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Research Article

Behavioral/Mood Disorders and Opioid-Drug Use in Chicago Community Areas Associated with Oral Health and Oral Surgery Need

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Abstract

Introduction: We hypothesize gender, race in Chicago's community areas (CAs) associated significantly with mood and depressive-behavior disorders, drug related hospitalizations (MDD/DRH) and oral health problems and need for oral surgery services.

Methods: We reviewed 18,846 dental records (AxiUm) sorted by zip codes associated with CAs. "Med Alerts" and 185 (14 types) neurotropic medications identified MDD/DRH. Chicago's Health Atlas 2.0, 77 CAs provided age-adjusted prevalence rates for 29 MDD/DRH related variables, with ORs at 95% confidence limit. Linear regression and relative risk (RR) predicted racial and gender associations for MDD/DRH and opioid prescriptions sites (DEA-2017+ARCOS database). We also tested significance at 95% CI for residents from 16 CAs for oral health association with high MDD/DRH probability by counting decay, missing, and filled teeth (DMFT), bleed on touch (BT), periodontal clinical attachment loss and use of oral surgery services.

Results: CAs significantly associated to MDD/DRH variables. MDD/DRH and opioid use were also significantly associated to non-Hispanic Black (NHB) > other persons. NHB from specific geographic CAs showed ANOVA's significant probability with OR (at 95% CI) and RRs for behavioral disorder indicators. Significantly (p<0.0001) oral health problems and need for oral surgery service consulting associated with medication users and MDD/DRH subjects identified by gender (F>M) and race/ethnicity (NHB>other).

Conclusion: Limitations included self-reporting and reliance on dental college populations although we showed statistically significant odds ratios and relative risk for MDD/DRH related to race and gender's oral health issues and oral surgery needs to suggest a broader role.

Introduction

Mood anxiety and depressive disorders (MDD) are increasing in US society. Oral health issues in relation to MDD are usually reported as a factor in behavioral issues, such as eating disorders or mental illnesses such as, dementia and schizophrenia [1-3]. We suggest a lack of direct measurements of oral health variables with correlations to community areas is anticipated to identify additional associations that require further study. For example, reasons for minority racial diverse populations and gender effects on presence of behavioral disorders and drug use problems. A review search using PubMed finds 69 articles discussing oral health and mental disorders. Reported is a 3-fold increased caries and missing teeth rate among individuals suffering from substance use disorders. A recent meta-analysis review used 28 studies to identify 4086 patients with substance use disorders compared to 28031 undiagnosed control patients. Results showed significant higher numbers of decayed, missing, filled surfaces, fewer restorations and increased periodontal disease [3,4]. However, racial and gender effects are infrequent areas for comment.

Few studies fulfill criteria needed to specify mental and oral health relationships. Studies lack assessment of oral health problems, and associated behaviors issues related to demography and epidemiology. For example, 'Is lack of access to oral health a surrogate for lack of access for psychiatric care? Many published reports focus on substance abuse use issues and dental care, oral health professional prescription activity and oral health needs. These reports unfortunately do not often consider community area local geography or confounding cultural and socioeconomic associations understand racial/ethnic behavioral problems in specific environmental context [4].

Violence, opioid and other recreational drug use in public areas often contribute to stressful events. Increases in frequency and severity of these types of events frequently parallel climatic seasons and resident anxiety and depression levels [5,6].

Chicago's, behavioral disorders cases predominant in specific community area locations and not in others ("Southside versus Northside") producing an uneven distribution [7]. Furthermore, community areas identified with a lack of greenness or open land encouraging physical activity in urban settings amplify racial disparity issues and high numbers of mood and anxiety disorders cases [8-10]. Mood depression disorders often associate with recreational drug use to include opioids overdoses and hospitalizations. 8 Notable are increases in opioid use and mood disorder's incidence associated with poor oral health, specifically periodontitis [2,11]. Opioid users also use alcohol, and use of additional behavior altering drugs further increases suicides, poverty, and accidents leading to anxiety and depression disorders. Our study investigates these behavioral indicators interactions with lifestyle, demographic and epidemiology factors to include daily life stressors, such

as, oral health issues [12]. Our approach has limitations because we lack prospective data. This limits casual insight for lack of poor behavioral treatment responses; poor behavior modification or acute mood anxiety disorder severity spikes in community areas [13].

