Alaskan Natives have more untreated dental caries than all other racial or ethnic groups in the United States (Phipps & Rick 2016). Those with lower SES, whether defined by income or educational obtainment, have been shown to have poorer dental health outcomes than those with a higher SES (Gaskin et al., 2021; Bersell, 2017; Eke et al., 2015). Skillman et al. (2010) showed that rural populations have less access to dentists, and higher rates of poverty. In general, individuals living rurally have more unmet dental health care needs (Vargas et al., 2002). Additionally, tobacco and high alcohol consumption both correlate with reduced dental health outcomes (Donaldson and Goodchild, 2006; Chaffee et al., 2021; Sachdev and Garg, 2018; D'Amore et al., 2011).

Materials and Methods

This study used a sample derived from the New Mexico Decedent Image Database (NMDID; Edgar et al., 2020). NMDID includes PMCT for >15,000 decedents who died between 2010-2017, associated with 69 variables regarding demography, life, and death. CT scans were taken at the Office of the Medical Investigator (OMI) in Albuquerque, New Mexico as a standard part of medicolegal investigations. Information on decedents was collected through death investigations and phone interviews with next of kin. NMDID includes 11% of the total New Mexican population who died between those years (Daneshvari Berry et al., 2021) drawn from across the state, suggesting it is likely representative of the population with regard to dental health.

We drew a sample of PMCT scans of 305 individuals from NMDID. Inclusion criteria were natural cause of death (e.g., cardiovascular disease, irregular heartbeat, substance intoxication, ethanolism), non-traumatic homicide, or non-traumatic suicide. Individuals were excluded who

had trauma-related deaths (gunshots, car accidents, head/neck injuries, and burns), that could result in inconclusive dentition scores. We prioritized including individuals who had information available on SES and substance use and sampled for equal representation of sex and race/ethnicity among EA, HL, NA from all areas of the state (using partial zip codes provided to ensure representation). Because the database lists "Hispanic" as either a race or ethnicity, decedents were categorized as HL in our study if either their ethnicity or race was Hispanic. As age correlates with the number of missing teeth due to natural senescence (Dye et al., 2015), we selected individuals who died between the ages of 35-44 so as to capture the effects of dental health disparities prior to age-related changes (Peter Loomis, DDS, pers. comm.).

Data Collection

Data collected were presence/absence of missing teeth, restorations, abscesses, and decayed teeth. CT slices and 3D reconstructions were examined using Amira™, a software used for data visualization, processing, and analysis. We used a threshold of 250 Hounsfield units to segment soft tissue from bone to visualize dentition, maxillae, and mandibles. Most CTs were examined using slice thickness of 1 mm with 0.5 mm overlap and a soft tissue reconstruction algorithm. First, 3D reconstructions were evaluated for an initial inventory of dentition and to score abscesses (Figure 1). Individual slices were then used to finalize the inventory and to determine which teeth had restorations, if any (Figure 2). Because third molars (M3) are often prophylactically removed, they were excluded from analyses. Scores for each tooth for each decedent were recorded in a custom LibreOffice (LibreOffice 7.0, 2020) database.

From the associated health and lifestyle information, drinking status was categorized into low ("low risk" and "never drank") and high ("high risk" and "previous high risk"). Tobacco use was similarly categorized as light ("light tobacco user", "current some-day tobacco user", and "former tobacco user") and heavy ("tobacco user" and "heavy tobacco user"). The rural or urban category was based on the county of death for each decedent. The US census defines rural as counties with >50% of the population living in rural areas and counties with <50% of the population living in rural areas as urban.

[Place Figure 1 Here]

[Place Figure 2 Here]

Analytical methods

Using logistic regression, we created four models represented by each of our response variables: missing teeth, restorations, abscesses, and decayed teeth. We included SES, sex, race/ethnicity, substance use, and location (county of death) as predictor variables in each of the four models to test whether these factors impacted the response variables. Some observations were missing information. For example, there were missing observations in drinking status (16% missing) and tobacco use (24% missing). We imputed missing values using the Mice package (van Buuren and Groothuis-Oudshoorn, 2011) in R, setting the number of multiple imputations (m) = 20 and maxit (number of iterations) = 10. The default imputations for each is five; increasing these

numbers improves accuracy of the imputations. Illicit substance use was missing too much information to impute; therefore, it was removed from all four models.

