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Geospatial Disparities in Dental Care Access across Worcester County, Massachusetts*

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Geospatial Disparities in Dental Care Access across Worcester County, Massachusetts

ABSTRACT

Dental health is an integral part of overall well-being and operates as a mirror of health and disease occurring within the rest of the body. This project uses quantitative information from Google Maps and the American Community Survey to examine associations between the number of dental offices and sociodemographic characteristics in 571 Census block groups in Worcester County, Massachusetts. Statistical modeling including negative binomial regression and GIS-based models were utilized for data analysis. Results revealed that dental offices are most often located in areas with fewer socioeconomic resources. Moreover, blocks with greater percentages of Asian/Asian Americans have higher likelihood of dental office access, but areas with greater concentration of Hispanic populations experience less access. The intersection of racial composition and socioeconomic resources is most telling such that areas with high Asian populations have extensive access to dental offices across socioeconomic conditions while access is more limited for areas with high Hispanic and impoverished populations. Overall, this study addresses a fundamental need to examine dental care access and the existing disparities. While programs have effectively established more dental offices in socioeconomically disadvantaged areas, access inequities remain especially pronounced for neighborhoods with large Hispanic populations.

Geospatial Disparities in Dental Care Access across Worcester County, Massachusetts

Despite receiving less scientific inquiry than other dimensions of well-being, dental healthcare is a basis for maintaining health at the individual and population-levels. In fact, dental health is an integral part of one's overall health status and acts as a mirror to the rest of the body.¹⁻³ Dental health is not often prioritized especially in low-socioeconomic groups due to inaccessibility and financial difficulties rather than a lack of consideration of its importance.⁴ Having access to dental health professionals who can observe, diagnose, and treat the condition of people's teeth, mouth, and gums is essential for people's health, quality of life, and educational outcomes.⁵⁻⁸ The present study focuses on my community of Worcester County, Massachusetts. Worcester County has neighborhoods that vary greatly in their composition of refugees, low-income, and racially marginalized populations who typically have less access to oral healthcare due to financial and transportation restrictions, or a lack of nearby dental offices. The present study aims to address the question: What is the association between an area's socio demographic composition (e.g., income and race-ethnicity) and the number of proximate dental offices?

Maintaining oral health and hygiene encompasses routine dental visits, transportation, access to care, and having health insurance plans that cover general dentistry.⁹⁻¹¹ The National Library of Medicine acknowledges the disparities in access to oral health,⁹ and in one important article, they incorporate the increasing importance of dental health through patient-centered care for disadvantaged patients. Despite the importance of wellness checks, disparities in access to care exist with considerable health consequences such as increased caries and periodontal diseases. Unfortunately, dental care has one of the highest financial barriers in healthcare, and insurance plans often do not cover dental health. One study focusing on the socioeconomic determinants of dental care accessibility found gaps related to race, income, and insurance

coverage.¹¹ Most articles highlight ethno-racial disparities where black and Hispanic communities are often most disadvantaged.

DATA AND METHODS

When looking at U.S Census Bureau Geographic labeling there is a hierarchy of names that are attributed to the borders of what those designated areas occupy. The smallest unit outlined is the Block Group within a Census Tract. These census blocks are the smallest geographic unit that includes information relevant to the present study. Based on the database, Worcester County spanned from Census Tract 7001 Block Group 1 to Census tract 7614.02 Block Group 2 (n=571). The datasets of different demographic data were collected for those chosen area sets. All demographic data derived from the American Community Survey, 5-year estimates. The specific characteristics included socioeconomic indicators, such as median household income, unemployment rate, rate of education, percentage living below the federal poverty line, and percentage that utilizes public health insurance. Incorporated was also ethnoracial composition measures including the ethnic percentage of Black, Hispanic, and Asian individuals, and language spoken in the home.

For the purposes of this study, dental offices are defined as a facility offering basic dental care rather than solely services in specialties such as orthodontics or endodontics. Once those were compiled, they would be used to analyze whether sociodemographic characteristics are associated with the number of dental offices. Compiling a list of dental offices was accomplished by using Google Maps and inputting the phrase “dental office” followed by the individual counties. Google Maps was used to simulate what several patients would use as their source to locate a dental office near them. So, although there were 200 dental offices collected there may be a margin of error due to inaccessibility to access their information via web services. The

name, address, and contact information were compiled and then inputted into GeoCoder hosted by the U.S Census Bureau to identify the census tracts and block groups they occupied.

Dependent Variable

Number of Dental Offices. The dependent variable for multivariable analyses reflects the number of dental offices in each Census Block Group.

