



Structural influences on psychiatric emergency department visits among racial and ethnic minority youth in North Carolina: A neighborhood-level analysis

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ABSTRACT

Mental health continues to be a growing crisis for children, adolescents, and young adults. Yet, increasing trends in subgroups are not uniform, and key differences exist across geographic, racial, and age groups. Few studies examine structural factors like economic and racial inequality, important upstream structural inequities that impact mental health. This study examines the association between individual drivers and structural factors like neighborhood privilege and youth mental health (i.e., depression, schizophrenia, suicide ideation, anxiety) and associated racial and ethnic disparities. Data on mental health were obtained from psychiatric emergency department (ED) visits for the state of North Carolina from 2012 to 2021 for residents under age 24. Multilevel logistic regressions were employed to examine trends and drivers of psychiatric ED visits compared to non-psychiatric ED visits. Results show an increase in psychiatric ED visits from 2012 to 2021 across all races and ethnicities. Although white youth represent the majority of psychiatric ED visits, increasing trends among minorities, including Black and Hispanic youth, were notable, particularly for severe mental health conditions like schizophrenia and suicide-related outcomes and for urban neighborhoods with greater segregation. Findings underscore the need for policies addressing economic and racial inequalities at the neighborhood level to mitigate youth mental health disparities.

1. Introduction

The United States (US) stands as a global outlier, with suicide as one of the leading causes of death for adults and the second leading cause of death for children and adolescents (10–14 years and 18–24) (CDC, 2023). The suicide rate for this age group has increased by 56% over the last decade, but not uniformly, with important differences based on age, gender, race, and ethnicity (Curtin and Heron, 2019). In general, suicide among young people has primarily been perceived as a problem among white youth. However, emerging data, particularly on suicide deaths, are shattering this perception, revealing the incidence of suicide is nearly two times higher among Black youth compared to white youth under age 13, contrasting sharply with a 50% lower incidence for Black compared to white youth aged 13–17 years old (Bridge et al., 2018). Similar trends occur among other minorities, such as American Indians, where suicide is the leading cause of death for youth ages 15 to 24, nearly four times higher than other US youth (SAMHSA, 2017). The COVID-19 pandemic further amplifies this disparity, with new research showing a higher risk of suicide for American Indian and Black youth in

2020 (Bridge et al., 2023).

In addition, recent estimates have shown that Black high school youth are reporting staggering increases in the rate of suicidal thoughts and now have a slightly higher percentage of past-year suicide attempts and past-year attempts requiring medical treatment than other minorities (CDC, 2017; CDC, 2023). These trends have been reported in other surveillance systems like the Youth Risk Behavior Surveillance System, which has shown a significant increase in suicide attempts by Black youth from 1991 to 2017, with no significant change in whites and decreases in other minorities, including Hispanic and Asian young people (Lindsey et al., 2019). Researchers have suggested misclassification or undercount of suicide risk among Blacks as a result of violence with suicidal intent (Shain, 2019; Talley et al., 2021). Yet, suicide rates and mental health concerns are increasing among Black youth despite potential misclassification, highlighting the urgent need for more research, surveillance, and interventions (Abramas et al., 2022).

In parallel to increases in suicidal behaviors among Black youth, pediatric mental health emergency department visits have also increased over the last few decades, with a 28% overall increase from

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2011 to 2015 in psychiatric youth ED visits and the highest increases observed among racial and ethnic sub-populations, specifically Black and Hispanic youth (Kalb et al., 2019). The COVID-19 pandemic likely further influenced youth ED visits, and emerging literature suggests an initial decrease in mental ED visits during the first year of the pandemic (Smulowitz et al., 2021) but substantial increases in mental health ED visits into the second year of the pandemic (Overhage et al., 2023). Trends among unique sub-populations like racial minorities are still emerging, and new research is needed.

Most troubling, more than half of youth requiring ED care had not previously sought outpatient mental health services, highlighting the ED as a critical point of intervention for youth mental health (Gill et al., 2017). The rise in these visits prompted a 2016 joint report from the American Academy of Pediatrics and the American College of Emergency Physicians providing clinical guidance on the recommendations for managing youth with mental health issues in the emergency department (Chun et al., 2016; Scott et al., 2016).

Although current research focuses on demographic trends of mental health and suicide risk among Black and other racial and ethnic minority populations (Uher and McGuffin, 2008; Bridge et al., 2018; Curtin and Heron, 2019), neighborhood and other social stressors also influence the occurrence of mental health. For instance, neighborhood poverty and living in severely disadvantaged neighborhoods places residents at risk for social disorder, violence, and discrimination (Curtrona et al., 2006; McCormick et al., 2005; Williams and Williams-Morris, 2000). As an enduring legacy of institutional racism, residential racial segregation has been consistently found to have detrimental effects, including decreased access to education, employment, and access to healthy food and environments (Visser et al., 2021). These inequities reinforce both racial and socioeconomic disparities, creating an unequal environment for children (Visser et al., 2021; Acker et al., 2023). Examining the early stages of the life course among this population is necessary for intervention and understanding the effect of structural income and racism on population health (Anderson et al., 2023).

Moreover, established frameworks for social determinants of health emphasize the concept of the “social gradient,” wherein racial and socioeconomic disparities accumulate over time, leading to heightened health risks (Marmot and Bell, 2016; Alegría et al., 2018). Specific to mental health, Allen et al. apply a multilevel framework that includes a life-course approach where community-level contexts help drive poor and disadvantaged populations to be the most affected by mental disorders (Allen et al., 2014). Over time, cumulative stressors and the effects of social determinants intensify across an individual’s lifespan. These determinants are particularly crucial during early and late childhood, as adverse conditions in early life are linked to an increased risk of developing mental health disorders (Jensen et al., 2013). However, strong family and community connections can serve as protective factors against negative mental health outcomes (Allen et al., 2014). Incorporating community-level determinants, such as structural racism and economic inequality, into electronic health records represents a critical emerging priority in research on social determinants and mental health outcomes and is a key focus of our study (Alegría et al., 2018).

Structural racism is often measured at the neighborhood level to capture historical and ongoing racial residential segregation (Adkins-Jackson et al., 2022; Hardeman et al., 2022). A common spatial metric is the index concentration at the extremes (ICE), which has been applied to mental health conditions among adolescents (Sugg et al., 2023), maternal and child health (Ulrich et al., 2023; Chambers et al., 2019; Runkle et al., 2023) and premature mortality (Krieger et al., 2016). Unlike other metrics, ICE considers both racial and economic inequities, and most recently, ICE metrics were applied to adolescent mental health in northern California to understand the association between structural racism and depression and suicidality using electronic health records (Acker et al., 2023). These findings demonstrated the strong association between lower neighborhood privilege and a higher risk of adolescent depression and suicidality among all adolescents and

young adults. Our study seeks to build upon existing research by examining racial and ethnic disparities in adolescent mental health among youth in North Carolina, a southeastern US state characterized by significant health disparities (Sugg et al., 2023; Mitchell et al., 2022; Ryan et al., 2023; Ulrich et al., 2024) and a historical context of racism. In particular, our study extends previous work (e.g., Acker et al., 2023) by not only examining adolescent suicide ideation and depression but also other psychotic outcomes, such as severe externalizing conditions like schizophrenia and other internalizing disorders like anxiety. Specifically, our research addresses the following questions: 1) What is the incidence of psychiatric emergency department (ED) visits across various demographic and socioeconomic factors, including age, race and ethnicity, income, and neighborhood structural characteristics such as rurality and racial and economic segregation? 2) What disparities exist between different racial and ethnic youth in psychiatric ED visits? and 3) How do psychiatric ED visits and racial and ethnic disparities change after the COVID-19 pandemic? Understanding psychiatric ED use among youth is important as the ED is an entryway to the mental health system for many children and families (Gill et al., 2017). To our knowledge, our results will be the first to examine neighborhood measures across racial and ethnic groups at a fine geographic scale for an entire state in the southeastern US.