We performed backwards and forwards stepwise selection with each of the full models using the Akaike Information Criterion (AIC) to determine the significance of each variable to the models. A residual deviance for lack-of-fit test was used to determine if the data fit the model where $p > 0.1$ indicates that the model can be accepted. We chose to use an alpha (α) level of 0.1 for each model. In the context of our research question, we were more concerned with committing a type-II error than a type-I error. One of the main goals of this project was to identify potential relationships between sociodemographic variables and indicators of dental health. Although by using $\alpha = 0.1$, we increased the likelihood of incorrectly rejecting our null hypotheses (type-I error), by increasing α, we reduced the chance of missing a potentially significant sociodemographic predictor of dental health (type-II error). Interactions in each of the four models were tested; none were significant. We also calculated odds ratios for the variables in each of the four final models. All analyses and plots were done in RStudio (R Studio Team, 2020).

Results

Table 1 lists the number of individuals found with each predictor variable. Despite efforts to balance the sample, there were more males than females in this sample, NA had the fewest decedents, and there were more decedents with high drinking status and light tobacco use. Regarding SES, the majority of decedents were classified as belonging to lower or middle class; only 18 were classified as part of the upper class. Rural vs urban living was not found to be significant in any models.

[Place Table 1 Here]

Missing teeth

Of the 305 decedents in our sample, 267 of them were missing at least one tooth. Our final model (Table 2) included sex and race/ethnicity as the only significant predictors. SES and tobacco usage were left in the final model because they decreased the value of AIC. Female decedents had a higher probability of missing at least one tooth ($p = 0.007$). The odds ratios (Figure 4a; Table 3) indicated that females were 3.8 times more likely to have missing teeth. NA had a higher probability than EA of at least one missing tooth ($p = 0.074$), while HL had a lower probability than EA of at least one missing tooth ($p = 0.067$) (Figure 3).

[Place Table 2 Here]

[Place Table 3 Here]

Odds ratios showed that NA are 4.3 times more likely to have missing teeth relative to EA, and HL are 0.42 times less likely than EA to have missing teeth (figure 4; table 3). Tobacco use and SES are both associated with missing teeth and included in the final model, but neither are significant. We included them in the final model because AIC decreased when they were kept in

the model. Out of the 18 decedents classified as upper class in the SES variable, 17 of them had missing teeth. The small sample brings into question the importance of this result.

[Place Figure 3 Here]

[Place Figure 4 Here]

Restorations

Of the 305 decedents in our sample, 236 of them had at least one restoration. The final restoration model (Table 2) included drinking status and sex as the significant predictors. The results indicated that females are more likely to have restorations than males ($p = 0.055$) and decedents with high, relative to low, drinking statuses are more likely to have restorations ($p = 0.097$; Figure 5b). Odds ratios illustrated that females are 1.8 times more likely than males to have at least one restoration, and that high drinking decedents are 1.6 times more likely to have at least one restoration (figure 4c; table 3). High drinking status is related to a greater change in probability of restorations for males than for females.

[Place Figure 5 Here]

Abscesses

54 of the decedents in this sample had at least one abscess. The final model for at least one abscess (Table 2) included race/ethnicity as the sole significant predictor (Figure 5a). NA are more likely to have at least one abscess than EA, and HL were less likely than EA ($p = 0.098$ and $p = 0.080$, respectively). NA are 1.7 times more likely than EA and HL are 0.5 times less likely than EA to have an abscess (Figure 4b; Table 3).

Severely decayed teeth

At least one severely decayed tooth was present in 57 individuals. The final model for decayed teeth (Table 2), included race/ethnicity as the only significant predictor (Figure 5c). HL are less likely than EA ($p = 0.017$) to have at least one decayed tooth. Odds ratio results indicated that HL are 0.38 times as likely as EA to have decayed teeth (Figure 4d). NA appeared in the final model of decayed teeth, but the difference was not significant. However, odds ratio results showed that NA are 1.6 times more likely than EA to have severely decayed teeth.

Discussion

In this study, we examined the relationship between sociodemographic predictors and measures of dental health in recently deceased New Mexicans. The most significant predictors from our analysis of differences in dental health include sex, race/ethnicity, and drinking status. Tobacco and SES were included in only one of the final models (missing teeth), but neither were significant. Living in a rural county was also not significant in any of the models.

Race/Ethnicity

In three of the four models (missing teeth, abscesses, and severely decayed teeth), race/ethnicity was a significant predictor of dental health. Being NA is correlated with a decline in dental health. In this study, we did not investigate other causes for poorer dental health outcomes for NA, but previous work has shown that NA have some of the poorest health conditions in the United States. On average, NA have a reduced life expectancy of five years when compared to EA (Jones, 2006; Sequist et al., 2011; Howard et al., 1999; Howard et al., 2000). This leads to the question: what is contributing to NA vulnerability to health and disease ailments?