Poor oral health, "gum" diseases (periodontitis) is identified with mood disorders and opioid use [2,11]. However, oral disease such as, periodontitis may also result from mood disorder treatment side effects. One common side effect is, "dry mouth", xerostomia, with decreased salivary flow. A reduction in saliva alters microbiome and saliva chemistry, (e.g., lacto-peroxidase, mucins, sialoproteins, proteoglycans, pH regulator, variety of nutrients), or immunity (e.g., antibodies, immune factors). A loss of saliva also accelerates tooth erosion and enhanced root, cementum sensitivity. Clinical attachment loss (CAL) and/or increased rates of dental decay increases loss of teeth, and periodontal disease [14-20]. For individuals with behavioral disorders visiting the dentist creates anxiety and phobias ("blood-injection-injury") fostering somatic reactions, for example, gagging [16] and reduced acceptance of dental care leading to more missing teeth [1,2].

Periodontal studies show an association to systemic disorders but assessment and accuracy varies [17,24]. Prevalence of periodontal disease and mood disorders in US both are relatively high. 46% of the US adult population, 30 years or older, about 65 million adults, presents with periodontitis and 8.9% exhibit severe periodontitis; [20,21] while among adults anxiety and depressive disorders; occurs in about 18% of the population with 40 million persons from 18 years to older ages. 36% receive treatment for mood disorders, while about 68% receive periodontal scaling and removal of periodontal plaque with yearly visits. This difference in treatment frequency suggests oral health examination can be an avenue to detect mood disorders. (https://www.statista.com/ statistics/187892/persons-with-a-dental-visit-in-the-past-year-in-the-us-since-1997/). We hypothesize residents from specific community area locations in Chicago are more probable to present with poor oral health and mood-behavioral disorders and drug related hospitalizations. This is important because these are racial disparity and gender issues.

Methods

Methods: Survey data included, zip code, (tabulation areas) and census data obtained from, Chicago Health Alas 2.0 (https://www.chicago healthatlas.org/healthy-Chicago) and 2018 Illinois Behavioral Risk Factor Surveillance System (BRFSS).(https://www.census.gov/ geo /reference/zctas.html; https://factfinder.census.gov /faces/nav/jsf/pages/index.xhtml). Survey questioned adults had at least one tooth extracted, or all teeth extracted to obtain age-adjusted percentage at 95% confidence interval. Other respondents indicated some missing teeth while others, do not know or refused to answer. Census data provided total community area population.

Determination of Gender and Ethnicity: Gender and ethnicity obtained from each of the above databases and from College of Dentistry, were self-reported records from residents of community areas. Where available, weighted and age-adjusted prevalence rates are used. Confounding effect was minimized with stratification and randomization (test set of community areas) controlling for demographics; restriction testing (selection of community areas served by College of Dentistry), and multivariate (ANOVA) determinations of geographic locations in Chicago by matching north-side and south-side geographic community areas. Data source for community area indicators often did not consistently provide highest and lowest incidence prevalence rates. This denied us the opportunity for disparity measures for absolute and relative values from each community area.

Health Records and Testing: Axium UIC College of Dentistry are self-reported health records. We rank medical conditions and habits and do not exclude subjects because of diagnosed systemic disease, medication or habit identified. Ranked from most common are: alcohol and tobacco use problems; hypertension; arthritis; diabetes type 2, and anxiety and depression. There was no population floor used for correlation, linear regression and correlation analyses.
Testing Community Areas: Initial study included 77 Chicago's community areas (CAs). A test set of 29 CAs included random selected "Central Southside"; "Northside", and "Westside" community areas, with restrictive matching for gender based on at least 50% representation of resident population. Our gender and racial distribution of records were: male (9573)/female (9273); (F: (13.3%); NHW (11.0%); NHB (56.6%); Asian (3.8%); M: H (10.8%); NHW (14,7%); NHB(47.0%); Asian(4.2%).

Dental Oral Health: College of Dentistry, dental records, "Axium" provided examination data to include number of teeth decayed, missing, filled and surfaces of teeth covered with restoration (DMFS), bleeding time (BT) and periodontal loss of attachment. The latter assessed by periodontal probe depth (>3mm) (PDP). 97-98% of adult population had decay, and/or missing at least one tooth. Percentages of decay of at least one tooth, shows males (92%) and females (93%). 18,846 dental records were retrospectively reviewed for MDD; oral health and oral surgery services requests to provide a cross-sectional observation of community area's residents in Chicago serviced by College of Dentistry. We recorded, 185 (14 types) medications (antidepressants: 15.6% predominant) indicating presence of behavioral disorder. This association was unverified by random testing for medication use or review of medical records. However, sixteen CAs with recorded MDD prevalence rates provided oral surgery request records. Our statistical calculation included correlation, p-Pearson values, linear regression, and RR results identified following significant association OR at 95% CI. Chicago Health Atlas 2.0 (CHA) significance at 95% CI also determined association of CAs and opioid prescriptions sites (DEA-2017 + ARCOS database sites).