2. Data and methods

2.1. Hospital administrative data

Anonymized statewide emergency department visit data was obtained from the Sheps Center at UNC-Chapel Hill (Sheps, 2022), providing a secondary data source of all ED hospital administrative data in North Carolina for analysis. Since 1996, the Cecil G. Sheps Center for Health Services Research has partnered with the North Carolina Division of Health Services Regulation (DHSR) to manage, maintain, and analyze the NC Discharge databases. While these databases are not considered public records, they are accessible for research. The following mental health disorders were included for youth under age 24 presenting to the emergency department (ED) in North Carolina from 2012 through September 2021 (Sheps Center, 2022): (1) Anxiety, (2) Depression, (3) Schizophrenia, (4) Suicide-Related Outcomes, and (5) Mental and Behavioral Disorders (aggregate of any mental health or behavioral concern) (Ridout et al., 2021a, b). Mental health outcomes were isolated using the International Classification of Disease (ICD) codes. The ED data spans 2012–2022; in 2015, the ICD coding standard was updated from ICD-9 codes to ICD-10 codes (US Department of Labor, 2015); as such, we included both ICD-9 and ICD-10 codes to identify mental health outcomes across the study period (Supplemental Table 1). The de-identified ED data contains demographic information, including patient age in years, race (White, Black, American Indian, Asian, Other), ethnicity (Hispanic, Non-Hispanic), sex (female, male), insurance (commercial, government, self-pay, other), and billing zip code. To examine the influence of race and ethnicity, we re-coded racial and ethnic groups (White, Black, Hispanic, Asian, American Indian, Other) using race and ethnicity categories. Data was crosswalked from billing zip code, the finest resolution patient-location information available in Shep’s dataset, to census zip-code tabulation areas (ZCTAs), a spatial geographic unit, to allow for geographic health analysis (AAFP, 2022). Mental health outcomes were aggregated to the ZCTA level, reporting the total mental health burden for each ZCTA in North Carolina ($n = 802$). The residential ZCTAs were utilized to identify key community-level variables. When examining associations between neighborhoods and health, ZCTAs serve as a useful proxy for neighborhood classification (Duncan and Kawachi, 2018). Data were restricted to ED visits of individuals aged 24 and younger with a residential location in North Carolina, producing a data set of 11,435,996 total ED visits between January 2012 and October 2022, of which 2,101,934 (18%) were related to a mental health or behavioral concern. The

start date was selected as 2012, the year with race and ethnicity information available for all EDs in North Carolina. Six missing cases were found in the data provided that did not include insurance. In addition, Asian ($n = 8087$; 0.4%) racial-ethnic groups were excluded from further analysis due to small sample sizes and the “other” race-ethnicity category ($n = 66810$, 3.2%) was also excluded due to unknown racial and ethnic backgrounds and a small sample size. Data was coded and processed in R (R Core Team, 2024) using the *glmmTMB* package (Brooks et al., 2017).

2.2. Covariates

2.2.1. Individual level determinants

Racial, ethnic, and socioeconomic disparities are well-documented in the United States as key determinants of mental health disparities among youth (Runkle et al., 2023). To account for individual-level factors contributing to these disparities, we included the following patient demographics: (1) Age (categorized as <12 years, 13–17 years, and 18–24 years), (2) Gender (female or male), (3) Race and Ethnicity (White, American Indian, Asian, Black, Hispanic), and (4) Insurance status (commercial, government, other, self-pay), which serves as a proxy for socioeconomic status.

2.2.2. Index concentration at the extremes

The Index of Concentration at the Extremes (ICE) was first implemented in 2001 as a measurement of the spatial social polarization of socioeconomic groups (Massey, 2001; 1996). The ICE was later extended to measure racial group polarization (Krieger et al., 2015; 2016) and is well-established as a measurement of structural racism at the neighborhood level in studies of health outcomes (Chambers et al., 2019; Krieger et al., 2015; Mitchell et al., 2022; Dyer et al., 2022; Walker et al., 2017). This metric is advantageous because it simultaneously encompasses spatial and social polarization, addressing multi-collinearity issues often associated with separate measures of privilege and inequality. ICE scores range from -1 to 1 and reflect how an area's population is concentrated in racial or economic extremes (Krieger et al., 2016; 2015). An ICE Race or ICE Income score of -1 indicates that an area is predominantly non-white or low-income, respectively. In contrast, areas with a score of 1 are predominantly white or higher-income. The ICE was calculated for both racial and economic residential segregation at the ZCTA scale using variables from the 2021 American Community Survey using the following: $ICE_q = (Taq - Tp_q) / T_q$, where Taq represents the population density at the q location and Taq , Tp_q represents population density of group a , p in the location of q (Kramer, 2018; Sugg et al., 2023). For ICE Income, group a is the number of households with an annual income of less than or equal to \$25,000, and group p is the number of households with an annual income of greater than or equal to \$125,000, and group q is the total number of households in each ZCTA. For ICE Race, group a is the total number of Black or non-white Hispanic residents, group p is the total number of white residents, and group q is the total population for each ZCTA. ICE was categorized into tertiles to compare risk associated with residence in the lower (most deprived), middle, and upper (most privileged) tertiles.

2.2.3. Urbanicity

To examine geographic differences across the urban-to-rural continuum, we used the Rural-Urban Commuting Codes (RUCA) published by the USDA Economic Research Service to classify ZCTAs as Urban (RUCA Codes 1–3), Micropolitan (RUCA Codes 4–6), Small Towns (RUCA Codes 7–9) and Rural/Isolated (RUCA Code 10). The most rural category (RUCA Code 10) was the categorical reference for all models. The RUCA codes consider population density, urbanization, and daily commuting measures. Research has shown higher rates of rural suicide among youth than their urban counterparts (Runkle et al., 2023).

2.2.4. COVID-19 pandemic

Because our time period intersected with the COVID-19 pandemic, we included an indicator variable to reflect if a case fell inside (ED visits before March 13, 2020) or outside of the pandemic (ED visits after March 1, 2020). March 13, 2020, was selected due to the US President's declaration of a national emergency (FEMA, 2020). Prior research has shown that the pandemic adversely impacted the mental health of young people (Sugg et al., 2023; Runkle et al., 2021; Ryan et al., 2024).

2.2.5. Statistical analysis

Descriptive statistics included means with standard errors and frequencies for categorical variables for all psychiatric ED visits. Comparisons were made using the analysis of the variance test for continuous variables and the chi-square test for categorical data. Crude annual rates of youth psychiatric visits were mapped at the ZCTA level and illustrated higher incidences of outcomes using quantile classification for each race and ethnicity for all mental health conditions. Local Moran's I and Getis Ord statistics were then calculated to identify significant spatial clusters of psychiatric ED, such as high-high, low-low, high-low, and low-high values, thereby indicating areas of spatial concentration and outliers.

Given the hierarchical nature of our research questions and the clustering of individuals within communities (i.e., ZCTAs), we employed multilevel logistic regression models to explore the individual and structural factors influencing psychiatric emergency department (ED) visits. Specifically, we utilized two-level random intercept models, with random intercepts for ZCTAs, to account for the nested structure of individual ED data within ZCTA locations. Fixed effects were included for individual-level sociodemographic variables (race, ethnicity, age, gender, insurance status) and community-level factors (ICE measures, RUCA classifications, COVID-19 impacts). Our analysis includes (1) all psychiatric ED visits, (2) schizophrenia, (3) anxiety, (4) suicide-related incidents, (5) depression, and (6) suicide-related behaviors. The initial models were designed to assess each psychiatric outcome as a dependent variable, incorporating individual-level sociodemographic variables (e.g., race, ethnicity, age, gender, and insurance status) and community-level factors (e.g., ICE measures, RUCA classifications, and COVID-19 impacts). In subsequent analyses, we focused on racial and ethnic disparities by comparing outcomes for American Indian versus White, Hispanic versus White, and Black versus White groups (dependent variable), following methodologies similar to Acker et al. (2023) to examine differences in racial-ethnic minority groups. These models included sociodemographic and community-level fixed effects. Finally, we ran separate models for each racial and ethnic group to investigate disparities in psychiatric ED visits between the COVID-19 pandemic and pre-COVID-19 (dependent variable) with sociodemographic and community drivers as covariates. Reference categories for all models and analysis included: ICE Race High or the least segregated neighborhoods, Gender: Female, Insurance: commercial, COVID-19: Pre-COVID-19 period, Age category: 18 to 24, ICE Income: High or the least economically segregated and RUCA: Rural. Analyses were conducted using R (R Foundation for Statistical Computing) and the packages *glmmTMB* (Brooks et al., 2017), and results were communicated as Odds Ratios (OR).