There are many factors behind health inequity in NA, such as differences in culture (more specifically, differences in the way health is treated and perceived), historical trauma, beliefs, and behaviors (Hinnant et al., 2019; Safran et al., 2009). Colonialism and dispossession of land are additional current issues compiling onto previously stated issues of social determinants of health that affect NA poorer health outcomes (Walters et al., 2011). On average, NA living on reservations are poor and segregated (Marley, 2018; Leung & Takeuchi, 2011). Drawing correlations between health and race/ethnicity, but also place, might be important for contextualizing health inequity in the state of New Mexico.

Another hurdle for NA receiving proper healthcare is Indian Health Services (IHS). Due to the lack of adequate funding, IHS does not offer the extent and level of services as other healthcare systems. IHS serves 2.56 million of the 5.2 million NA and Alaska Natives (IHS, 2019; Sequist et al., 2011). The lack of funding to IHS has resulted in only one dental IHS clinic on the entire Navajo Reservation, and it is located in the state of Arizona. A second dental clinic is in Albuquerque, New Mexico, which is hours by car from the Navajo Reservation, and from many Pueblos as well (IHS, 2022). These conclusions on IHS could influence support for more funding to IHS dental clinics on reservations (Marley, 2018; Niederdeppe et al., 2013; Sequist et al., 2011).

Previous studies have shown that inequity in access to dental healthcare is mostly seen in non-Hispanic Blacks and Mexican Americans (Gaskin et al., 2021; Shelly et al., 2011; Sharif & Edelstein, 2016). In the current study, EA decedents were more likely than HL decedents to have missing teeth. According to Gaskin et. al. (2021), identifying as HL was protective against having missing teeth relative to being non-Hispanic EA (2021). This finding is consistent with another study that found no statistically significant result between missing teeth in EA and HL individuals (Huang & Park 2015). To our surprise, our results support these previous findings. On the other hand, several studies have suggested HL were more likely than non-Hispanic EA to experience poorer dental health (Fisher-Owens et al., 2013; Eke et al., 2015; Huang & Park, 2016).

Potential explanations for conflicting results may include differences in sample compositions and specific data collection methods. For example, Huang and Park's (2016) sample included individuals who were older than 65. They repeatedly surveyed via self-report the same group of individuals for two years. Our sample was aged 35-44 at time of death and individuals were not surveyed, but their dentition was examined more closely. Huang and Park conducted a tooth count (one of four of the variables we collected for) but did not go further in assessing dentition. Because our sample sizes within each race/ethnicity are comparable, the differences in our

results could be caused by methodological differences. Additionally, identification of race and ethnicity varies regionally across the US. Hunley et al., (2017) showed that identifying with a deep Spanish heritage (due to the history of the area of New Mexico) may still be prominent today. Therefore, differences in genetic makeup as well as personal identity could be the reason for differences in HL samples from New Mexico and other areas. Huang and Park's sample could have derived from these other areas, causing differences in personal identifiers between the two samples. However, they do not write where their sample is from, so we cannot be sure.

Sex

We found that females have higher dental health risks (more missing teeth and more restorations) than males. This result is contrary to previous research which found that females had better dental health outcomes than males, possibly due to women being more concerned about dental health (Bencosme, 2018; Buunk-Werkhoven, 2015, Eke et al., 2015; Gaskin et al., 2021).

However, Ferraro and Vieira (2010), found that women were at greater risk of developing dental caries (92.66% likely in women and 90.57% likely in men). Other factors contributing to sex differences in dental health outcomes are genetics and hormones. Pregnancy and the associated physiological changes, such as peaking estrogen levels, can exacerbate dental health risks due to an increased blood flow to the gums, which can result in pregnancy gingivitis, tooth erosion, dental caries, and more (Bencosme, 2018; Michalowicz et al., 2013). Our interpretation of the results may be informed by this because females in our sample have more missing teeth as well as more restorations. More restorations could support the conclusion that females may be more concerned about dental health and would therefore see the dentist more often than males to get treatment (Bencosme, 2018; Lipsky et al., 2021). There were no differences between females and males in the presence of decayed teeth or abscesses. This could be because females get dental work done before it results in decayed teeth or abscesses, which would again support our finding that restorations are of higher prevalence in females than males. Females are more likely to go to the dentist early enough to get restorations before caries result in severe decay or abscesses.

Alcohol and tobacco use

In a study by Khairnar et al. (2017), alcohol was defined as the second most used drug worldwide. The authors suggest that heavy alcohol consumption is linked to over 60 medical conditions, suicide, homicide, and other accidents. This is important in the condition of the decedents in our sample because over half of the deaths in our sample were alcohol or substance use related. In our study, a high drinking status correlated with restorations. Sachdev & Garg (2018) outline links of high alcohol consumption to dental health issues, such as damage to enamel which can lead to tooth decay and higher plaque levels, which both can result in an increase in restorations, as shown in our results. It is important to note that restorations show the decedent had at least some kind of dental healthcare access. However, the number of restorations a decedent had can still be indicative of poor dental health.