Periodontal Depth Probe: Recorded PDP using only the UNC15 periodontal probe instrument. Probe depths at mesial, mesial-buccal, buccal, distal-buccal, mesial-lingual, lingual and distal-lingual surfaces inform us about loss of attachment. Each tooth from the upper right maxillary quadrant: second molar (#2); first molar (#3); second premolar (#4); first premolar (#5); canine (#6); lateral incisor (#7), and right central incisor (#8) examined. We report, CAL (calculated attachment loss) with a mean and total value for each tooth and probe depths (PDP) >3mm from all dimensions.

Total number of probe recordings (PDP) numbers: females with MDD: 4927 +/- 75.0; no MDD 4646+/-79.0 vs. Males: MDD: 4677+/-52.0; no MDD 4577+/-78.0. Bleeding on touch: Touch and bleed recorded for each tooth #2-#7; buccal and lingual surfaces using this designation: yes = 1, or no =0 for all 6 dimensions.

Periodontal Definition of Severity of Diseases:
For examination of periodontal disease severity in population we use the WHO (1982), "Community periodontal index of treatment needs", supported by the Academy of Periodontics (2012) report. Assessment used both buccal and lingual dimensions as listed above to determine loss of gingival attachment > 3mm values for teeth #2-#7. This criteria determines presence of at least mild periodontitis describes as, "≥2 interproximal sites with clinical attachment loss (CAL)≥3 mm, and ≥2 interproximal sites with periodontal probing depth (PPD)≥4 mm (not on same tooth) or one site with PPD≥5 mm" [21,22].

Oral Surgery Services: Oral surgery service examination used MDD-behavioral disorder identified areas vs non-associated MDD areas. Reviewed AxiUm dental records (2012-2019) and applied searched topics that included limited oral evaluation-problems. Topics were comprehensive oral examination and evaluation; implant, removal; biopsy of oral tissues, hard; biopsy of oral tissue, soft; unspecific oral surgery procedure, oral surgery consultation. Total services requested with mood disorder present: 750 vs. no mood disorder: 239.
Statistics: One-way and multivariate analysis (ANOVA), odds ratios at 95% confidence interval used to attain probability and significance and relative risk ratio results assessed gender and race/ethnicity associations. Moreover, XLSTAT software (https://www.xlstat. com/en/) calculated correlations, p-Pearson values at 95% confidence interval for standard and linear regression predictive residual values to test rejection of null hypothesis.

Results

In Illinois, mood disorders (MDD) diagnosis occurred in 1,746,541 persons, with a weighted percent of 17.1% and 16.5%-19.0% at 95% CI (2017). Among patients at UIMC and UIC COD, MDD treatment occurs in 20% of the medical center patient population. Anxiety treatment in about 13% and 5% diagnosed respectively with attention deficit disorders (ADHD/ADD). Non-Hispanic Black (NHB) patients have the highest overall rate at 20% diagnosed with depression disorders while non-Hispanic White persons were diagnosed 18% with anxiety disorders or ADHD/ADD. (https://vcha.uic.edu/units/ population-health-sciences-program-phsp/). Examination of zip code designated community areas in Chicago served by the UI medical center and College of Dentistry used to determine any association between behavioral disorder diagnoses, and racial, gender effects on oral health and oral surgery needs. MDD Hospitalizations

Shows Association to Six Behavioral Disorder Variables in 77 Community Areas in Chicago.

Table 1: Statistically significant variables most correlated with MDD hospitalizations in 77 Chicago community areas.

MDD HOSPITALIZATIONS PROBABILITY SIGNIFICANCE BEHAVIOR VARIABLES CHARACTERIZING CHICAGO'S 77 COMMUNITY AREAS						
Source	Value	Standard error	t	Pr > |t|	Lower bound (95%)	Upper bound (95%)
Opioid-related overdose deaths	0.101	0.047	2.135	0.044	0.003	0.199
Homicides	0.752	0.298	2.523	0.019	0.135	1.369
Drug-related hospitalizations	-1.254	0.086	-14.621	<0.0001	-1.431	-1.076
Alcohol-related hospitalizations	-0.247	0.023	-10.847	<0.0001	-0.294	-0.199
Behavioral health hospitalizations	3.341	0.151	22.175	<0.0001	3.029	3.653
Schizophrenic disorder hospitalizations	-1.224	0.085	-14.393	<0.0001	-1.4	-1.048

Table 2: showing statistically significant positive correlation between DRH, race, and other variables in 77 Chicago community areas.