3. Results

3.1. Descriptive statistics

Table 1 demonstrates the population characteristic differences between psychiatric ED visits compared to all ED visits for youth under age 24. The average age for all ED visits is 13.4 (SD: 7.3), and more than half of cases were female (56.4%). In contrast, psychiatric ED visits were older (19.1, SD 4.5) and had fewer female ED visits (52.7%). White youth were more likely to visit the ED for psychiatric conditions, and the frequency of conditions peaked in 2017 (10.7%). In contrast, Black (38.9%), American Indian (1.5%), and Hispanic (11.8%) youth were

Table 1

Comparison of non-psychiatric to psychiatric conditions among youth emergency department visits from 2012 to 2021, North Carolina USA.

	Strata	Non-Psychiatric Conditions	Psychiatric Conditions	p-value
n		9334062	2101934	
Age (mean (SD))		13.4 (7.3)	19.1 (4.5)	<0.001
Population in ZCTA (mean (SD))		30475 (18511)	30005 (17898)	<0.001
Sex (%)	Female	5267510 (56.4)	1107841 (52.7)	<0.001
	Male	4066552 (43.6)	994093 (47.3)	
Age Categories (%)	Less than 12 years old	4130895 (44.3)	206325 (9.8)	<0.001
	13–17 years old	1634249 (17.5)	349417 (16.6)	
	18–24 years old	3568918 (38.2)	1546192 (73.6)	
Race and Ethnicity (%)	White	3980626 (42.6)	1204510 (57.3)	<0.001
	American Indian	139958 (1.5)	26169 (1.2)	
	Asian	69078 (0.7)	8078 (0.4)	
	Black	3632349 (38.9)	680847 (32.4)	
	Hispanic	1098924 (11.8)	115520 (5.5)	
Insurance (%)	Other Commercial	413127 (4.4)	66810 (3.2)	<0.001
	Government	2347566 (26.4)	553492 (27.0)	
	Self Pay	5037588 (56.6)	907228 (44.2)	
Rural-Urban Classifications (%)	Rural	41425 (0.5)	9185 (0.4)	<0.001
	Small Town	1469157 (16.5)	581276 (28.3)	
	Micro	249768 (2.7)	53185 (2.5)	
	Urban	552113 (5.9)	102068 (4.9)	
Index Concentration at the Extremes - Race (%)	High ICE Race–Most privileged	1755863 (18.8)	381727 (18.2)	<0.001
	Medium ICE Race	6776318 (72.6)	1564954 (74.5)	
	Low ICE Race–Most Deprived	3000494 (32.1)	811504 (38.6)	
Index Concentration at the Extremes - Income (%)	High ICE Income–Most privileged	3122699 (33.5)	689300 (32.8)	<0.001
	Medium ICE Income	3210869 (34.4)	601130 (28.6)	
	Low ICE Income–Most Deprived	3105801 (33.3)	706197 (33.6)	
	Medium ICE Income	3103734 (33.3)	708265 (33.7)	
	Low ICE Income–Most Deprived	3124527 (33.5)	687472 (32.7)	

more likely to visit for non-psychiatric ED visits. Compared to all ED visits, psychiatric ED visits were less likely to occur in rural environments and were more common in the 18 to 24 age group and for individuals with self-pay insurance. On a neighborhood scale, measures of neighborhood privilege, such as predominately white and higher-income communities, had a higher percentage of psychiatric visits. Among psychiatric ED visits, the most common conditions were anxiety (15.7%) and depression (14.7%). Less frequent and more severe conditions include schizophrenia (2.9%) and suicide ideation (6.3%) (Supplemental Table 2). Psychiatric ED visits were the population sample used for analysis. Table (see Table 1).

Across racial and ethnic groups with psychiatric ED visits, Hispanic youth comprise the youngest patients for psychiatric visits (14% under the age of 13). In addition, a higher proportion of Hispanic youth were

male (53.3%). In contrast, youth from other racial and ethnic groups were more likely to be female (51.5% for Black, 53.2% for American Indian, and 54.1% for White) (Table 2). Black youth were the most likely to experience schizophrenia (4.4%), whereas Hispanic youth had a higher percentage of anxiety (20.9%), suicide-related visits (9.2%), and depression (18.4%). Surprisingly, American Indian youth were the most likely to live in the most segregated racial and economic neighborhoods (60.0%, 68.4%), followed by Black youth (39.0%, 52.3%).

Anxiety is the primary driver of mental health conditions, and White populations have a greater share of psychiatric ED visits compared to other ED visits. Fig. 1 illustrates the increasing prevalence of psychiatric ED visits for Black, White, Hispanic, and American Indian youth across time.

3.2. Individual and neighborhood drivers of psychiatric visits

Fig. 2 illustrates the odds ratios for individual and neighborhood level drivers of psychiatric ED visits for all psychiatric visits (i.e., mental health), schizophrenia, anxiety, depression, and suicide-related visits. Psychiatric visits occurred less frequently in racial and ethnic minority populations and were generally less likely to occur in predominately racially segregated neighborhoods (ICE Race-Low OR: 0.80, CI: 0.76–0.84). Of all the outcomes studied, schizophrenia had a higher occurrence in Black populations (OR:1.31, CI: 1.28–1.34), and patients were more likely to live in segregated neighborhoods (ICE Race Low OR:1.28, CI: 1.16–1.42). Suicide-related outcomes were also more common among residents living in segregated neighborhoods (ICE Race-Low OR:1.1, CI: OR: 1.02–1.19). In contrast, residents in predominately white neighborhoods reported a higher risk of ED visits for depression (ICE Race-Low: OR:0.93, CI: 0.86–1.00) (Fig. 2).

Surprisingly, residents in lower-income neighborhoods had lower odds of schizophrenia (ICE Income Low OR:0.91, CI: 0.82–1.00), anxiety (ICE Income Low OR: 0.88, CI: 0.81–0.94), depression (ICE Income Low OR: 0.84, CI: 0.78–0.90), and suicide-related outcomes (ICE Income Low OR: 0.75, CI: 0.69–0.80). Mental health conditions were more common among male populations than other ED visits, except for anxiety (OR:0.74, CI: 0.72–0.72) and depression (OR:0.69, CI: 0.68–0.69). All conditions were less common among children (under age 13) and more likely to occur in urban locations (OR>1.24).

3.3. Racial and ethnic minority vs. white youth disparities

Fig. 3 illustrates the odd ratios of White to American Indian, White to Hispanic, and White to Black youth disparities and their corresponding prevalence of mental health conditions and associated covariates. Racial and ethnic minorities, like Hispanic youth, had higher odds of depression (OR:1.13, CI: 1.11–1.15) and schizophrenia (OR:1.47, CI: 1.41–1.51) compared to white youth. American Indian youth had higher odds of schizophrenia (OR:1.32, CI: 1.20–1.46). Male racial and ethnic minority youth (Black, Hispanic, American Indian) were significantly more likely to visit the ED for mental health compared to white youth (OR>1.07). Minority youth were also most likely to have these conditions in racially segregated neighborhoods, with over 300% greater odds compared to less segregated neighborhoods. Results were insignificant across neighborhoods' income distributions (Fig. 3). Black youth had a higher risk than White youth for psychiatric-related visits for schizophrenia (OR: 1.99, CI: 1.94–2.03) but significantly lower risk of all other conditions (OR<0.86).

Black youth are nearly three times more likely to utilize EDs in urban neighborhoods compared to rural neighborhoods than their white counterparts (OR: 2.7, CI: 2.07–3.53). In addition, Black youth are more likely to have government insurance (OR:1.98, CI: 1.97–2.00) and/or self-pay (OR: 1.98, CI: 1.96–2.00). Most troubling, Hispanic children (under 13 OR: 1.82, CI: 1.78–1.86) and teenagers (13–17 OR: 1.66, CI: 1.63–1.69) were significantly more likely to visit the ED for psychiatric conditions than white youth. Unlike other racial and ethnic minorities,

Table 2

Summary of individual, neighborhood factors, and psychiatric ED visits stratified by Race/Ethnicity Comparison from 2012 to 2021, North Carolina, USA.