Independent Variables

Socioeconomic Conditions. For parsimony, we created a single measure of socioeconomic conditions of an area that is composed of dichotomous indicators of whether the area has a less than average median household income, a higher-than-average percentage of the population living in poverty, a higher than average percentage of the population that relies on any form of public assistance, and a higher than average percentage of households headed by single mothers (yes=1). In sum, five categories were created that included the highest socioeconomic conditions (i.e., met zero of the criteria described above), second highest (i.e., met 1 criterion), middle (i.e., met 2), second lowest (i.e., met 3), and lowest group (i.e., met all four criteria).

Percentage of the Population, of Color. The percentage of the population that is of color references what percentage is comprised of Asian, Black, Hispanic, Native, or other non-white ethno racial category.

Percentage of the Population, Asian. Percentage of the population, Asian reflects the percentage, ranging from 0 to 100 of the population in an area that identifies as being of non-Hispanic Asian or Asian American descent.

Percentage of the Population, Black. Similarly, percentage Black refers to the percentage of the population in an area that is non-Hispanic Black.

Percentage of the Population, Hispanic. Percentage Hispanic reflects the breakdown of the population composition that is Hispanic.

Covariates

Multivariable models also account for the total population of a Census Block group, the percentage of the population that speaks English poorly, and the percentage of the population that relies on public transportation. We control these measures to isolate the independent impacts of socioeconomic conditions and ethnoracial composition that are unexplained by population size, language barriers, and transportation concerns.

Analytic Technique

The primary multivariable analyses relied on negative binomial models to estimate the number of dental offices in Census block groups in Worcester County, MA. We estimated four models. The first model examined associations between the percentage of the population that is of color, socioeconomic conditions, total population, English proficiency, and percentage that takes public transit. The second model disaggregated the ethnoracial composition measure into percentage Asian, Hispanic, and Black, and incorporated all covariates. The third and fourth models examined interactions between percent Asian and socioeconomic conditions, and percent Hispanic and socioeconomic conditions, respectively. In other words, the latter two models examined whether associations between socioeconomic conditions and dental offices depend on the ethnoracial composition of that neighborhood. Following best practices for interpreting the significance of interactions in nonlinear models, I graph adjusted predictions of dental offices at representative values of percent Asian and Black, respectively.

RESULTS

Descriptive Results

Table 1 reports descriptive statistics for all study variables. Table 1 shows that Census Block Groups averaged .34 dental offices (*Standard Deviation* [*SD*]=.83). In other words, most

Census Block Groups did not have a dental office. Moreover, Worcester County has a higher percentage of people of color comparatively to the total population of the US. Most of the population are Hispanics followed by Black and Asian. More specifically, about 70 percent of Census Block group populations are white compared to 30 percent that are of color ($SD=21.02$). After disaggregating further, Census groups are on average 5 percent Asian ($SD=6.95$), 14 percent Hispanic ($SD=14.37$), and 5 percent Black ($SD=6.24$).

Table 1. Descriptive Statistics for Census Block Groups in Worcester County, Massachusetts, 2021 (n=571).

<i>Variables</i>	<i>Mean/%</i>	<i>SD</i>
<i>Dental Offices</i>		
Number of Dental Offices (<i>range 0–7</i>)	0.34	(0.83)
<i>Ethnoracial Composition</i>		
Population Percentage, of Color (<i>range 3–92</i>)	30.51%	(21.02)
Population Percentage, Asian (<i>range 0–74</i>)	4.98%	(6.95)
Population Percentage, Hispanic (<i>range 17.2071</i>)	14.41%	(14.37)
Population Percentage, Black (<i>range 0–33</i>)	5.34%	(6.24)
<i>Socioeconomic Conditions</i>		
Highest Socioeconomic Status (yes=1)	35.73%	—
2 nd Highest Socioeconomic Status (yes=1)	25.04%	—
Middle Socioeconomic Status (yes=1)	15.59%	—
2 nd Lowest Socioeconomic Status (yes=1)	20.84%	—
Lowest Socioeconomic Status (yes=1)	2.80%	—
<i>Covariates</i>		
Total Population (logged <i>range 6–8</i>)	7.20	(0.02)
Population Percentage, Speaks English Poorly (<i>range 0–35</i>)	1.53%	(3.70)
Population Percentage, Takes Public Transportation (<i>range 0–26</i>)	1.77%	(3.46)

Note: Means and percentages presented with standard deviations in parentheses (*SD*).