DRUG RELATED HOSPITALIZATIONS PROBABILITY SIGNIFICANCE BEHAVIOR VARIABLES CHARACTERIZING CHICAGO'S 77 COMMUNITY AREAS						
Source	Value	Standard error	t	Pr > |t|	Lower bound (95%)	Upper bound (95%)
NHW (%)	-0.065	0.054	-1.21	0.238	-0.176	0.046
NHB (%)	-0.162	0.074	-2.172	0.04	-0.316	-0.008
Hispanic (%)	-0.042	0.049	-0.865	0.396	-0.142	0.058
Alcohol-related hospitalizations	-0.192	0.014	-13.3	<0.0001	-0.222	-0.162
Behavioral health hospitalizations	2.564	0.078	33.021	<0.0001	2.404	2.725
Schizophrenic disorder hospitalizations	-0.955	0.044	-21.81	<0.0001	-1.046	-0.865
Mood and depressive disorder hospitalizations	-0.72	0.049	-14.621	< 0.0001	-0.822	-0.618

In Table 1. Behavioral health in 77 Chicago's CAs examined by assessing probability to reject null hypothesis to indicate, community areas are associated with behavioral disorders. Opioid related overdose deaths (p=0.044; Pr>[t]); accidents (p-0.050, Pr>[t]); homicides (p=0.019, Pr>[t])), and behavioral health hospitalizations (p<0.0001), all reject null hypothesis. Drug related hospitalization (DRH) (Table 2) examined in 77 CAs of Chicago showed significant probable association related to race. NHB population had a p=0.040 probability for drug related hospitalization. Other race/ethnicity did not show this level of probable association. However, DRH with high significant probability associated to four other behavioral indicators (Table 2). This result indicated community area resident behavioral disorders are associated with racial/ethnicity disparity issues.

Table 3: Statistically significant correlation between race and MDD in 77 Chicago community areas.

RACIAL CORRELATION to MDD ASSOCIATED VARIABLES					
	Tobacco Related Death	Firearm Related Homicide	Homicides	Injury Death	Vehicle Crash
NHB	p= 0.001	p<0.0001	p=0.001	p=0.003	p=0.037
NHW	0.366	0.106	0.11	0.304	0.364
Hispanic	0.012	0.063	0.064	0.043	0.125

In Table 3, MDD association to NHB compared to other race/ethnicities is identified with significant probability (all positive correlations) to tobacco related deaths (p = 0.001), firearm-related homicides (p <0.0001), homicides (p = 0.001), injury death (p = 0.003), and vehicle crashes (p = 0.037). In contrast, NHW person in 77 CAs have a significant probability with inverse correlation for behavioral health hospitalization (corr: -0462, p=0.000); schizophrenic disorder hospitalization (corr:-0.404, p=0.003); MDD hospitalization (corr: -0.375, p=0.006), and poverty level (corr:-0.762; p<0.0001). Further income diversity for NHB inversely correlated with a high level of probable significance (corr: -0.643; p<0.0001) while NHW showed positive correlation: (corr: 0.711; p<0.0001). These results suggest racial diversity issues in Chicago can characterize probability for presentation of behavioral disorder associations in specific CAs.

Behavioral Indicators Association in Community Areas

Observing race/ethnicity effects associations among 77 CAs, we tested the hypothesis, race/ethnicity residence in specific geographic locations for community areas effect probability for presence of behavioral disorders and activities. We segmented Chicago's CAs into Northside (11 CAs); Westside (21 CA), and South-Central (21 CA) to show associations to behavioral indicators. CA demographics shows predominance of racial/ethnicities in each geographic location. For example, Non-Hispanic persons predominantly reside in Westside, and Northside community areas (CA) has a predominant non-Hispanic White/Asian (SW/SE) demographic. Non-Hispanic Black/Hispanic persons predominantly reside in Southside CAs. Using geographic locations, we calculate significant differences for presentation of behavioral disorders and habits. CAs: North (N) vs South (S), North vs West (W) and South vs West and we determined significant associations to seven different behavioral indicators.