	Strata	White	American Indian	Black	Hispanic	p-value
n		1204510	26169	680847	115520	
Age in Years (mean (SD^a))		19.17 (4.42)	19.79 (4.06)	19.41 (4.50)	17.88 (5.09)	<0.001
Age Category (%)	Less than 12	111580 (9.3)	1722 (6.6)	64628 (9.5)	17251 (14.9)	<0.001
	13 to 17	205686 (17.1)	3645 (13.9)	97783 (14.4)	26487 (22.9)	
	18 to 24	887244 (73.7)	20802 (79.5)	518436 (76.1)	71782 (62.1)	
Sex (%)	Female	652040 (54.1)	13924 (53.2)	350469 (51.5)	53995 (46.7)	<0.001
	Male	552470 (45.9)	12245 (46.8)	330378 (48.5)	61525 (53.3)	
Insurance (%)	Commercial	375032 (31.7)	4277 (16.7)	131305 (19.9)	19976 (18.1)	<0.001
	Government	490546 (41.5)	13640 (53.4)	318209 (48.2)	52967 (48.1)	
	Other	6696 (0.6)	67 (0.3)	1487 (0.2)	643 (0.6)	
	Self Pay	310155 (26.2)	7568 (29.6)	209213 (31.7)	36533 (33.2)	
Schizophrenia (%)	No	1180443 (98.0)	25327 (96.8)	650691 (95.6)	111689 (96.7)	<0.001
	Yes	24067 (2.0)	842 (3.2)	30156 (4.4)	3831 (3.3)	
Anxiety (%)	No	999545 (83.0)	23338 (89.2)	597629 (87.8)	91359 (79.1)	<0.001
	Yes	204965 (17.0)	2831 (10.8)	83218 (12.2)	24161 (20.9)	
Depression (%)	No	1008106 (83.7)	23579 (90.1)	604284 (88.8)	94259 (81.6)	<0.001
	Yes	196404 (16.3)	2590 (9.9)	76563 (11.2)	21261 (18.4)	
Suicide-Related (%)	No	1127293 (93.6)	24660 (94.2)	645132 (94.8)	104942 (90.8)	<0.001
	Yes	77217 (6.4)	1509 (5.8)	35715 (5.2)	10578 (9.2)	
Rural-Urban Classifications (%)	Rural	39403 (3.3)	1204 (4.6)	8446 (1.2)	3115 (2.7)	<0.001
	Small Town	56675 (4.7)	1066 (4.1)	33541 (4.9)	8436 (7.3)	
	Micro	241639 (20.1)	9988 (38.2)	106162 (15.6)	14838 (12.8)	
	Urban	866793 (72.0)	13911 (53.2)	532698 (78.2)	89131 (77.2)	
Index Concentration at the Extremes - Income (%)	High–Most privileged	419291 (34.8)	4266 (16.3)	205824 (30.2)	44829 (38.8)	<0.001
	Medium	434495 (36.1)	4009 (15.3)	209423 (30.8)	36421 (31.5)	
	Low–Most Deprived	350724 (29.1)	17894 (68.4)	265600 (39.0)	34270 (29.7)	
Index Concentration at the Extremes - Race (%)	High–Most privileged	650272 (54.0)	5516 (21.1)	97743 (14.4)	32986 (28.6)	<0.001
	Medium	388844 (32.3)	4958 (18.9)	226794 (33.3)	43092 (37.3)	
	Low –Most Deprived	165394 (13.7)	15695 (60.0)	356310 (52.3)	39442 (34.1)	

^a SD: Standard Deviation.

Hispanic youth had a higher incidence following the COVID-19 pandemic (OR:1.06, CI: 1.04–1.08). In addition, self-pay insurance among Hispanic youth had some of the highest risk (OR: 3.26, CI:3.19–3.33) compared to commercial insurance. Lastly, compared to white youth, yearly trends show high increases in psychiatric ED visits for all racial and ethnic minorities, with the largest increases observed for Hispanic (OR:1.12, CI: 1.11–1.12) and American Indian youth (OR:1.15, CI: 1.14–1.16).

3.4. Youth psychiatric ED visits during the COVID-19 pandemic

Fig. 4 demonstrates the odds ratios for each racial-ethnic minority for ED visits during the COVID-19 pandemic. Results from the early pandemic (March 2020–September 2022) compared to pre-pandemic (January 2012 to April 2020) show higher odds of suicide (OR>1.51), anxiety (OR> 1.79), and schizophrenia (OR>1.20) across all youth racial and ethnic groups. In contrast, depression declined for all youth in the pandemic period, although most associations were insignificant. Increases in psychiatric conditions in the most segregated neighborhoods during the pandemic time period were only noted for American Indian youth (ICE Income Low OR: 1.53, CI: 1.06–2.20) and white youth (OR:1.14, CI: 1.07–1.22). Increases among minorities were also observed in urban neighborhoods for Hispanic populations (OR:1.46, CI: 1.17–1.82) and in rural communities for white youth (urban OR: 0.88, CI: 0.80–0.95). Across all race and ethnic groups, youth in the 18 to 24 age category had the highest odds of psychiatric visits during the pandemic period (Fig. 4).

3.5. Spatial trends in mental health

Minority psychiatric ED visits varied across the state (Fig. 5). Black youth had a higher rate of psychiatric visits in Western NC, whereas Hispanic youth had a higher rate in Eastern NC (Fig. 5). Significant spatial clustering was noted in metropolitan locations, like Charlotte, NC, for American Indian youth. Rural locations in western NC and eastern NC exhibited spatial clustering of Black and Hispanic youth,

respectively (Supplemental Figs. 1 and 2).

4. Discussion

Our study aims to examine racial and ethnic minority trends and the structural economic and racial drivers of psychiatric emergency department visits among youth (under age 24) in North Carolina from 2012 to 2022. Consistent with previous research, we found that white youth exhibited a higher risk for most psychiatric conditions, except for schizophrenia. At the neighborhood scale, psychiatric conditions were primarily located in predominately white neighborhoods. However, our analysis revealed higher psychiatric visits among Black youth in areas with high structural racism and a notable increase in visits over time for this demographic and other racial and ethnic minorities. Additionally, significant trends were observed among Hispanic youth, particularly those under age 13, with the largest disparity in psychiatric visits compared to White youth.

Similar to prior studies (Simon and Schoendorf, 2014; Bommersbach et al., 2023), we observed an overall increase in psychiatric ED visits among youth from 2012 to 2022. These increases were highest for severe conditions, like suicide-related visits, with the most notable increases among racial and ethnic minority youth. Our results correspond to other work on youth, demonstrating increases in suicidal ideation, attempts, and deaths over the last decade, particularly for Black youth (Bommersbach et al., 2023; Xiao et al., 2021). Black youth suffer from marginalization and unfair treatment and have a higher chance of being the victims or witnesses of police brutality than their white counterparts (Talley et al., 2021). The mindset of hopelessness from inequality and discrimination can accelerate risk factors for suicidal ideation and other psychiatric conditions (Walker et al., 2017; Talley et al., 2021).

Our findings indicate that psychiatric visits among Black youth were more prevalent in segregated neighborhoods than in low-income neighborhoods. Across all youth, visits were significantly higher in segregated neighborhoods for conditions like schizophrenia and suicide-related outcomes yet lower for less severe conditions such as anxiety and depression. This finding is supported by previous research suggesting