In terms of the socioeconomic breakdown of Worcester County blocks, 36 percent of neighborhoods have the highest socioeconomic conditions followed by 25 percent in the second highest, 16 percent in the middle tier, 21 percent in the second lowest tier, and 3 percent in the lowest conditions. Each block group contains 250–520 housing units of about 600–3000 people

depending on the area. For the blocks included here, populations averaged about 1,400 people or 7.20 after taking the natural log plus 10 ($SD=.02$). We accounted for English proficiency and usage of public transportation. On average, about 2 percent of Census Blocks reported speaking English with limited proficiency, and close to 2 percent use public transportation.

Bivariate Relationships

Table 2 shows correlations between study variables for Census block groups. Of note, while the bivariate association between number of dental offices and percentage of the population that is of color is relatively weak ($r=.04$), the measure most strongly associated with dental offices is percentage of the population that is of Asian descent ($r=.18$). In other words, as the percentage of the population that's Asian increases, so too does the number of dental offices in that Census block. The pattern is opposite for the percentage of the population that is Hispanic such that areas with dense populations of Hispanics on average have fewer dental offices in their neighborhoods ($r=-.04$). Furthermore, at the bivariate level, a clear disparity in access appears across socioeconomic conditions. Areas that have the highest ($r=.03$) or middle level of resources ($r=.07$) typically have more dental offices whereas the second lowest ($r=-.05$) and lowest conditions have the least number of dental offices ($r=-.07$). Consistent with what research would expect areas with larger populations most often have access to more dental offices ($r=.07$). The measures for limited English proficiency ($r=.02$) and percentage that takes public transit ($r=.07$) were also positively related to the number of dental offices, which may reflect offices offering multilingual services and people having the opportunity to travel for dental care via public transportation.

Table 2. Correlations between Study Variables for Census Block Groups in Worcester County, Massachusetts, 2021 (n=571).

Variables	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. Number of Dental Offices	1.00	—	—	—	—	—	—	—	—	—	—	—	—
2. Population Percentage, of Color	.04	1.00	—	—	—	—	—	—	—	—	—	—	—
3. Population Percentage, Asian	.18	.37	1.00	—	—	—	—	—	—	—	—	—	—
4. Population Percentage, Hispanic	-.04	.89	.00	1.00	—	—	—	—	—	—	—	—	—
5. Population Percentage, Black	.01	.77	.12	.61	1.00	—	—	—	—	—	—	—	—
6. Highest Socioeconomic Status	.03	.41	-.11	.46	.36	1.00	—	—	—	—	—	—	—
7. 2 nd Highest Socioeconomic Status	-.01	.19	.10	.18	.15	-.43	1.00	—	—	—	—	—	—
8. Middle Socioeconomic Status	.07	-.17	.01	-.14	-.19	-.32	-.25	1.00	—	—	—	—	—
9. 2 nd Lowest Socioeconomic Status	-.05	-.41	.01	-.45	-.35	-.38	-.30	-.22	1.00	—	—	—	—
10. Lowest Socioeconomic Status	-.07	-.31	.01	-.40	-.15	-.13	-.10	-.07	-.09	1.00	—	—	—
11. Total Population (logged)	.07	-.20	.09	-.26	-.13	-.27	-.01	.17	.13	.10	1.00	—	—
12. Population Percentage, Speaks English Poorly	.02	.51	.02	.54	.35	.24	.11	-.14	-.19	-.22	-.19	1.00	—
13. Population Percentage, Takes Public Transportation	.07	.25	.18	.18	.20	.04	.14	-.03	-.17	-.03	-.04	.19	1.00

Note: Correlation coefficients presented.

Multivariable Findings

Table 3 reports negative binomial models estimating the number of dental offices in Census block groups across Worcester County by ethnoracial composition, socioeconomic conditions, English proficiency, and public transportation. Model 1 examines the impact of the population percentage of color, socioeconomic conditions, and covariates. Model 1 identifies no significant association between percentage of color and dental offices. Dental offices seem similarly accessible in whiter areas of Worcester County as well as areas with higher concentrations of nonwhites. Model 1 also shows that areas with middle socioeconomic status have significantly fewer dental offices compared to the lowest conditions (*Incident rate ratios* [IRR]=.30, *Standard Error* [SE]=.18).

Table 3. Negative Binomial Models Estimating the Number of Dental Offices in Census Block Groups across Worcester County by Ethnoracial Composition, Socioeconomic Conditions, English Proficiency, and Public Transportation, 2021 (n=571).