Our results indicate that heavy tobacco use was only slightly significant in increasing the proportion of the population with missing teeth. We did not categorize the various ways to use tobacco (cigarettes, smokeless (chewing), cigars and pipes, e-cigarettes, etc.); we only categorized "light" and "heavy" use. Chaffee et al. (2021) demonstrated that all ways of using

tobacco had negative effects on overall health as well as dental health. Those authors suggest tobacco use is one reason for periodontal and gingival diseases, dental caries, dental cancer, increased dental plaque levels, and overall dental pain. A CDC study showed that over 40% of 20–64-year-old adults who smoke have untreated tooth decay, and nearly 43% of adults 65 years and older who currently smoke cigarettes are missing all their teeth (CDC, 2019).

Limitations

Intra-observer error was not accounted for during data collection. Scoring for composite fillings was difficult at times due to the inability to recognize them from axial slices. This was not a problem for amalgam (metal) fillings, which were easy to score on the CT scans (Figure 2). Additionally, the composition of this sample includes its own biases. This sample is a mortality sample, which could represent a more accurate cross-sectional sample of the New Mexican population, but, because of the nature of the decedent's deaths, they were examined at the OMI. The manner or cause of death of these decedents could have been a result of social risks or hazards they experienced while living, which could be reason for both poor dental health outcomes and premature deaths (decedents died aged 35-44). Therefore, the sample could be biased in the way that these decedents might have faced unfavorable living and social conditions, causing them to die prematurely.

Further considerations

Education Obtainment Correlates to Dental Health

One variable that was not examined in this study that could provide further insight into dental health in New Mexicans is education levels. Tanner et al., (2015) and Gaskin et al., (2021) both mention one of the factors driving certain dental health outcomes is level of education. In fact, Tanner et al., mentioned in their study that education level protected against declination of dental health more than other variables examined. Gaskin et al. reported similarly that less educated and low-income US residents were less likely to have visited a dentist in the last five years.

Benefit of Dental Therapists on Dental Health Outcomes

Lenaker (2017) and Koppelman & Singer-Cohen (2017) show how poor and rural communities could benefit from dental therapists. Dental therapists are midlevel dental providers under the supervision of dentists who specialize in restorative care (filling caries for instance) and conducting nonsurgical tooth extractions while accepting public health insurance. By their ability to reach underserved communities, future research might benefit by investigating possible ways to implement dental therapists in the state of New Mexico.

Conclusion

The goals of this study were to uncover the correlates between sociodemographic factors such as SES, sex, race/ethnicity, substance use, and urban or rural living, and indicators of dental health, including missing teeth, restorations, abscesses, and severely decayed teeth. Our results indicate that the most significant sociodemographic predictors of dental health are sex, race/ethnicity, and substance use. Females, NA and EA decedents, and drinking status showed to be significant

sociodemographic variables in our final models. Race/ethnicity was a significant predictor for three out of four of the dental health indicators examined, and the sole predictor for two of these conditions.

Inaccessible dentistry and social determinants of health can exacerbate dental disease. Narrowing down the causes and implications of New Mexican inequity on dental health outcomes offers new insights on overall healthcare quality and access in the state. Uncovering what the dental health disparities are is the first step in furthering dental health research in New Mexico and implementing possible interventions.