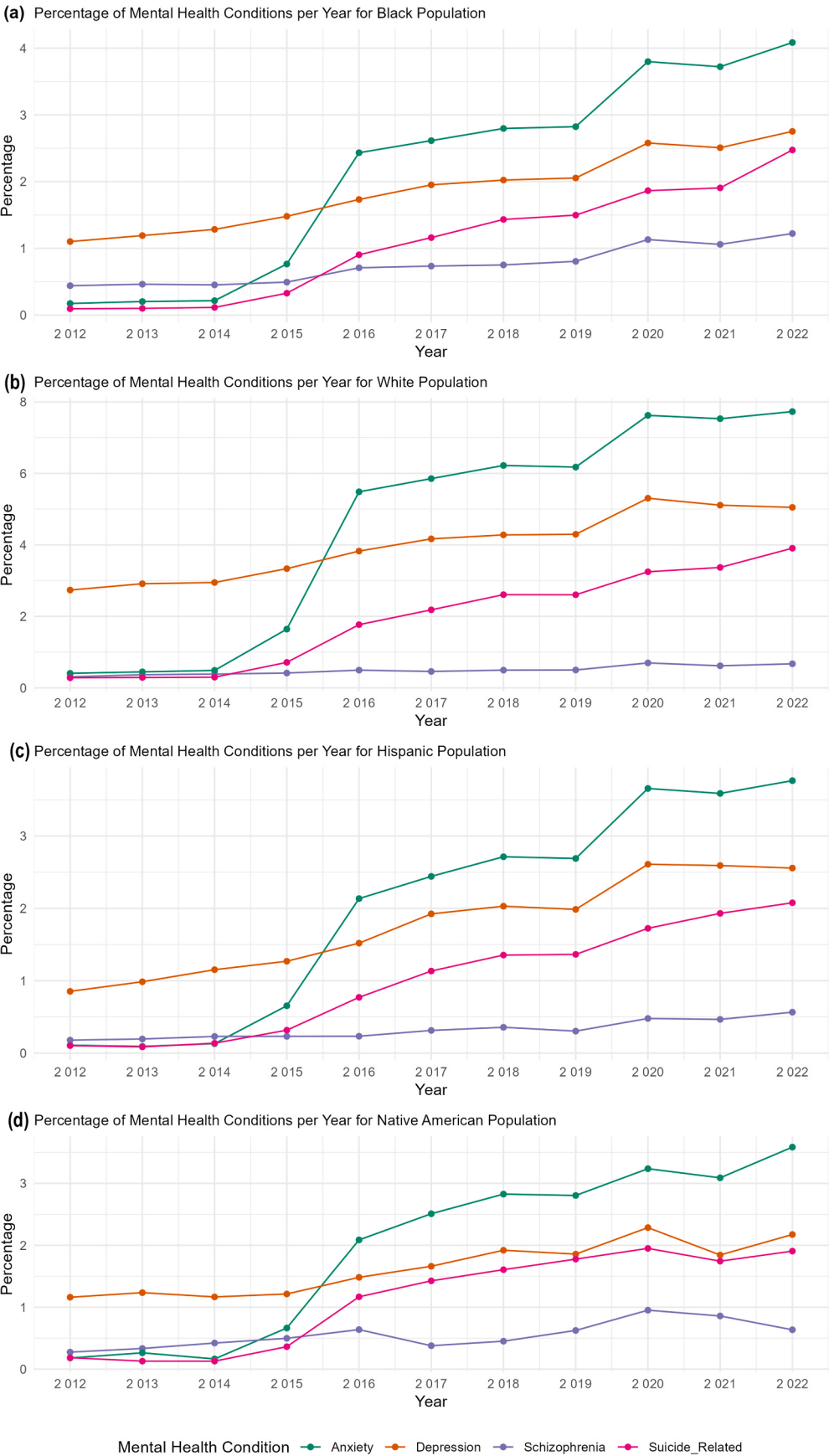


Fig. 1. Trends in Percentage of Mental Health Conditions by Year and Race/Ethnicity. Data points for 2022 are adjusted to account for a 10-month period. Each subplot corresponds to a specific racial/ethnic group: (a) Black, (b) White, (c) Hispanic, and (d) Native American populations.

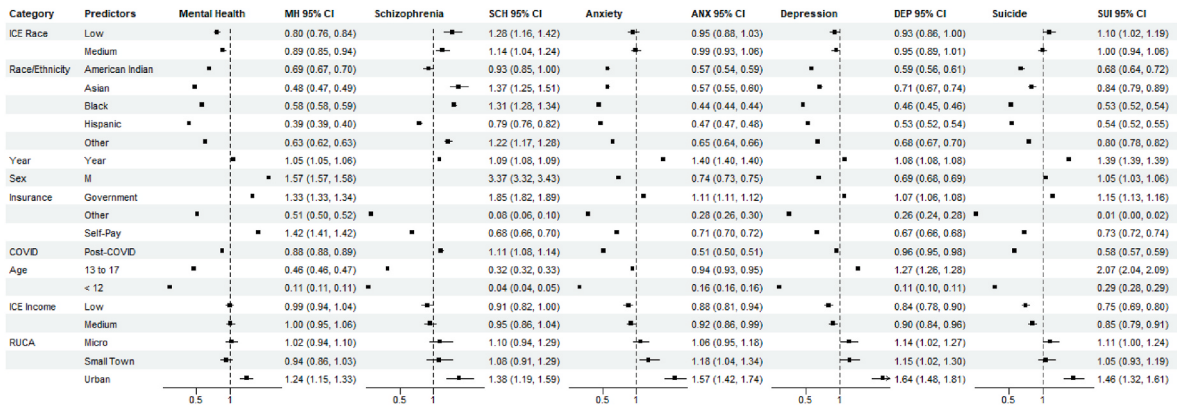


Fig. 2. Forest plot demonstrating individual and neighborhood factors for psychiatric ED visits for 1) All Psychiatric ED visits (Mental Health), 2) Schizophrenia, 3) Anxiety, 4) Depression, and 5) Suicide-related visits. Reference categories include ICE Race: High or the least segregated neighborhoods, Gender: Female, Insurance: Commercial, COVID-19: Pre-COVID-19 time period, Age category: 18 to 24, ICE Income: High or the least economically segregated, and RUCA: Rural (RUCA 10). Values are Odds Ratios

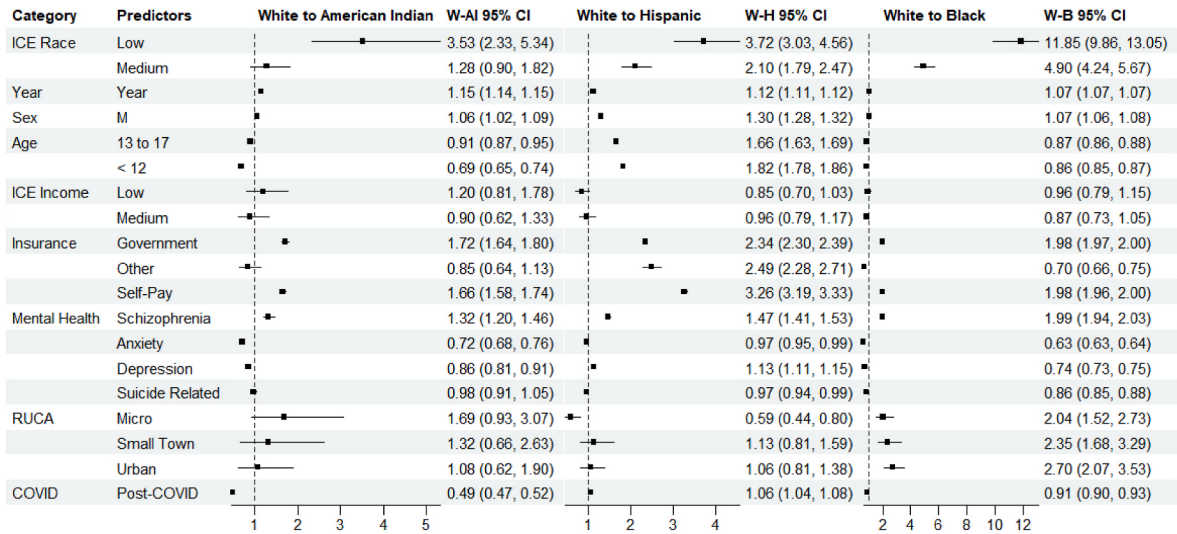


Fig. 3. Forest plots demonstrating disparities between racial and ethnic minorities and white youth: 1) White to American Indian, 2) White to Hispanic, and 3) White to Black. Reference categories include ICE Race: High or the least segregated neighborhoods, Gender: Female, Insurance: Commercial, COVID-19: Pre-COVID-19 time period, Age category: 18 to 24, ICE Income: High or the least economically segregated, and RUCA: Rural (RUCA 10). Values are odds ratios.