<i>Variables</i>	Number of Dental Offices (<i>range 0–7</i>)							
	Model 1		Model 2		Model 3		Model 4	
	<i>IRR</i>	<i>SE</i>	<i>IRR</i>	<i>SE</i>	<i>IRR</i>	<i>SE</i>	<i>IRR</i>	<i>SE</i>
<i>Ethnoracial Composition</i>								
Population Percentage, of Color	1.00	(.01)	—	—	—	—	—	—
Population Percentage, Asian	—	—	1.05***	(.01)	.97	(.12)	1.05***	(.01)
Population Percentage, Hispanic	—	—	.97**	(.01)	.96**	(.01)	.87†	(.06)
Population Percentage, Black	—	—	1.01	(.02)	1.01	(.02)	1.00	(.02)
<i>Socioeconomic Conditions</i> (yes=1)								
Highest Socioeconomic Status	.38	(.24)	.14**	(.09)	.10*	(.09)	.00*	(.00)
2 nd Highest Status	.46	(.28)	.20*	(.12)	.09**	(.08)	.00*	(.01)
Middle Socioeconomic Status	.30*	(.18)	.14**	(.09)	.09**	(.08)	.00*	(.01)
2 nd Lowest Status	.54	(.31)	.36†	(.21)	.28	(.24)	.01†	(.02)
<i>Covariates</i>								
Total Population (logged)	1.45†	(.32)	1.29	(.28)	1.25	(.28)	1.37	(.31)
Population Percentage, Speaks English Poorly	1.00	(.03)	1.04	(.03)	1.04	(.03)	1.04	(.04)
Population Percentage, Takes Public Transportation	1.04	(.03)	1.02	(.03)	1.01	(.03)	1.02	(.03)
<i>Interactions</i>								
Population Percentage, Asian x Highest Socioeconomic Status	—	—	—	—	1.07	(.13)	—	—
x 2 nd Highest Status	—	—	—	—	1.17	(.15)	—	—
x Middle Socioeconomic Status	—	—	—	—	1.09	(.14)	—	—
x 2 nd Lowest Status	—	—	—	—	1.06	(.14)	—	—
Population Percentage, Hispanic x Highest Socioeconomic Status	—	—	—	—	—	—	1.19*	(.10)
x 2 nd Highest Status	—	—	—	—	—	—	1.12	(.08)
x Middle Socioeconomic Status	—	—	—	—	—	—	1.10	(.08)
x 2 nd Lowest Status	—	—	—	—	—	—	1.11	(.08)
Bayesian Information Criterion	895.988		887.027		906.109		905.750	

Note: Incident rate ratios (IRR) presented with standard errors in parentheses. Reference group for socioeconomic conditions is Census group blocks with the lowest socioeconomic status. †*p*<.10; **p*<.05; ***p*<.01; ****p*<.001 (two-tailed tests).

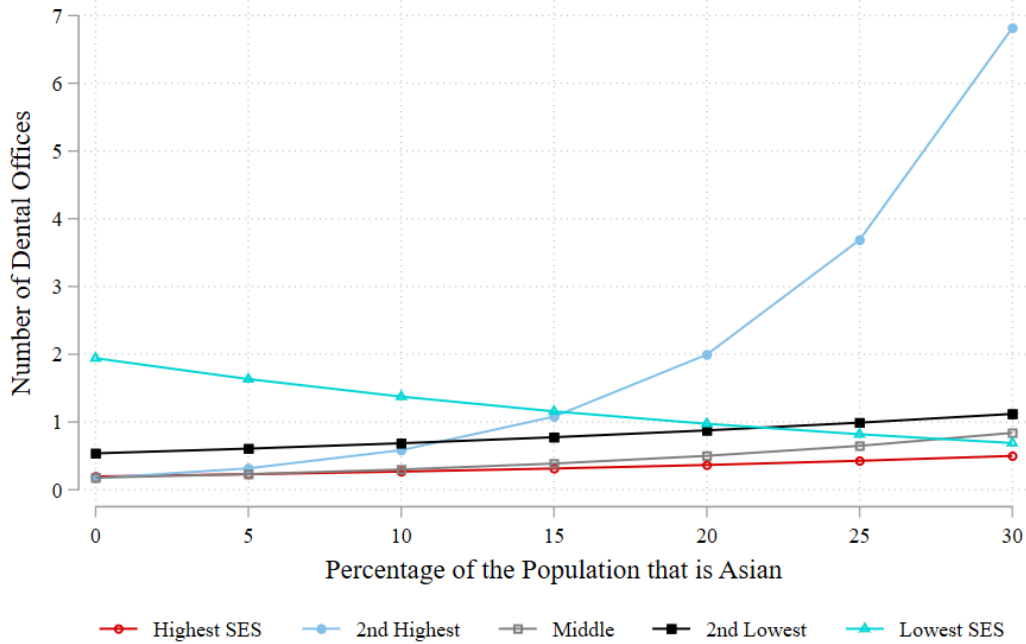
Model 2 in Table 3 disaggregated the ethnoracial composition measure into percentage Asian, Hispanic, and Black, and incorporated all covariates. Model 2 shows that as the percentage of the population that is Asian increases by 1, the number of dental offices in an area increases by a factor of 1.05 ($SE=.01$). By contrast, a unit increase in the percentage of the population that is Hispanic is associated with a decrease in the number of dental offices by a factor of .97 ($SE=.01$). Model 2 also uncovers multiple significant socioeconomic conditions. Areas with the highest ($IRR=.14$, $SE=.09$), second highest ($IRR=.20$, $SE=.12$), middle ($IRR=.14$, $SE=.09$), and second fewest resources have fewer dental offices ($IRR=.36$, $SE=.21$), on average, relative to areas with the fewest resources. That is, counterintuitively, areas with the poorest socioeconomic conditions typically have more dental offices than neighborhoods with better conditions.

