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**Western Illinois
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Dental Care Use in the Midwest: Metro vs. Nonmetro

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Abstract

This research is about dental care use; motivations for care and likelihood of visiting a dentist or dental clinic are researched. The Midwest region was the geographical unit of analysis. Three sources of data were pooled to gain insights into user behavior, both for the metro and the nonmetro. Empirical analysis suggests that a larger proportion of minorities in the nonmetro delay dental care due to costs, 38% of the minorities compared to 5% of the Whites.

Introduction

The oral health of the population is listed as a salient policy issue in the “Healthy People 2030” initiative². For policy purposes, lawmakers and healthcare practitioners need small-area data about population’s overall condition of mouth and teeth³. However, oral and craniofacial health and surveillance systems are yet to be operational in most of the states; for example, the Illinois Department of Public Health is hoping to get the system up and running in the next 12-18 months⁴. Some data such as the ratio of population to dentists can be sourced at the county level, but data such as the proportion of “population with untreated tooth decay” are unavailable at the county level⁵; the best one could do is

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² <https://health.gov/healthypeople/objectives-and-data/browse-objectives#health-conditions>.

³ <https://dph.illinois.gov/topics-services/prevention-wellness/oral-health/oral-health-data.html>.

⁴ For a discussion of policy processes, see Athiyaman, A. (2023). Health Policy for Rural Illinois, Data for Policy Development, *Research Brief*, February 25, 5(4), 1-10. Available: http://www.iira.org/wp-content/uploads/2023/03/RB5_4-Health-Policy-for-Rural-Illinois-Data-for-Policy-Development.pdf.

⁵ One could apply to NHANES research data center for access to state or county data, but data may not be valid, representative of the geography.

extract oral health data for the US Census regions such as the Midwest. This strategy is used in this paper; oral health data for the Midwest region⁶ has been assembled from data sources listed in Table 1 and metro / nonmetro differences in dental care use were examined. Research questions that guided data analysis include:

1. What are the primary 'drivers' of oral health; for example, problem removal, problem avoidance, social approval, etc.?

2. Do motives for oral health differ between the metro and the nonmetro?
3. Does the modal value of the variable "time since last dental exam" differ between the metro and the nonmetro?
4. Did more people in the nonmetro delay dental care due to cost?
5. Does demographics play a role in explaining one's dental care use?

Table 1: Dental Data Sources

Dataset	Geographical Coverage
National Health Interview survey (NHIS)	Midwest, metro and nonmetro.
Behavioral Risk Surveillance System (BRFSS)	Midwest and Illinois; for both the regions, metro and nonmetro data are available.
Medical Expenditure Survey (MES)	Midwest, no metro / nonmetro breakdown.
National Ambulatory Medical Care Survey (NAMCS)	The nation; metropolitan /non-metropolitan data are available.
Illinois Department of Public Health; http://healthcarereportcard.illinois.gov/maps	Some county-level data are available for Illinois counties; for example, ED visits for dental issues.
Center for Disease Control; https://nccd.cdc.gov/DOH_MWF/Default/CountyList.aspx	Water fluoridation data for all US counties.
Area Health Resource File, 21-22	US counties; health shortage areas for dentists.
Center for Disease Control; Oral Health Data by Location, CDC www.cdc.gov/oralhealthdata/	State level data, doesn't contain metro / nonmetro breakdown; can be aggregated to the US census regions. Data has to be downloaded one variable at a time.

⁶ The Midwest region includes the East North Central division: Illinois, Indiana, Michigan, Ohio, and Wisconsin; and the West North Central division: Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota.

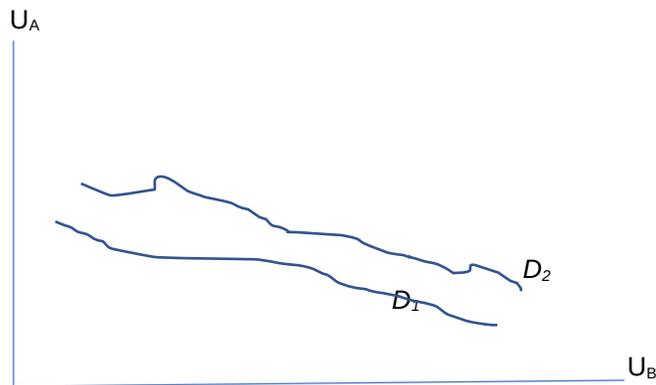
Theory

Consider the oral care consumption function:

$$D = f(U_A, U_B)$$

where, oral care consumption D is a function of the utility U of the people A and B. Figure 1 shows the indifference curves; they show the different combinations of utilities that give the same level of consumption.