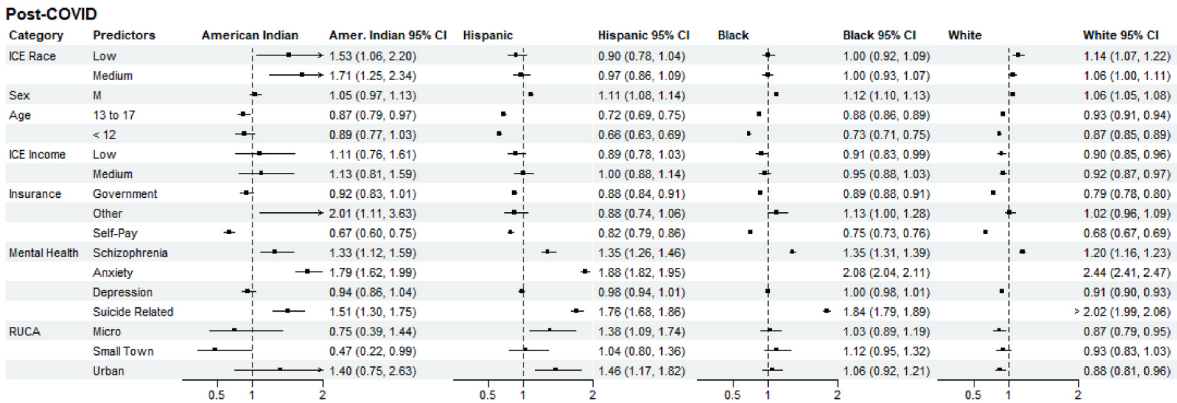


Fig. 4. Youth Psychiatric ED Visits During the COVID-19 Pandemic for American Indian Youth, Hispanic Youth, Black Youth and White Youth. Reference categories include ICE Race: High or the least segregated neighborhoods, Gender: Female, Insurance: Commercial, COVID-19: Pre-COVID-19 time period, Age category: 18 to 24, ICE Income: High or the least economically segregated, and RUCA: Rural (RUCA 10). Values are odds ratios.

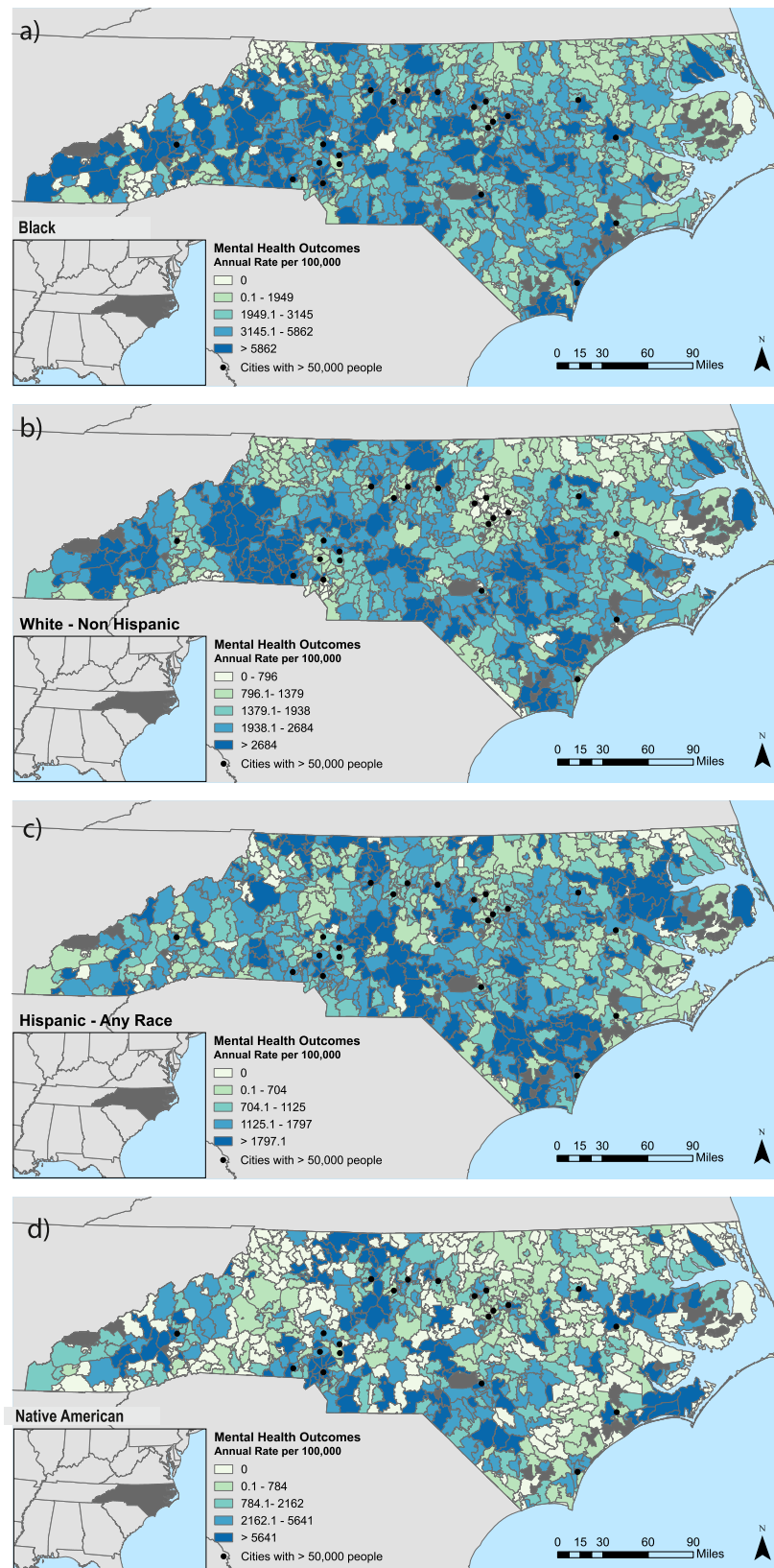


Fig. 5. Map illustrating the geographic distribution of youth psychiatric emergency department (ED) visits (all mental health outcomes) for a) Black, b) White, c) Hispanic, and d) Native American. ED visits are displayed at an annual rate per 100,000 people using quantile classification. *The high-resolution version is attached via the online system portal.

that living in segregated neighborhoods affects access to and utilization of psychiatric services (Dinwiddie et al., 2013). The stigma associated with psychiatric issues may also discourage individuals from seeking help through traditional healthcare avenues, resulting in the manifestation of more severe psychiatric conditions and less utilization of less severe conditions like anxiety and depression (Fox et al., 2018).

Interestingly, our study found no strong association between neighborhood income and psychiatric visits compared to other youth ED visits for all psychiatric ED visits. However, lower-income youth were more likely to visit the ED for psychiatric issues, with this trend being more pronounced among minority youth. These findings are corroborated by national data that also find a higher incidence of psychiatric visits for low-income youth (Kalb et al., 2019; Pittsenbarger and Mannix, 2014). Low-income youth did not show an increase in ED visits for psychiatric conditions during the early pandemic, which is consistent with other analyses for states within the Southeastern US (Penner et al., 2022).

Contrary to some other studies, our research noted a higher incidence of youth psychiatric conditions in higher-income neighborhoods, particularly for conditions like anxiety, suicide ideation, and depression. While this finding contrasts with some previous research (Sundquist and Ahlen, 2006), it is supported by national studies reporting higher ED revisits for youth in more affluent neighborhoods and those with commercial insurance (Torio et al., 2015). In addition, emerging work on attempted suicides ED visits in Maryland has shown similar trends, with prosperous communities measuring through the distress community index, having the highest rate of attempted suicides (Akinyemi et al., 2024). We hypothesize this trend is observed in North Carolina due to the high number of White ED Psychiatric ED visits, as neighborhood levels of income were largely insignificant for racial-ethnic minority populations. Prior work in North Carolina has noted localized spatial clustering (i.e., extremely elevated risk) of suicide ideation among youth in lower-income communities when compared to rates of suicide ideation across the state (Sugg et al., 2023). This work highlights the geographic outliers of low-income communities and the need for future work to identify priority populations for mental health interventions. Surprisingly, although these psychiatric conditions are more likely in affluent neighborhoods across North Carolina, youth are still more likely to be low-income, an interesting paradox that requires further research.

Our sample saw decreases in psychiatric ED visits from the COVID-19 pandemic (March 2020–October 2022), consistent with the literature (Leeb et al., 2020; Villas-Boas et al., 2023). Similar to Villas-Boas et al. (2023), we find a quicker rebound of psychiatric ED visits than ED visits for youth, demonstrating the vulnerability of this subpopulation. The only demographic that noted a significant increase throughout the pandemic was Hispanic youth, a potential new finding observed in hospital administrative data. Samples of Hispanic youth during the COVID-19 pandemic showed greater responsibility for childcare, and almost half reported that a household member had experienced job loss/reduced work hours or that the family had experienced increased financial problems since the start of the pandemic (Roche et al., 2022).