Models 3 and 4 introduce interactions between socioeconomic conditions and ethnoracial composition to determine whether the association between socioeconomic conditions and dental offices changes depending on the ethnoracial makeup of that area. Following best practices for interpreting interactions in generalized models, I graphed adjusted predictions of dental offices at representative percentages of Asian and Hispanic, respectively.

Figure 1 estimated the number of dental offices in Census block groups across Worcester County by percentage of areas' populations that is Asian and socioeconomic conditions. The y-axis reflects the predicted number of dental offices in an area while accounting for covariates. The x-axis ranges from zero to 30 and reflects the percentage of the population that is Asian. Each graphed line reflects one of the five socioeconomic conditions associated with Census block groups. Two notable patterns emerge from Figure 1. First, the green line, which reflects the predicted number of dental offices for areas with fewest socioeconomic conditions typically decreases as the percentage of the population that is Asian increases from zero to 30. By contrast,

the light blue line demonstrates that the number of dental offices in areas with the second highest or best socioeconomic conditions experience a dramatic increase as percentage Asian increases. On average, only the poorest areas with the highest concentrations of Asians experience a disadvantage in dental care access. By contrast, the second richest areas have an exponential increase in dental offices as the percentage Asian increases.

Figure 1. Estimated Number of Dental Offices in Census Block Groups across Worcester County by Percentage of Areas' Populations that is Asian and Socioeconomic Conditions, 2021.

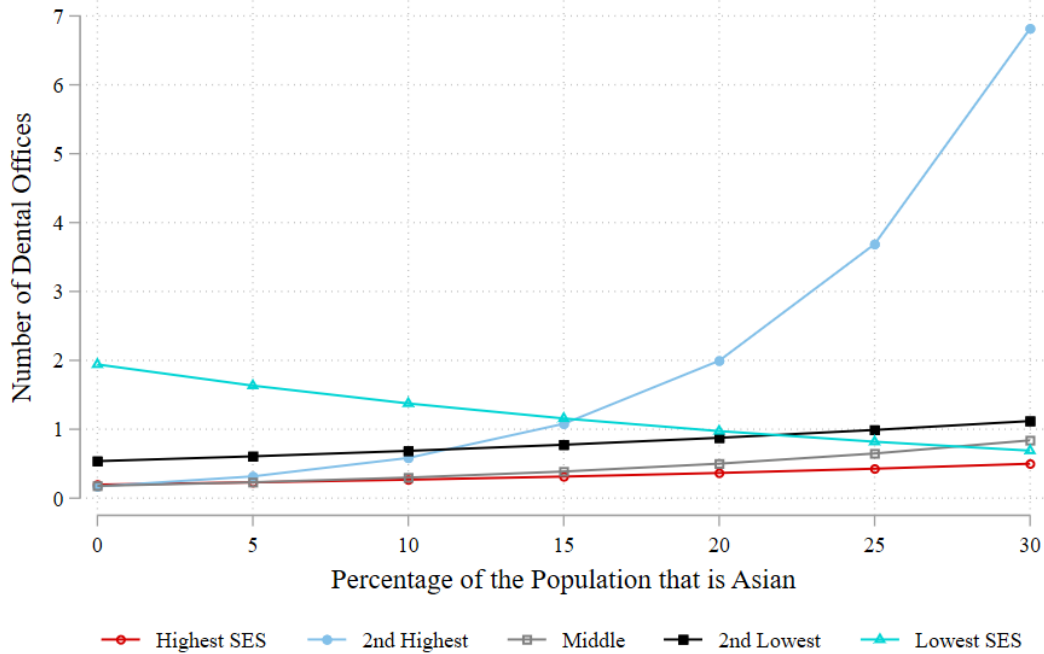


Note: Fully-adjusted estimates generated from Model 3 in Table 3 (n=571).