Figure 1: Indifference Curves, Oral Care Consumption



If the utility of each individual depended only on what the individual consumed, then making both A and B better off would require movement from D_1 to D_2 . This would be the case if the motive for oral care is problem removal, for example, tooth pain, and A and B live in a dental care shortage area; increasing the number of oral care providers in the shortage area should benefit both A and B.

In reality, oral care could be triggered by social approval motives, for example, reference group's approval for whiter

teeth. In this scenario, dental care depends not only on one's consumption, but also on the consumption of others. In this context, increasing the number of oral care providers may not influence A and B's dental care consumption.

The implication? Motives for dental care should be considered before examining dental care use data. Table 2 lists the motives that could be relevant for dental care use⁷.

⁷ See, for example, Lerner, R. M. (2001). *Concepts and theories of human development*. Psychology Press.

Table 2: Motives for Dental Care Use

Motive	Relevance for Dental Care
Problem removal	This motive is active when problems such as tooth ache are present; often, relief is sought by visiting a healthcare professional.
Problem avoidance	Preventive care to maintain good oral health, for example, oral exam, teeth cleaning, and routine x-rays.
Social approval	Reference group approval or social norms may dictate use of 'cosmetic dentistry' such as teeth whitening and tooth and gum contouring.

Methodology

Three different datasets were used to address the research questions. Data on “motives for dental care use” were accessed from National Ambulatory Medical Care Survey (NAMCS), 2019⁸. Items with the following codes were extracted for both the metro and the nonmetro⁹:

15000: symptoms of teeth and gums;
15001: toothache;
15002: gum pain;
15003: bleeding gums;
26751: dental abscess;
26752: dental cavities.

In order to explore the frequency of dental visits by geography, and to understand the reasons for delaying dental care, data were obtained from the National Health Interview Surveys (NHIS) for 2018, 2020, and 2021¹⁰. Similarly, Behavioral Risk Factor Surveillance System (BRFSS), 2018 and 2020, were mined to gain information about dental care use by demographics¹¹. Table 3 lists the operational definitions of the variables.

⁸ The 2019 NAMCS traditional or core sample included 3,000 physicians: 2,800 Medical Doctors and 200 Doctors of Osteopathy; see https://www.cdc.gov/nchs/ahcd/namcs_participant.htm.

⁹ NAMCS do not tabulate data for the census regions such as the Midwest.

¹⁰ NHIS interviews a national sample of 30,000 adults and 9,000 children; the sample elements include households and noninstitutional group quarters such as homeless shelters and rooming houses; see <https://www.cdc.gov/nchs/nhis/data-questionnaires-documentation.htm>.

¹¹ BRFSS completes more than 400,000 adult interviews each year; topics covered include health conditions and use of preventive services; see <https://www.cdc.gov/brfss/index.html>.

Table 3: Definitions of Variables

Variable	Operational Definition	Source
LUPPRT	Lost all upper & lower natural teeth; Binary, Yes / No responses	NHIS 2018
AHCAFYR3	Could not afford dental care in the past 12 months; Binary, Yes / No responses	
SINCOVDE	Have a single service (insurance) plan; Binary, Yes / No responses	NHIS 2021
REGION	Household region; four levels: Northeast, Midwest, South, West	
URBRRL	NCHS urban-rural classification scheme for counties; 1-3 = Metro; 4 = Nonmetro	
SEX	Gender of the respondent; Binary, Female / Male	
EDUCP	Educational level of the respondents; 11 census categories; 0 = never attended to 10 = Professional School or Doctoral Degree	
RATCAT	Ratio of family income to poverty threshold; 14 levels; 1 = 0-.49 to 14 = 5 or greater.	
AGEP	Age of the respondent; 2 levels: 18-84 and 85+	
DENPREV	Time since last dental exam; 7 levels: 0 = Never; 6 = 10 years ago or more	NHIS 2020
DENDL12M	Delayed dental care due to cost	
LASTDEN4	Last visited dentist or dental clinic; 4 levels: 1 = anytime less than 12 months ago; 2 = within the past 2 years; 3 = within the past 5 years; 4 = 5 or more years ago.	BRFSS 2020
RMVTETH	Number of permanent teeth removed; 3 levels: 1 = 1-5; 2 = 6 or more; 3 = all.	BRFSS 2018
EXTETH65	Adults aged 65+ who have had all their natural teeth; 2 levels: 1 = no; 2 = yes	