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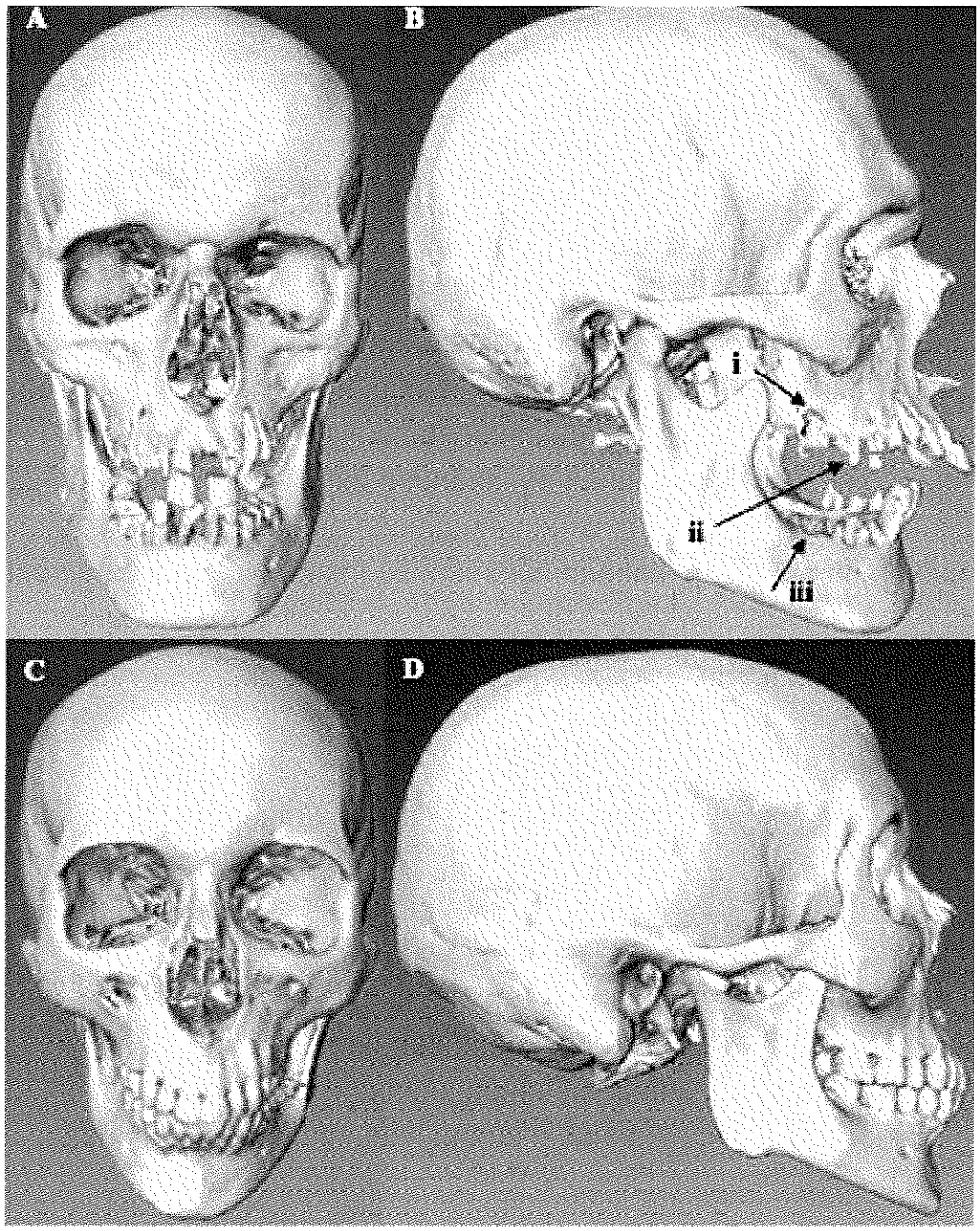

Figure 1: Example 3D reconstructions. (A) Anterior view: abscesses, decayed, missing teeth (B) Right lateral view: abscesses (i), decayed (ii), missing teeth (iii) (C and D) Anterior and right lateral views: teeth intact.