Figure 2 graphs the number of dental offices in Census block groups across Worcester County by percentage of areas' populations that is Hispanic and socioeconomic conditions. Figure 2 differs noticeably from Figure 1 in two respects. First, as the Hispanic concentration increases, the poorest areas experience an exponential decrease in the number of dental offices relative to Figure 1. In other words, impoverished areas that are predominantly Hispanic experience some of the steepest dental care disparities. Even for the richest areas, the slope increases by fewer than 1 dental office as the Hispanic percentage increases by ten percent. The

figure appears to show that socioeconomic resources typically provide fewer benefits in terms of dental care for predominantly Hispanic areas relative to predominantly Asian areas.

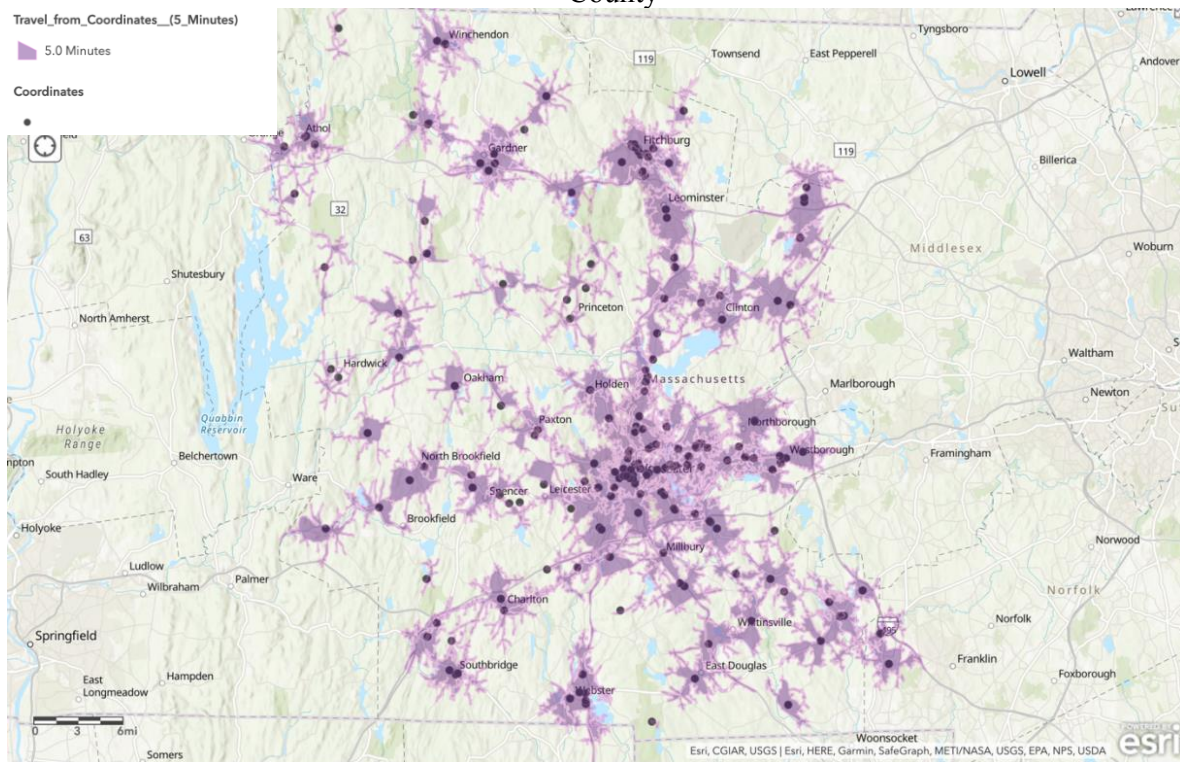
Figure 1. Estimated Number of Dental Offices in Census Block Groups across Worcester County by Percentage of Areas' Populations that is Asian and Socioeconomic Conditions, 2021.



Note: Fully-adjusted estimates generated from Model 3 in Table 3 (n=571).

There are several methods used by previous studies to examine access to health care such as geospatial analysis to identify healthcare deserts and distance models. In this study ArcGIS Online was used to visualize the geographical spacing and accessibility of the offices. The longitudes and latitudes were inputted into the map and then another analysis layer was added that shows the 5-minute drive distances from the individual office.