BEHAVIORAL INDICATORS ASSOCIATIONS in COMMUNITY AREAS			
	North vs South	North vs West	South vs West
Mood and Depressive Disorder Hospitalizations	ANOVA: P=0.1299 OR:1.273 (at 95% CI 1.086 to 1.376)	ANOVA: P=0.0653 OR:1.464 (at 95% CI: 1.306 to 1.643)	ANOVA: P=0.2494 OR: 1.289 (at 95%: CI:1.156 to 1.438)
Drug-Related Hospitalizations	ANOVA: P= 0.00158 OR: 3.004 (at 95% CI 2.419 to 3.728)	ANOVA: P=0.00526 OR: 4.390 (at 95% CI 3.568 to 5.407)	ANOVA: P= 0.1427 OR: 1.462 (at 95% CI 1.267 to 1.688)
Opioid-related overdose deaths	ANOVA: P= 0.0183 OR:1.918 (at 95% CI 0.9542 to 3.8578)	ANOVA: P= 0.0033 OR: 3.0069 (at 95% CI 1.563 to 5.782)	ANOVA: P= 0.0295 OR: 0.6103 (at 95% CI 0358 to 1.038)
Homicides	ANOVA: P= 0.0018 OR: 9.3577 (at 95% CI 2.843 to 30.790)	ANOVA: P= 0.00122 OR: 10.362 (at 95% CI 3.166 to 33.906)	ANOVA: P= 0.7077 OR:1.107 (at 95% CI 0.6638 to 1.847)
Alcohol-related hospitalizations	ANOVA: P= .06473 OR: 0.7945 (at 95% CI 0.0647 to 0.9716)	ANOVA: P= 0.64877 OR: 0.9510 (at 95% CI 0.7863 to 1.1472)	ANOVA: p=0.00704 OR: 0.7556 (at 95% CI 0.6192 to 0.9220)
Behavioral health hospitalizations	ANOVA: P= 0.0551 OR:1.437 (at 95% CI 1.327 to 1.556)	ANOVA: P= 0.0316 OR: 1.380 (at 95% CI 1.278 to 1.489)	ANOVA: P= 0.1885 OR: 1.0415 (at 95% CI 0.969 to 1.118)
Schizophrenic disorder hospitalizations	ANOVA: P= 0.2184 OR:1.362 (at 95% CI 1.826 to 1.5703)	ANOVA: P= 0.1293 OR:1.628 (at 95% CI 1.4196 to 1.8679)	ANOVA: P= 0.3906 OR: 1.1949 (at 95% CI 1.0353 to 1.3560)

Table 4: Statistical significance of certain behavioral indicators in Chicago based on geographical region: North vs South vs West.

Citation: Beckerman JJ, Dachman JC, Schwartz LR, Schwartz JL (2024) Behavioral/Mood Disorders and Opioid-Drug Use in Chicago Community Areas Associated with Oral Health and Oral Surgery Need. Open Access J Dent Oral Surg 5: 1075

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(Table 4) DRH (N vs S; N vs W); opioid related overdose deaths (all comparisons); homicide (N vs S; N vs W), and alcohol-related hospitalizations (S vs W) produced a significant ANOVA probability and OR at 95% CI results (Table 4). Homicide has the highest significant probability to occur based on geographic location; however, other behavior indicators listed above, also identified with significant probability to associate with racial/ethnicity and CA location.

This analysis addressed behavioral indicators associated with CA for an indirect detection of race/ethnicity effect. To extend this and to determine possible confounding effect between behavioral indicators in North or South CAs we show in Table 5 an association with mood and drug related hospitalization (MDDH/DRH) and probable association to opioid related overdose deaths; accidents, homicides, and behavioral health hospitalizations (BHH). Noted in Table 5, only MDDH/DRH associated to BHH to show OR at 95% CI significant probability. Although we noted a confounding effect from use of BHH and other behavioral indicators associated, with 77 CA because not every CA had assessable correlations and p (Pearson) levels to determine significant probabilities and this created an imbalance in values used to test ANOVA. Subsequently we required more direct assessment of each geographic location for racial/ethnicity effects on specific behavioral disorder presentations.

Table 5: showing association with mood and drug related hospitalization (MDDH/DRH) and probable association to opioid related overdose deaths; accidents, homicides, and behavioral health hospitalizations (BHH) broken down by different community areas.

Probability Assessment for MDD and Drug Related Hospitalizations Associated with Independent Behavior Variables				
	Opioid Related Overdose Deaths		Accidents	
	Community Areas		Community Areas	
	Northside	Southside	Northside	Southside
a. MDD Hospitalization	p=0.512 (95%, CI= -0.891 to 0.986)	p=0.932 (95%, CI=-0.795 to 0.827)	p=0.234 (95%, CI= -0.740 to 0.995)	p=0.201(95%, CI= -0.403 to 0.950)
b.Drug–Related Hospitalizations	p= 0.098 (95%, CI= -0.163 to 0.946]	p=0.912 95%, CI=-0.831 to 0.791)	p= 0.306 (95%, CI= -0.802 to 0.993]	p=0.234 (95%, CI=-0.445 to 0.945]
	Homicides		Behavioral Health Hospitalizations	
	Northside	Southside	Northside	Southside
a. MDD Hospitalization	p= 0.350 (95%, CI= -0.606 to 0.956)	p= 0.382 (95%, CI= -0.577 to 0.922)	p= 0.074 (95%, CI= 0.937 to 0.999)	p= 0.005 (95%, CI= 0.910 to 0.999)
b. Drug–Related Hospitalizations	p= 0.494 (95%, CI= -0.684 to 0.943)	p= 0.444 (95%, CI= -0.616 to 0.913)	p= 0.000 (95%, CI= 0.919 to 0.999)	p= 0.000 (95%, CI= 9.998 to 1.000)