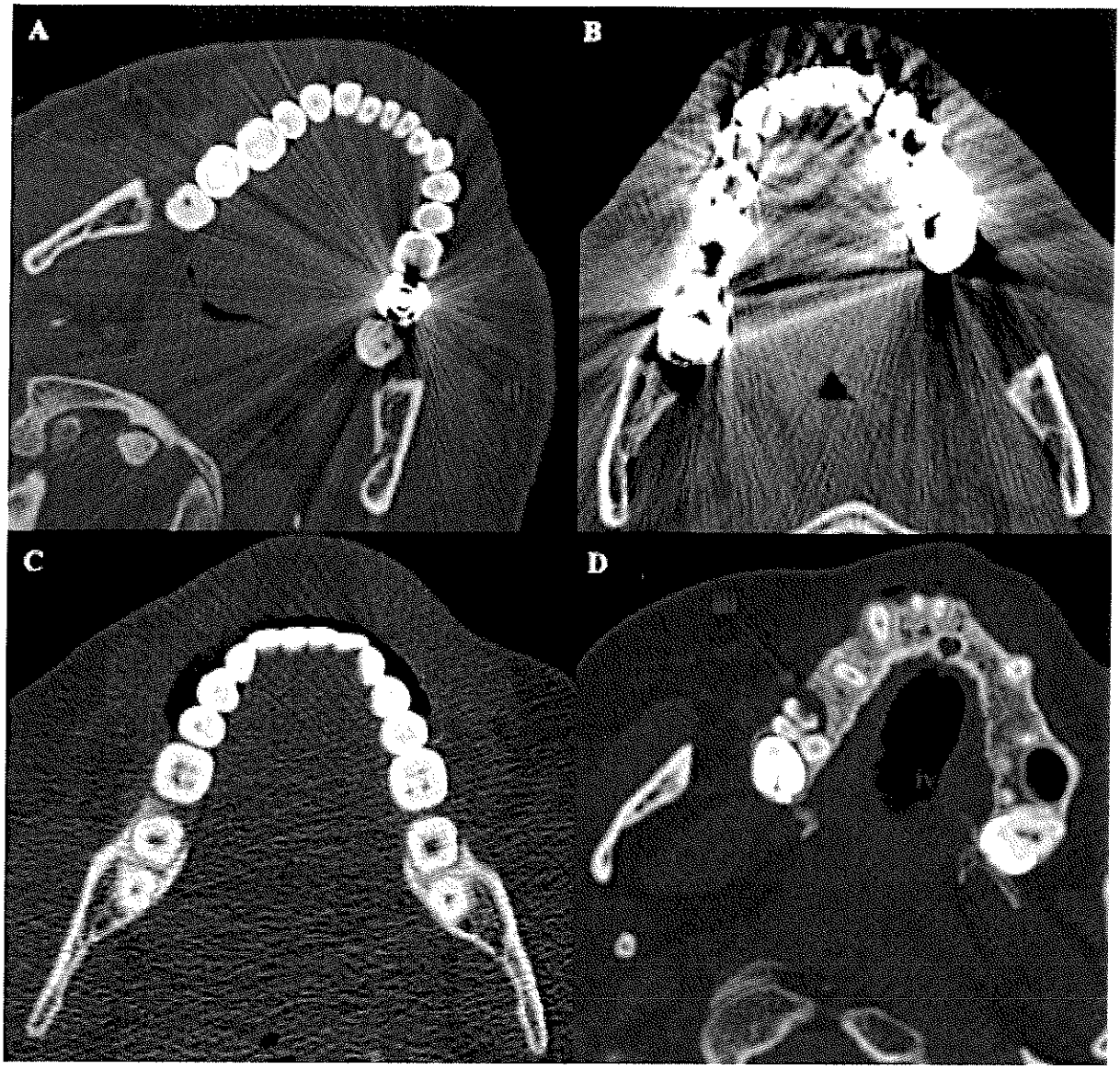

Figure 2: Example slice views of mandibles (A-C) and a maxilla (D) from PMCT scans. (A) Composite (i) and metal filling (ii), (B) Multiple restorations, (C) No dental work, (D) Abscess (iii) and missing teeth (iv).