Note: Demographic variables were sourced for all the datasets, but the demographics are listed only for NHIS 2021.

Data were analyzed by computing frequency counts, descriptive statistics, and crosstabulations of variables.

Multidimensional contingency tables were analyzed using the loglinear approach.

Findings

Motives for Dental Care Use

Of all the three datasets considered for this paper, only NAMCS contained

information about motivations for dental care use, at the national, metro level; nonmetro had little or no data. Table 4 shows the ‘drivers’ of oral care behavior; all ‘problem removal’ related.

Table 4: Reasons for Dental Care Use

Reason for Care	% of Respondents	Motive Category
Symptoms of teeth and gums	68%	
Dental abscess	4%	Problem removal
Dental cavities	28%	
N	731,505	

Note: Symptoms of teeth and gums include toothache, gum pain, and bleeding gums.

Source: NAMCS, 2019; see footnotes 8 and 9.

Table 5 shows the impacts of demographics on “reasons for dental care”. A majority of females, 94%, seek care for teeth and gum symptoms. In contrast, dental cavities afflict most of the males ($\phi = 0.89, p < .05$). Similarly, one’s race is a correlate of dental care use;

minorities, or non-White seek care mostly for toothache whereas only 9% of the Whites report seeking dental care for toothache; a majority of Whites seek dental care to manage symptoms of teeth and gums ($\phi = 0.77, p < .05$).

Table 5: Reason for Care by Demographics

(i) Impact of Gender on Care

Reason for Care	Female	Male
Symptoms of teeth and gums	94%	16%
Dental abscess	6%	-
Dental cavities	-	84%
N	487,684	243,820

Note: $\chi^2 = 582,156, p < .0001$

(ii) Impact of Race on Care

Reason for Care	White	Non-White
Symptoms of teeth and gums	54%	-
Toothache	9%	~100%
Dental abscess	4%	-
Dental cavities	33%	-
N	628,923	102,582

Note: $\chi^2 = 429,809, p < .0001$.

Source: NAMCS, 2019.

Dental Care Use

When it comes to having dental health insurance, race matters; specifically, the odds of holding a single service insurance plan for dental care in the nonmetro is 3.47 times more for the Whites than the Blacks¹². In general, proportionally more non-Whites score poorly in oral care; for example, 3% of the minorities in the

nonmetro report that they never had a dental exam compared to 1% for the Whites. Furthermore, a higher proportion of non-Whites in the nonmetro delay dental care due to cost; for example, 38% of “other races” in the nonmetro delayed care due to cost compared to 5% for the Whites (Table 6).

Table 6: Race Impacts on Dental Care Use

(i) Dental Insurance, Possession of a Single Service Plan

	White		Black		Other Races	
	Metro	Nonmetro	Metro	Nonmetro	Metro	Nonmetro
Yes	46%	34%	31%	13%	35%	22%
N (Weighted)	61.23mil	20.55mil	8.10mil	317,764	3.93mil	504,988

Note: All χ^2 significant at the $p < .05$ level.

(ii) Time Since Last Dental Exam

	White		Black		Other Races	
	Metro	Nonmetro	Metro	Nonmetro	Metro	Nonmetro
Never	0.32%	1%	0.19%	-	2%	3%
Within the past year	70%	60%	55%	68%	54%	53%
Within the last 2 years	12%	13%	15%	5%	16%	23%
Within the last 2+ years	18%	27%	30%	27%	28%	21%
N (Weighted)	30.07mil	10.57mil	4.01mil	199,689	2.02mil	247,664

Note: All χ^2 significant at the $p < .05$ level.

Source: NHIS, 2021, see footnote 10.