Racial Diversity and CA Related Behavioral Indicators

Using above Central-Southside-Westside Cas, comparative significant difference from Northside CA we attempted to first calculate the probable presence of each race/ethnicity in16 C-W-S Cas. C+S CA: Hispanic, OR: 4.332, at 95% CI: 1.944 to 9.648 but Black, OR: 35.267, at 95% CI: 13.301 to 93.5119, compared to <1.0 Ors for NHW and Asian: White: OR: 5.821, at 95% CI: 3.017 to 11.233 and Asian: OR: 2.765, 0.726 to 10.520. W Cas: Hispanic, OR: 9.997 at 95% CI: 4.567 to 21.885 while Black: OR, 0.2101 at 95% CI: 0.0106 to 0.0751and others <1.0 Ors. N Cas are similarly composed of N/ and Asian (SW/SE) with relatively low numbers of NHB/Hispanic residents. For opioid prescription, sites the DEA-ARCOS data set indicated the highest number of opioid prescriptions is located in or adjacent to C+S Cas. We tested to show NHB/Hispanic residents in Cas associations to various behavioral disorders, and MDD/DRH indicators: fire-arms related homicides (corr: 0.967; p<0.0001); homicide (corr: 0.962; p=0.0001), injury related deaths (corr: 0.887; p=0.003), and motor-vehicle death (corr: 0.737; p=0.037). Furthermore, we calculated comparing C+S to N Cas to determine relative risk (RR): drug induced death, 1.788; alcohol induced death, 1.112, drug overdose, 1.792; mood and depressive disorder, 1.1648, and opioid related hospitalization, 1.8871. Comparison of W to N related Cas for opioid related hospitalization indicated: RR, 2.027 with OR, 2.169, at 95% CI: 1.159 to 4.061. Taken together racial diversity and geographic location in Chicago are highly associated with high probability for NHB> other ethnicities for behavioral disorders and MDD/DRH.

Gender and CA Related Behavioral Indicators

Examining gender effect on 20 behavioral disorder related variables, associated with 77 Chicago's CAs indicated a male predominance (Table 6A.1). Although, female predominance was associated with behavior health treatment. OR: 2.8023 at 95% CI 1.557 to 5.043 with a RR= 1.866; serious psychological distress, OR: 1.5822, at 95% CI 0.3154 to 7.940, with a RR= 1.560; youth depression, OR: 2.2342, at 95% 1.2132 to 4.1145, and youth suicide attempts, OR: 1.1949, at 95% CI: 0.2630 to 5.4286 with a RR= 1.875.

Table 6A1

Male Predominance in Behavioral Disorders in Chicago's 77 CAs									
	Mood and depressive disorder hospitalizations	Drug-related hospitalizations	Opioid-related overdose deaths	Homicides	Alcohol-related hospitalizations	Behavioral health hospitalizations	Schizophrenic disorder hospitalizations	Accidents	Motor vehicle crash deaths
OR	1.201	2.017	2.836	9.408	3.678	1.704	2.094	2.777	3
at 95% CI	0.848 to 1.700	1.351 to 3.246	1.452 to 5.540	2.971 to 29.788	1.674 to 8.082	1.372 to 2.116	1.351 to 3.246	1.595 to 4.835	0.775 to 11.602
P value	0.028	0.003	0.007	0.0005	0.004	0	0.003	0.007	0.001

In contrast, males compared to females showed significant drug induced deaths. For example, male compared to female incidence rates. RR= 2.746 for alcohol induced deaths. We also recorded for RR= 3.944 for drug overdose deaths. Opioid related overdose deaths had a RR= 2.825; accidents, RR=2.836; motor vehicle crash deaths, RR=2.776; injury deaths, RR=3.000; firearm related homicide, RR=3.822; homicide, RR=18.857; behavioral health hospitalizations, RR= 9.406; alcohol related hospitalization, RR= 1.688; drug related hospitalization, RR= 3.670; RR= 2.012; schizophrenia disorder hospitalizations, RR= 2.087, and mood and depressive disorder hospitalization, RR=1.199. We further recorded males>females ORs at 95% CI and p value probability for MDD/DRH indicators (Table 6A 1).