Based on our findings, it is evident that the emergency departments will continue to play a critical role in addressing both acute and chronic psychiatric issues among youth, particularly among low-income youth and in marginalized communities. Despite efforts to link youth with outpatient mental health services, which have mixed results for the reduction of ED visits (Kirkland et al., 2018; Frosch et al., 2011), our study underscores persistent disparities in access and outcomes with racial and ethnic minorities, especially Black, American Indian, and Hispanic youth facing higher rates of psychiatric ED visits over time. Therefore, enhancing ED capabilities to identify and treat mental health crises effectively remains essential. This necessitates investment in specialized training for ED staff and the implementation of innovative crisis intervention models such as mobile crisis centers like 988, peer crisis services, and telemedicine crisis support (Newton et al., 2017; Narasimhan et al., 2015). Moreover, designing new urgent care models that are accessible and culturally sensitive is crucial to improving

outcomes and reducing the burden on EDs for mental health emergencies.

4.1. Strengths and limitations

Our study contributes to the understanding of the psychiatric health of racial and ethnic minority youth in North Carolina. Specifically, we highlight disparities in psychiatric conditions among different racial and ethnic groups, emphasizing the disproportionate burden faced by youth for severe conditions like suicide-related outcomes and schizophrenia that are increasing over time, particularly in segregated neighborhoods. Our results also show unique patterns of individual and neighborhood-level drivers, such as higher-income communities experiencing more disorders like depression and anxiety. However, individuals themselves are low-income. Additional analysis is needed to elucidate the nuances of individual and community-level drivers of mental health among youth.

Our study also had several limitations. First, the use of administrative billing data to identify psychiatric ED visits is limiting, as these secondary data may represent the most severe and higher-risk cases for mental health disorders and are subject to clinical diagnostic and administrative coding errors (Davis et al., 2016). Therefore, our results may be more generalizable to a more high-risk youth population based on underlying socioeconomic factors. Additionally, stigma associated with mental health conditions and potential underreporting in specific communities could introduce bias into our findings, impacting the accuracy and completeness of psychiatric visit data (Fields-Oriogun et al., 2024; Fox et al., 2018). Unobserved or omitted variables such as educational attainment or unobserved confounding at the neighborhood level may bias our findings. Third, data used in this study includes only visit-level and not patient-level information. It is unknown if these encounters result from unique incidents or recurrent ED visits. We also may underestimate the effect on youth if the ED may be the only resource available for some families. We also conducted this analysis at a neighborhood scale, defined as the patients' ZCTA of residence. However, residential location does not necessarily reflect activity patterns, such as school location or other contextual factors that may influence mental health. Lastly, a limitation of this article is that, despite the authors' efforts to use appropriate racial and ethnic terms, these social constructs are subject to change (Flanagin et al., 2021). The authors attempt to be culturally sensitive and recognize the limitations of constructs like racial and ethnic categories.

5. Conclusions

Our study underscores the complex interplay of racial and economic factors in the psychiatric outcomes of youth in North Carolina. While white youth generally show higher risks for most psychiatric conditions, Black and Hispanic youth are experiencing increasing trends in psychiatric issues, particularly for more severe psychiatric conditions. The cause of these trends is unknown and could be related to stigma, utilization patterns, and/or inequality. Nonetheless, these findings highlight the need for targeted interventions that address the specific needs of racial and ethnic minority youth and consider the broader structural factors influencing psychiatric health. Addressing stigma and improving access to psychiatric services in segregated and underserved neighborhoods are crucial steps toward mitigating these disparities. Future research should continue to explore these dynamics and develop strategies to support the psychiatric health of all youth, particularly those from marginalized communities.

CRedit authorship contribution statement

Margaret M. Sugg: Writing – review & editing, Writing – original draft, Supervision, Methodology, Investigation, Funding acquisition, Formal analysis, Conceptualization. **Sophia C. Ryan:** Writing – review

& editing, Methodology, Data curation. **Sarah E. Ulrich:** Writing – review & editing, Visualization, Methodology. **Jennifer D. Runkle:** Writing – review & editing, Funding acquisition, Formal analysis, Conceptualization. **Martie P. Thompson:** Writing – review & editing, Funding acquisition.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.healthplace.2024.103379>.

Data availability

The authors do not have permission to share data.