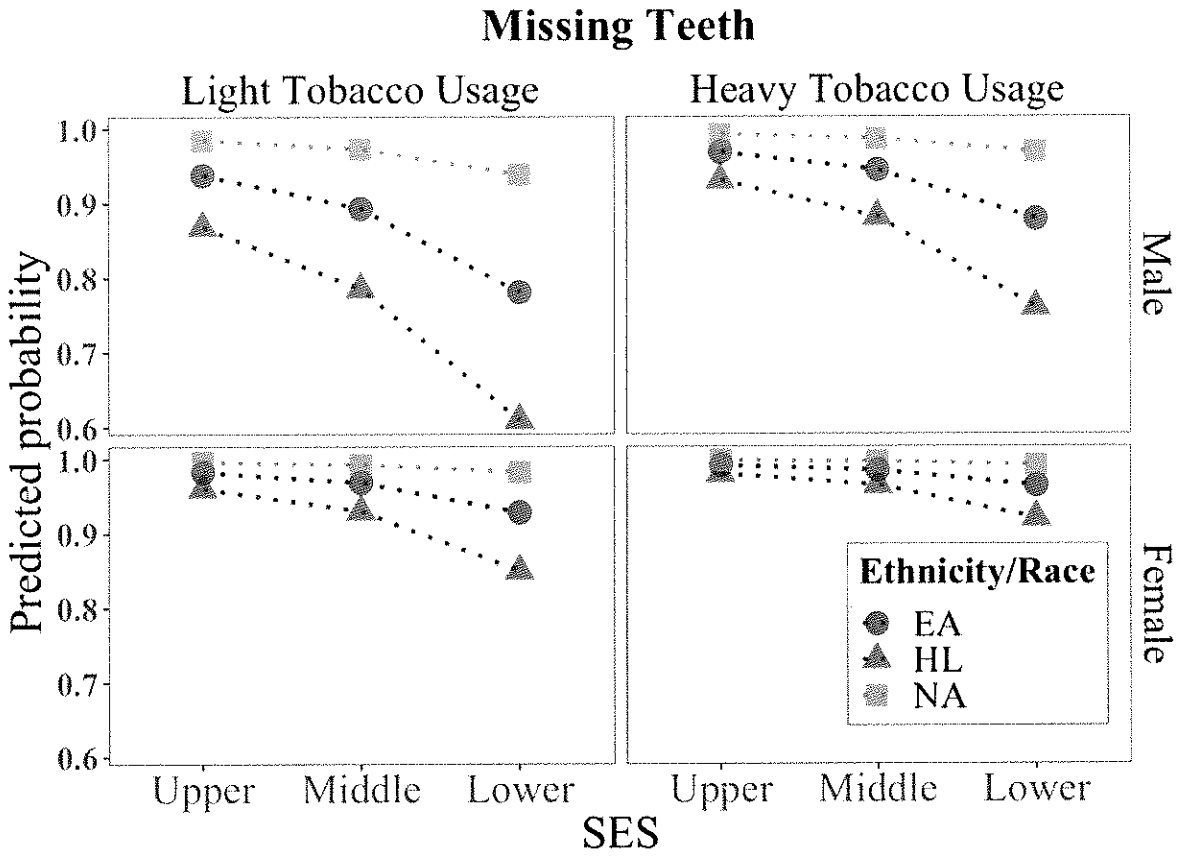

Figure 3: Predicted probabilities of an individual having at least 1 missing tooth based on model.

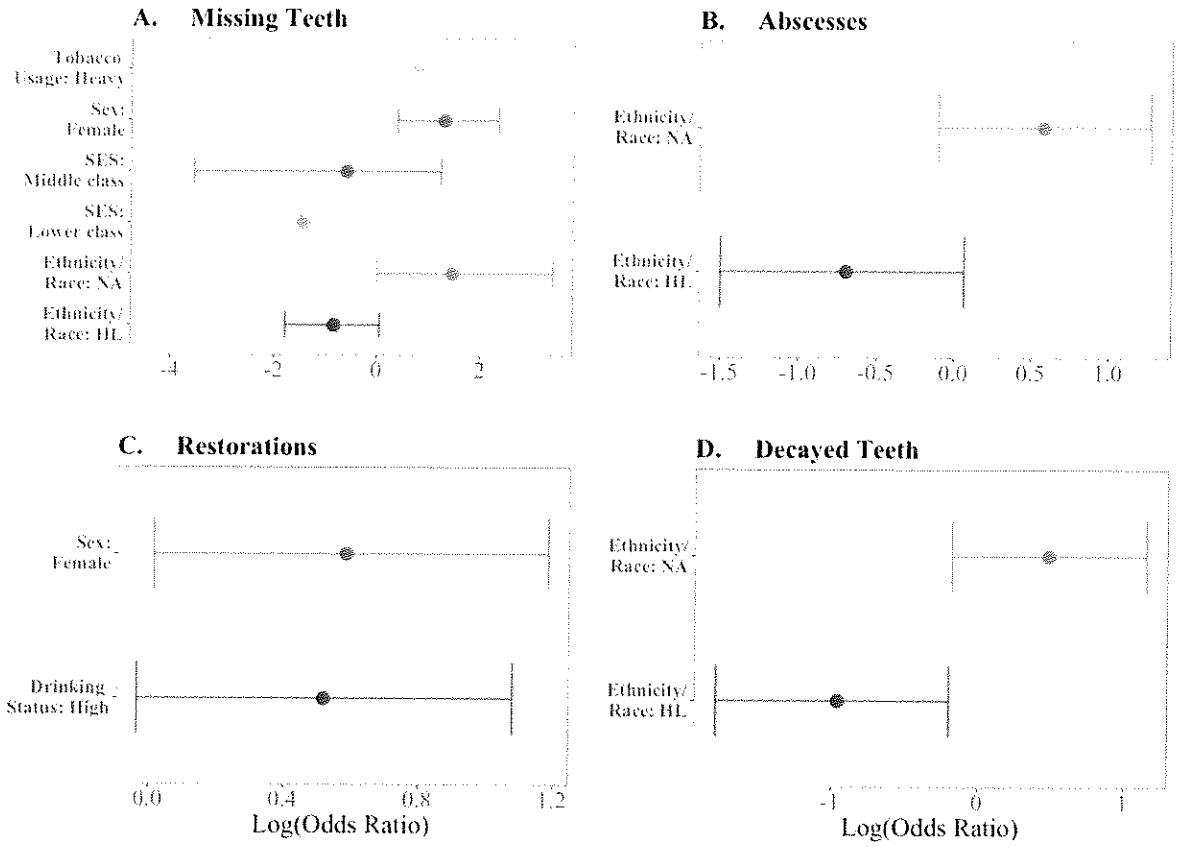

Figure 4: Odds ratio results with logarithmic transformations. Bars are the 95% confidence interval. These plots show odds ratios transformed on a logarithmic scale (Cruz et al., 2017) where the baseline for each variable equals zero.