College of Dental records from residents of C+S CAs, with high RR for behavioral disorders and/or drug hospitalizations detected through use of psychotropic medications (MED) showed association to oral health variables (Table 6A 2). Individuals under medication for behavioral disorders compared to individuals with no medications showed a significant probable bleed on touch of "gum" and loss of attachment (p<0.0001). Both females and males with medication use compared to non-medication users also had higher levels of DMFS (Table 6.A2).

Table 6A2

Gender Effect on Oral Health Indicators for CAs with High Probability for Behavioral Disorders	DMFS P value	Bleed on Touch P value	Loss of Attachment P value
(90 Records)	DMFS	Bleed on Touch	Loss of Attachment
Meds vs No Meds	NS	<0.0001	<0.0001
Female Meds vs Female No Meds	<0.0001	<0.0001	<0.0001
Male Meds vs Male No Meds	<0.0001	<0.0001	<0.0001

Although we used identical numbers of female and male records, (CAL), mean loss of attachment for females >male, we recorded, 2.624 buccal/2.714 lingual times larger for female medication users. Similarly, we compared female>male: 2.561 buccal/2.629, lingual bleed on touch, to find similar times larger values for females. In addition, we recorded female >male for DMFS, and found 2.867 times higher values. This determination coincided with our analysis for need for oral surgeries + consultations. Both gender med users compared to non-med users from CAs had a greater number of requests for oral surgery services. In addition, probability (p=0.0046) and OR: 1.743 at 95% CI was higher for NHB that used psychotropic medications compared to other race/ethnicities (Table 6B).

Table 6B

Table 6: showing (A.1) male predominance of behavioral health disorders in 77 Chicago community areas (A.2) patients with MDD vs no MDD having more bleeding on touch and greater number of deep probing depths, females and males with MDD having more DMFS and bleeding on touch, and females with no MDD having more deep probing depths compared to males with MDD having more deep probing depths and (B) patients with MDD, particularly NHBs, having more oral surgery visits at UIC.

3 Year (2017-2019) Assessment of Meds vs. No Meds Using Dental College Records from 16 (Central-South) CA, Number, Gender, and Race Relationship to Oral Surgeries + Consultations		
	Meds	**No Meds**
Total Records (meds rev: 450: 327F/123M) (no meds rev: 450: 327F/123M)	T oral consultations and surgeries = 507 : 369 F 138 M Mean 173 +/- 1 5.8	T oral consultations and surgeries = 140 : 97 F 43 M Mean 47.3 +/- 3.2
PR	12/10,000	3.2/10,000
P value	<0.0001	
Female	F = 8.7 +/- 7.2	F = 3.1 +/- 1.9
PR	10.1/10,000	2.2/10,000
P value	<0.0001	
Male	M = 4.0 +/- 2.1	M = 2.0 +/- 1.0
PR	3.1/10,000	9.9/10,000
P value	<0.0001	
NHB vs Other	NHB: 386 records (PR = 8.9/10,000) NHW + Other: 182 records (PR =4 .2/10,000)	NHB: 73 records (PR = 1.6/10,000) NHW + Other: 60 records (PR = 1.3/10,000)
	OR: 1.743 (95% CI: 1.186 to 2.560) (Med vs no Med) P=0.0046	

These results indicate behavioral disorders have significant probability to occur in community areas of Chicago, which also suggests a racial disparity and gender, association. Additionally, oral disease and oral surgery service needs are also associated with presence of behavioral disorders, racial/ethnicity and resident gender in Chicago's CAs.

Discussion

College of Dentistry at UIC serves a diverse racial/ethnic population with patients that reside in community areas identified with a high significant probability for association between mood depressive disorders and other manifestations of behavioral disorders (Table 1, 2 & 4).

We further recorded significant ANOVA and ORs at 95% CI for four behavioral indicators associated with geographic location in Chicago. This division also characterized a racial diversity issue. For example, N vs S or W communities which compares predominant NHW/Asian resident populations to NHB/Hispanic. We record results for racial/ethnicity effect on behavioral disorder associations in geographic located CAs tested by OR, at 95% CI (Tables 4, 5). Furthermore, race/ethnicity as well gender resulted in higher RRs for residents from specific community areas for a variety of behavioral disorders which included drug associated problems and hospitalizations (Table 4, 5).