Figure 3. 5-Minute Drive-Time Area ArcGIS Online Mapping of Dental Offices in Worcester County



DISCUSSION

This paper has compared demographic information based on race, income, and other socioeconomic factors with data on surrounding dental offices. With the findings we can discuss health disparities and some social determinants of health to understand the patterns that emerge when looking at the correlations. Based on Table 3, we infer there is statistical significance between dental offices and race. Specifically, as the number of dental offices increases there is a higher Asian population. The opposite is true with Hispanic populations where the number of dental offices decreases with the population. Figure 1 delves more closely at the Asian

population and their socioeconomic status in relation to the dental offices. The graph shows that typically as the percentage of the population that is Asian increases, then the number of dental offices increases too. This is especially the case in areas with the 2nd highest socioeconomic status (SES) areas. This means that Asians experience fewer barriers to dental care in Worcester County, and that this is especially the case for higher SES Asian populations. In fact, there are fewer dental offices only in areas with lower SES. Contrastingly, when we analyze Table 3 and Figure 2, it appears that Worcester County does a decent job of having dental offices in areas that are more impoverished, but that it is rarer for there to be dental offices in impoverished areas where there is a large Hispanic population. In other words, it looks like the poor are being well served but only when they are white or Asian. Also noteworthy is that all the middle range SES areas do not improve access to dental care for Hispanic populations. Hispanic folks are typically not benefiting from improved SES as we see with Asian Populations in Figure 1.

To inform my findings, I return to insights from the research literature and theoretical framework. The first reason we see this trend could be due to race and how that relates to education, occupation, and income. According to a research report done in 2020 by Shauna Lo at University of Massachusetts Boston “Asian Americans have the highest median household income; ...The per capita income of Asian Americans is about 90% that of white, non-Hispanics.”¹⁷ As a group, Asian Americans in Massachusetts have high educational attainment as compared to white, non-Hispanics: 38% of Asian Americans have a graduate or professional degree as compared to 21% for white, Non-Hispanics. The population of Asian American men and women most are heavily concentrated in computer, engineering and science fields as compared to the general population¹⁷. When we understand the positive effect higher education and income have on Socioeconomic Status, we can infer that there is access to more dental care. Having more income and a higher SES status allows people to move into wealthier

neighborhoods. Additionally, if they are pursuing jobs in the science and tech fields there is a chance of living closer to healthcare establishments or more developed areas where these jobs are available.

Phillip Granberry from University of Massachusetts Boston published statistics on Latinos in Worcester and found that they have the highest percentage of their population with less than a high school diploma: 26.5%, compared to 25.1 % for Asians, 15.4% for blacks, and 11.2% for whites. At the other end of the educational scale, Latinos in Worcester have the lowest percentage of their population with at least a bachelor's degree: 12.8%, compared to 55.7% for Asians, 30.6% for whites, and 24.5% for blacks.¹⁸ When we talk about specifically Hispanic populations being underserved it is important to take into account whether occupation plays a role in where they decide to live and how those areas are served. In Worcester, Latinos are overrepresented in what are traditionally considered blue collar jobs such as farming, construction, production, and transportation. Comparatively to the Asian Populations, Latinos are underrepresented in what are traditionally considered white-collar jobs (professional and managerial).¹⁸

A continuous explanation of this correlation could be due to their appearance of redlining in Worcester County and inherent surroundings created by past segregation. As we notice trends in SES of certain populations, how does that play out in the geographic locations of housing and establishments? According to the racial majority maps, a large part of Worcester County is occupied by the majority race: White. However, the densely populated city of Worcester and Fitchburg have a much higher rate of Hispanic individuals. Aside from those there are also clustered areas with higher populations of Asian Americans. Because of redlining we understand that systematically certain groups were pushed into areas that did not have the best resources. Many of those events may have had a domino effect on today's world which could be an

explanation for the correlations we have seen.

CONCLUSIONS

Dental health remains key to one's overall health and well-being, but less research examines disparities in access to care geospatially in states that typically prioritize equitable access via healthcare policy as is the case with Massachusetts. This study merged insights from quantitative and qualitative data to examine associations between the number of dental offices and sociodemographic characteristics in 571 Census block groups in Worcester County, Massachusetts. I found that, on average, poorer Census block groups have more dental offices than richer areas. While a positive result, results also revealed that dental offices are fewer in number in areas with greater concentration of Hispanic populations. Moreover, the intersection of racial composition and socioeconomic resources is most telling such that areas with high Asian populations have extensive access to dental offices across socioeconomic conditions while access is more limited for areas with high Hispanic and impoverished populations. Overall, the present study has addressed a fundamental need to examine existing disparities in dental care access. While programs have effectively established more dental offices in socioeconomically disadvantaged areas, access inequities remain especially pronounced for neighborhoods with large Hispanic populations. Public health practitioners and policy makers should be cognizant of the disadvantages that populations may experience at the intersection of race and class rather than one or the other in isolation. Because dental health is imperative for overall health and health disparities, decision makers should ensure that dental health care for Hispanic populations is accessible to all in Worcester County.