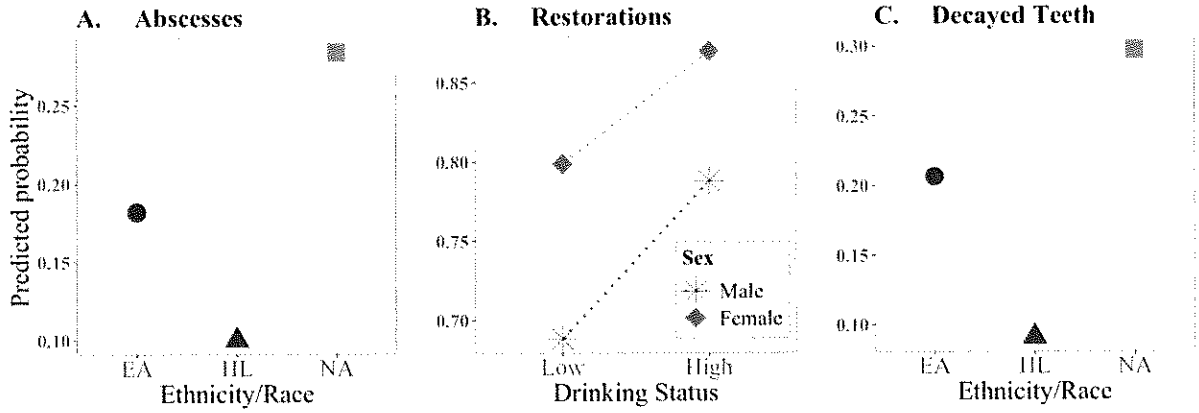

Figure 5: Predicted probabilities of an individual having at least 1 restoration, abscess, or decayed tooth based on model.

Table 1: Descriptive statistics.

	Missing Teeth		Abscess		Restorations		Decayed Teeth		Total	
	n	%	n	%	n	%	n	%	n	%
Sex									**305**	
Female	124	*95. 4*	23	*17.7*	130	*74.9*	25	*19.2*	130	*42.6*
Male	150	*85.7*	31	*17.7*	109	*83.8*	32	*18.3*	175	*57.4*
Race/Ethnicity									**305**	
EA	113	*93.4*	22	*18.2*	95	*78.5*	25	*20.7*	121	*39.7*
HL	89	*80.9*	11	*10*	83	*75.5*	10	*9.1*	110	*36.1*
NA	72	*97.3*	21	*28.4*	62	*83.8*	22	*29.7*	74	*24.2*
Location									**304**	
Rural	45	*93.8*	10	*20.8*	38	*79.1*	10	*20.8*	48	*15.8*
Urban	228	*89.1*	212	*17.2*	201	*78.5*	47	*18.4*	256	*84.2*
Drinking Status									**257**	
Low	94	*87.9*	20	*18.7*	79	*73.8*	18	*16.8*	107	*41.6*
High	135	*90*	26	*17.3*	124	*82.7*	34	*22.7*	150	*58.4*
Tobacco Use									**233**	
Light	118	*85.5*	26	*18.8*	109	*79*	29	*21*	138	*59.2*
Heavy	90	*94.7*	15	*15.8*	76	*80*	17	*17.9*	95	*40.8*
SES									**303**	
Lower	99	*84.6*	21	*17.9*	91	*77.8*	20	*17.1*	117	*38.6*
Middle	156	*92.9*	30	*17.9*	134	*79.8*	31	*18.5*	168	*55.4*
Upper	17	*94.6*	2	*11.1*	14	*77.8*	5	*27.8*	18	*5.9*

Table 2: Logistic regression results displaying variables in the final models.

	Coefficient	P- Value	Final AIC	Residual Deviance for Lack-Of-Fit
Missing Teeth				
Female	*1.340*	*0.007**		
HL	*-0.860*	*0.067**		
NA	*1.476*	*0.074**		
Middle Class	*-0.645*	*0.561*	*182.05*	*1.0*
Lower Class	*-1.473*	*0.193*		
Heavy Tobacco	*0.720*	*0.180*		
Restorations				
Female	*0.570*	*0.055**		
High Drinking	*0.470*	*0.097**	*315.58*	*0.37*
Abscesses				
HL	*-0.693*	*0.080**	*280.54*	*0.87*
NA	*0.578*	*0.098**		
Decayed Teeth				
HL	*-0.957*	*0.017**	*286.37*	*0.81*
NA	*0.485*	*0.153*		

Table 3: Exponentiated odds ratio results summary.

	Odds Ratios
Missing Teeth	
Female	*3.820*
HL	*0.423*
NA	*4.376*
Middle Class	*0.524*
Lower Class	*0.229*
Restorations	
Female	*1.768*
High Drinking	*1.600*
Abscesses	
HL	*0.500*
NA	*1.783*
Decayed Teeth	
HL	*0.384*
NA	*1.624*