¹² Odds ratio were computed using data from Table 6, for Whites vs. Blacks.

Figure 2 shows changes to dentist or dental clinic visits by race; the proportions of Blacks who have last visited a dentist / dental clinic more than 5+ years ago

have changed to the better since 2018, from 12% in 2018 to 10% in 2020.

Figure 2: Last Visit to a Dentist or Dental Clinic by Race



Source: BRFSS, 2018 and 2020; see footnote 11.

Finally, a logit model was calibrated to predict the probability of dental care use; the model included race, gender, and “number of permanent teeth that have been removed” as predictors.

higher the number of teeth loss due to decay or gum disease, the less likely is the visit to a dentist. Finally, compared to Hispanics, Whites, Blacks, and other races are more likely to use dental care.

The results of the logit run are shown in Table 7; the model fits better than an intercept only model. All parameter estimates are statistically significant; compared to females, men are less likely to visit a dentist or dental clinic. Also, the

Table 7: Results of the Logit Analysis

(i) Model Fit Statistics

Criterion	Intercept Only	Intercept and Covariates
AIC	78276	72190
SC	78285	72244
-2 Log L	78274	72178

(ii) Test of Global Null Hypothesis, Beta = 0

Test	Chi-Square	DF	P > Chi-Square
Likelihood ratio	6096	5	<.0001
Score	6156	5	<.0001
Wald	5594	5	<.0001

(iii) Maximum Likelihood Estimates

Parameter	DF	Estimate	Std. Error	Wald Chi-Square	p > Chi-Square
Intercept	1	1.55	.0443	1238	<.0001
Gender (Male)	1	-.20	.01	123.70	<.0001
Race (Whites compared to Hispanics)	1	.547	.04	170.08	<.0001
Race (Blacks compared to Hispanics)	1	.32	.05	37.85	<.0001
Race (Other races compared to Hispanics)	1	.32	.06	24.96	<.0001
No. of teeth removed	1	-.92	.01	5486	<.0001

Source: BRFSS, 2020.**Summary and Conclusion**

This paper profiles dental care use among people in the Midwest; paucity of data at the state level – most states are yet to deploy fully functional oral and craniofacial health and surveillance systems – motivated us to work at the US Census - region level, the Midwest region.

Data were analyzed for both the metro and the nonmetro regions of the geography.

Three datasets were used to gain insights into dental care use: National Ambulatory Medical Care Survey (NAMCS), 2019; National Health Interview Survey (NHIS),

2018, 2020 and 2021, and Behavioral Risk Factor Surveillance System (BRFSS), 2018 and 2020.

Results of data analysis indicate that:

- i. Preventive oral care is seldom a motive for visiting a dentist or dental clinic; most dental care use is of the problem removal type, for example, toothache.
- ii. A majority of females, 94%, seek care for teeth and gum symptoms. In contrast, dental cavities afflict most of the males.
- iii. The odds of holding a single service insurance plan for dental care in the nonmetro is 3.47 times more for the Whites than the Blacks.
- iv. A higher proportion of minorities in the nonmetro delay dental care due to costs; 38% of the minorities compared to 5% of the Whites.
- v. the proportions of Blacks who have last visited a dentist / dental clinic more than 5+ years ago have changed to the better since 2018, from 12% in 2018 to 10% in 2020, and
- vi. compared to Hispanics, Whites, Blacks, and other races are more likely to use dental care.

care in the nonmetro is lacking, difficult to find, or nonexistent.

Policymakers craft policy to respond to some problem, but lack of data on dental care could limit problem identification, particularly at the small-area level such as a county. Oral health policies should be built on scientific evidence; this research has filled gaps in knowledge about dental care use at the nonmetro level.

There are at least two takeaways: (i) this research confirms our earlier conclusion that disparities in healthcare are more pronounced in the nonmetro and among Hispanics¹³; and (ii) essential data on oral

¹³ Athiyaman, A. (2023). Health and healthcare disparities in Illinois: Metro vs. Nonmetro. *Research Brief*, 5(3), February 16. Available http://www.iira.org/wp-content/uploads/2023/02/RB5_3-Health-and-Healthcare-Disparities-in-Illinois-Metro-vs-Nonmetro.pdf.