Additionally, I gathered data on accessibility services, which is defined as the presence of bilingual workers, acceptance of public insurance, and distance from the nearest bus station.

Collecting this information involved scouring public websites and directly contacting offices to inquire about their services. Due to limited responses, I focused the present paper on the quantitative results, however I hope to continue this project and use the data collections as a further analysis on access to dental care.

REFERENCES

1. Institute of Medicine of the National Academies (IOM). *Advancing Oral Health in America*. The National Academies Press; 2011:1-248.
<https://www.hrsa.gov/sites/default/files/publichealth/clinical/oralhealth/advancingoralhealth.pdf>
2. Centers for Disease Control and Prevention (CDC). *Disparities in Oral Health*. Division of Oral Health, National Center for Chronic Disease Prevention and Health Promotion; 2021. Accessed August 12, 2022.
https://www.cdc.gov/oralhealth/oral_health_disparities/index.htm
3. Kleinberger JA, Strickhouser SM. Missing Teeth: Reviewing the Sociology of Oral Health and Healthcare. *Social Compass*. 2014;8(11):1296-1314. doi:10.1111/soc4.12209
4. Johnson V, Brondani M, von Bergmann H, Grossman S, Donnelly L. Dental Service and Resource Needs during COVID-19 among Underserved Populations. *JDR Clin Transl Res*. 2022;7(3):315-325. doi:10.1177/23800844221083965
5. Aldossri M, Saarela O, Rosella L, Quiñonez C. Suboptimal oral health and the risk of cardiovascular disease in the presence of competing death: a data linkage analysis. *Can J Public Health*. Published online September 6, 2022. doi:10.17269/s41997-022-00675-z
6. Davenport C, Elley K, Salas C, et al. The clinical effectiveness and cost-effectiveness of routine dental checks: a systematic review and economic evaluation. *Health Technol Assess*. 2003;7(7). doi:10.3310/hta7070
7. Douds AS, Ahlin EM, Kavanaugh PR, Olaghere A. Decayed Prospects: A Qualitative Study of Prison Dental Care and its Impact on Former Prisoners. *Crim Justice Rev*. 2016;41(1):21-40. doi:10.1177/0734016815611727

8. Kotronia E, Brown H, Papacosta AO, et al. Oral health and all-cause, cardiovascular disease, and respiratory mortality in older people in the UK and USA. *Sci Rep.* 2021;11(1):16452. doi:10.1038/s41598-021-95865-z
9. Northridge ME, Kumar A, Kaur R. Disparities in Access to Oral Health Care. *Annu Rev Public Health.* 2020;41(1):513-535. doi:10.1146/annurev-publhealth-040119-094318
10. McGrail MR. Spatial accessibility of primary health care utilizing the two step floating catchment area method: an assessment of recent improvements. *Int J Health Geogr.* 2012;11(1):50. doi:10.1186/1476-072X-11-50
11. Manski RJ, Magder LS. Demographic and Socioeconomic Predictors of Dental Care Utilization. *J Am Dent Assoc.* 1998;129(2):195-200. doi:10.14219/jada.archive.1998.0177
12. Chung PC, Chan TC. Association between local spatial accessibility of dental care services and dental care quality. *BMC Oral Health.* 2021;21(1):582. doi:10.1186/s12903-021-01943-z
13. Nasseh K, Eisenberg Y, Vujicic M. Geographic access to dental care varies in Missouri and Wisconsin. *J Public Health Dent.* 2017;77(3):197-206. doi:10.1111/jphd.12197
14. Luo W, Wang F. Measures of Spatial Accessibility to Healthcare in a GIS Environment: Synthesis and a Case Study in Chicago Region. *Environ Plan B Plan Des.* 2003;30(6):865-884. doi:10.1068/b29120
15. Voinea-Griffin A, Solomon ES. Dentist shortage: an analysis of dentists, practices, and populations in the underserved areas. *J Public Health Dent.* 2016;76(4):314-319. doi:10.1111/jphd.12157

16. Talbert RD, Macy ED. Former Incarceration, Time Served, and Perceived Oral Health among African American Women and Men. *Int J Environ Res Public Health*. 2022;19(19):12906.
17. Lo, Shauna. Asian Americans in Massachusetts including Boston and other selected cities: Data from the 2020 Decennial Census and American Community Survey (2022). *Institute for Asian American Studies Publications*. 48. https://scholarworks.umb.edu/iaas_pubs/48
18. Granberry, Phillip and Agarwal, Vishakha. Latinos in Massachusetts: Worcester (2021). *Gastón Institute Publications*. 278. https://scholarworks.umb.edu/gaston_pubs/27