This association as noted is a racial diversity issue because NHB most often present with behavioral disorders compared to other race/ethnicities (Table 2 & 3). Individuals of Hispanic race/ethnicity also suffer from these behavioral disorders but with a lower probability than NHB (e.g., OR at 95% CI values) as detected by testing specific Chicago's "Westside" community areas (Table 4). Males and females identified by medication use had a higher probability for behavioral disorders associated with oral health issues (Table 6A1). We further calculated RR for race and gender for a variety of behavioral disorders to suggest complex environmental and social-economic factors predominant that exerts combined effects with oral health. In regards to oral health, a higher probability relates to medication use for females that also present with more loss of "gum" (gingiva) attachment to teeth, which could lead to tooth loss or need for oral surgery services (Table 6A2, B). This is in contrast to national NHANES values that indicate more males and more non-Hispanic Blacks/Hispanics present with loss of attachment, and periodontal disease [23,24].

Although NHB male residents often live in high-risk community areas, we record a higher probability to associate with significantly increased behavioral hospitalizations, homicides, accidents, and opioid-related deaths. In addition, NHB persons present with higher statistical significant incidence for firearm-related homicides, homicides, injury death, and vehicle crashes, and tobacco related deaths, to suggest more tobacco related disease such as periodontal diseases, which is consistent with national findings but not our College of Dentistry population [24]. Differences between national and local detection of incidence of periodontal disease suggests patients at the College of Dentistry are self-selecting for gender and patient's dental care needs resulting in more females and fewer males with fewer oral health needs that previously recorded. Life stressors also affect drug-related hospitalizations to suggest opioid's drug use tracking to opioid prescription sites and NHB residence in "Southside" community areas is a useful factor to understand DRH incidence and oral health needs (Table 6B).

We study this relationship between oral disease, including "gum" (periodontal) disease because oral problems are increasingly associated with systemic diseases including neurologic and mental disorders [12,25,26].

Interestingly, female's relationship to periodontal problems differs from male's association and this difference requires further study particularly for MDD/DRH incidence and pathogenesis of systemic diseases [27-29].

Reviewing human and non-human primate studies there is a lack of significant differences in pathogenic periodontal bacteria between males and females but there is evidence from comparative studies of animals, both in captivity and in natural habitat to suggest males are at higher risk for periodontal bone loss compared to females [28-30]. In addition, male non-human primates show more systemic inflammatory factors compared to females [31]. Findings indicate gender differences for periodontal disease may-be independent of MDD and derived from complex immune reactivity, complemented by metabolic and endocrine differences. Furthermore, use of antipsychotic medications may amplify already present periodontal and other oral diseases and this effect widens already present differences between gender or races/ethnicities [13-18].

Suggested above poor oral health in a College of Dentistry setting may not reflect accurately or significantly the amount of periodontal disease or oral health issues in specific community areas or the types of care needed. A difference in female to male decision to become a patient in College of Dentistry noted by our accrual numbers. We compared 2253 females to 974 males, from the identical community areas and we assessed with high probability different sets of behavioral disorders requests for oral surgery service (Table 6B). These differences were noted even after normalization (total number 450: 327F/123M) of number of records for gender (Table 6B). We need more study about gender related decision-making and choice selection for oral surgery service needs and confounding effect from racial/ethnicity and community area's high probability for behavioral disorders (MDD/DRH) [32-34].

Conclusion

In summary, this study identified in Chicago's community areas racial/ethnicity, NHB>others and gender demographic and epidemiologic associations for behavioral disorders. In Chicago, this takes the form of geography location: Northside versus South-Central-Westside. Our findings also shows oral health diseases and need for oral health services coincides to female > male requests for dental care. This association also coincides with annual dental cleaning service for all 77 Chicago community areas, female /male: OR: 1.061 (at 95% CI 0.5993 to 1.8979; RR= 1.022). This study's limitations included self-reporting for medications, limited population pool and College of Dentistry patient's database. This creates a sample bias related

to service area for College of Dentistry, with fewer patients from NHW community areas. Moreover, this study identifies associations in Chicago's populations without providing an oral or behavior disorder centric mechanism to explain probability findings. .Although, this study will provide a foundation for future genomic expression study to uncover specific molecular markers that result from racial/ethnicity and gender differences noted in this study. Additionally, opioid use tracking of pharmacies assumes patients will generally travel to nearby pharmacies for prescriptions, but this may not be accurate. Most opioid misuse arises from obtaining them from friends and families, not from doctors and use of legal prescriptions and this relationship can have a confounding effect on other behavioral disorder prevalence rates.

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Citation: Beckerman JJ, Dachman JC, Schwartz LR, Schwartz JL (2024) Behavioral/Mood Disorders and Opioid-Drug Use in Chicago Community Areas Associated with Oral Health and Oral Surgery Need. Open Access J Dent Oral Surg 5: 1075

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