References

- AAFP, 2022. ZIP code to ZCTA crosswalk. UDS-mapper. <https://udsmapper.org/zip-code-to-zcta-crosswalk/>.
- Abrams, A.H., Badolato, G.M., Boyle, M.D., McCarter, R., Goyal, M.K., 2022. Racial and ethnic disparities in pediatric mental health-related emergency department visits. *Pediatr. Emerg. Care* 38 (1), e214–e218.
- Adkins-Jackson, P.B., Chantarat, T., Bailey, Z.D., Ponce, N.A., 2022. Measuring structural racism: a guide for epidemiologists and other health researchers. *Am. J. Epidemiol.* 191 (4), 539–547.
- Akinoyemi, O., Ogundare, T., Welleslase, T., Andine, T., Fasokun, M., Odusanya, E., et al., 2024. The association between community-level economic deprivation and incidences of emergency department visits on account of attempted suicides in Maryland. *Front. Public Health* 12, 1353283.
- Alegría, M., NeMoyer, A., Falgàs Bagué, I., et al., 2018. Social determinants of mental health: where we are and where we need to go. *Curr. Psychiatr. Rep.* 20, 95. <https://doi.org/10.1007/s11920-018-0969-9>.
- Allen, J., Balfour, R., Bell, R., Marmot, M., 2014. Social determinants of mental health. *Int. Rev. Psychiatr.* 26 (4), 392–407.
- Anderson, N.W., Eisenberg, D., Zimmerman, F.J., 2023. Structural racism and well-being among young people in the US. *Am. J. Prev. Med.* 65 (6), 1078–1091.
- Bommersbach, T.J., McKean, A.J., Olsson, M., Rhee, T.G., 2023. National trends in mental health-related emergency department visits among youth, 2011–2020. *JAMA* 329 (17), 1469–1477.
- Bridge, J.A., Horowitz, L.M., Fontanella, C.A., et al., 2018. Age-related racial disparity in suicide rates among US youths from 2001 through 2015. *JAMA Pediatr.* 172 (7), 697–699. <https://doi.org/10.1001/jamapediatrics.2018.0399>.
- Bridge, J.A., Ruch, D.A., Sheftall, A.H., Hahn, H.C., O'Keefe, V.M., Fontanella, C.A., et al., 2023. Youth suicide during the first year of the COVID-19 pandemic. *Pediatrics* 151 (3).
- Brooks, M.E., Kristensen, K., Van Benthem, K.J., Magnusson, A., Berg, C.W., Nielsen, A., et al., 2017. glmmTMB balances speed and flexibility among packages for zero-inflated generalized linear mixed modeling. *The R Journal* 9 (2), 378–400.
- Centers for Disease Control and Prevention, National Center for Health Statistics. National Vital Statistics System, Mortality 2018–2021 on CDC WONDER Online Database, released in 2023. Data are from the Multiple Cause of Death Files, 2018–2021, as compiled from data provided by the 57 vital statistics jurisdictions through the Vital Statistics Cooperative Program. Accessed at <https://wonder.cdc.gov/mcd-icd10-expanded.html> on January 11, 2023.
- Chun, T.H., Mace, S.E., Katz, E.R., 2016. Evaluation and management of children with acute mental health or behavioral problems. Part II: recognition of clinically challenging mental health-related conditions presenting with medical or uncertain symptoms. *Pediatrics*.
- Curtin, Sally C., Heron, Melanie P., 2019. Death Rates Due to Suicide and Homicide Among Persons Aged 10–24: United States, 2000–2017.
- Cutrona, C.E., Wallace, G., Wesner, K.A., 2006. Neighborhood characteristics and depression: an examination of stress processes. *Curr. Dir. Psychol. Sci.* 15 (4), 188, 192Return to ref 17 in article.
- Davis, K.A., Sudlow, C.L., Hotopf, M., 2016. Can mental health diagnoses in administrative data be used for research? A systematic review of the accuracy of routinely collected diagnoses. *BMC Psychiatr.* 16, 1–11.
- Dinwiddie, G.Y., Gaskin, D.J., Chan, K.S., Norrington, J., McCleary, R., 2013. Residential segregation, geographic proximity and type of services used: evidence for racial/ethnic disparities in mental health. *Soc. Sci. Med.* 80, 67–75.
- Duncan, D.T., Kawachi, I. (Eds.), 2018. *Neighborhoods and Health*, second ed. Oxford University Press. <https://doi.org/10.1093/oso/9780190843496.00>.
- Fields-Oriogun, D., Foley-Nicpon, M., Thornburg-Suresh, M., 2024. Mental health stigma and service use among Black American youth: a systematic review. *Am. J. Orthopsychiatry*.
- Flanagan, A., Frey, T., Christiansen, S.L., AMA Manual of Style Committee, 2021. Updated guidance on the reporting of race and ethnicity in medical and science journals. *JAMA* 326 (7), 621–627.
- Fox, A.B., Earnshaw, V.A., Taverna, E.C., Vogt, D., 2018. Conceptualizing and measuring mental illness stigma: the mental illness stigma framework and critical review of measures. *Stigma and health* 3 (4), 348.
- Frosch, E., dosReis, S., Maloney, K., 2011. Connections to outpatient mental health care of youths with repeat emergency department visits for psychiatric crises. *Psychiatr. Serv.* 62 (6), 646–649.
- Gill, P.J., Saunders, N., Gandhi, S., Gonzalez, A., Kurdyak, P., Vigod, S., Guttmann, A., 2017. Emergency department as a first contact for mental health problems in children and youth. *J. Am. Acad. Child Adolesc. Psychiatr.* 56 (6), 475–482.
- Hardeman, R.R., Homan, P.A., Chantarat, T., Davis, B.A., Brown, T.H., 2022. Improving the measurement of structural racism to achieve antiracist health policy: study examines the measurement of structural racism to achieve antiracist health policy. *Health Aff.* 41 (2), 179–186.
- Jensen, B.B., Currie, C., Dyson, A., Eisenstadt, N., Melhuish, E., 2013. Early Years, Family and Education Task Group: Report. *European Review of Social Determinants of Health and the Health Divide in the WHO European Region*. World Health Organization, Copenhagen.
- Kalb, L.G., Stapp, E.K., Ballard, E.D., Hologue, C., Keefer, A., Riley, A., 2019. Trends in psychiatric emergency department visits among youth and young adults in the US. *Pediatrics* 143 (4).
- Kirkland, S.W., Soleimani, A., Newton, A.S., 2018. Review: the impact of pediatric mental health care provided outpatient, primary care, community and school settings on emergency department use – a systematic review. *Child Adolesc. Ment. Health* 23 (1), 4–13.
- Leeb, R.T., 2020. Mental health-related emergency department visits among children aged 18 years during the COVID-19 pandemic—United States, January 1–October 17, 2020. *MMWR. Morbidity and Mortality Weekly Report* 69.
- Lindsey, M.A., Sheftall, A.H., Xiao, Y., Joe, S., 2019. Trends of suicidal behaviors among high school students in the United States: 1991–2017. *Pediatrics* 144 (5).
- Marmot, M., Bell, R., 2016. Social inequalities in health: a proper concern of epidemiology. *Ann. Epidemiol.* 26 (4), 238–240.
- Mitchell, J.H., Runkle, J.D., Andersen, L.M., Shay, E., Sugg, M.M., 2022. Inequalities in life expectancy across North Carolina: a spatial analysis of the social determinants of health and the index of concentration at extremes. *Family & Community Health* 45 (2), 77–90.
- Narasimhan, M., Druss, B.G., Hockenberry, J.M., et al., 2015. Impact of a telepsychiatry program at emergency departments statewide on the quality, utilization, and costs of mental health services. *Psychiatr. Serv.* 66 (11), 1167–1172.
- Newton, A.S., Hartling, L., Soleimani, A., Kirkland, S., Dyson, M.P., Cappelli, M., 2017. A systematic review of management strategies for children's mental health care in the emergency department: update on evidence and recommendations for clinical practice and research. *Emerg. Med. J.* 34 (6), 376–384.
- Overhage, L., Hailu, R., Busch, A.B., Mehrotra, A., Michelson, K.A., Huskamp, H.A., 2023. Trends in acute care use for mental health conditions among youth during the COVID-19 pandemic. *JAMA Psychiatr.* 80 (9), 924–932.
- Penner, F., Rajesh, A., Kinney, K.L., Mabus, K.L., Barajas, K.G., McKenna, K.R., Lim, C.S., 2022. Racial and demographic disparities in emergency department utilization for mental health concerns before and during the COVID-19 pandemic. *Psychiatr. Res.* 310, 114442.
- R Core Team, 2024. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing. <https://www.R-project.org/>.
- Ridout, K.K., Alavi, M., Ridout, S.J., Koshy, M.T., Awsare, S., Harris, B., et al., 2021a. Emergency department encounters among youth with suicidal thoughts or behaviors during the COVID-19 pandemic. *JAMA Psychiatr.* 78 (12), 1319–1328.
- Ridout, K.K., Alavi, M., Ridout, S.J., Koshy, M.T., Awsare, S., Harris, B., Vinson, D.R., Weisner, C.M., Sterling, S., Iturralde, E., 2021b. Emergency department encounters among youth with suicidal thoughts or behaviors during the COVID-19 pandemic. *JAMA Psychiatr.* 78 (12), 1319–1328. <https://doi.org/10.1001/jamapsychiatry.2021.2457>.
- Roche, K.M., Huebner, D.M., Lambert, S.F., Little, T.D., 2022. COVID-19 stressors and Latinx adolescents' mental health symptomatology and school performance: a prospective study. *J. Youth Adolesc.* 51 (6), 1031–1047.
- Runkle, J.D., Sugg, M.M., Yadav, S., Harden, S., Weiser, J., Michael, K., 2021. Real-time Mental Health Crisis Response in the United States to COVID-19. *Crisis*.
- Runkle, J.R., Harden, S., Hart, L., Moreno, C., Michael, K., Sugg, M.M., 2023. Socioenvironmental drivers of adolescent suicide in the United States: a scoping review. *Journal of rural mental health* 47 (2), 65.
- Ryan, S.C., Sugg, M.M., Runkle, J.D., Matthews, J.L., 2023. Spatial analysis of greenspace and mental health in North Carolina: consideration of rural and urban communities. *Family & Community Health* 46 (3), 181–191.
- Ryan, S.C., Sugg, M.M., Runkle, J.D., Werts, L., Singh, D., Green, S., 2024. Short-term changes in mental health help-seeking behaviors following exposure to multiple social stressors and a natural disaster. *Soc. Sci. Med.* 348, 116843.
- Shain, B.N., 2019. Increases in rates of suicide and suicide attempts among black adolescents. *Pediatrics* 144 (5).
- Simon, A.E., Schoendorf, K.C., 2014. Emergency department visits for mental health conditions among US children, 2001–2011. *Clin. Pediatr.* 53 (14), 1359–1366.
- Smulowitz, P.B., O'Malley, A.J., Khidir, H., Zaborski, L., McWilliams, J.M., Landon, B.E., 2021. National trends in ED visits, hospital admissions, and mortality for medicare patients during the COVID-19 pandemic: study examines trends in emergency

- department visits, hospital admissions, and mortality for medicare patients during the COVID-19 pandemic. *Health Aff.* 40 (9), 1457–1464.
- Sugg, M.M., Runkle, J.D., Andersen, L.M., Desjardins, M.R., 2023. Exploring place-based differences in suicide and suicide-related outcomes among North Carolina adolescents and young adults. *J. Adolescent Health* 72 (1), 27–35.
- Sugg, M.M., Runkle, J.D., Ryan, S.C., Singh, D., Green, S., Thompson, M., 2023. Crisis response and suicidal behaviors of essential workers and children of essential workers during the COVID-19 pandemic. *Publ. Health Rep.* 138 (2), 369–377.
- Sundquist, K., Ahlen, H., 2006. Neighborhood income and mental health: a multilevel follow-up study of psychiatric hospital admissions among 4.5 million women and men. *Health Place* 12 (4), 594–602.
- Talley, D., Warner, S.L., Perry, D., Brissette, E., Consiglio, F.L., Capri, R., et al., 2021. Understanding situational factors and conditions contributing to suicide among Black youth and young adults. *Aggress. Violent Behav.* 58, 101614.
- Torio, C.M., Encinosa, W., Berdahl, T., McCormick, M.C., Simpson, L.A., 2015. Annual report on health care for children and youth in the United States: national estimates of cost, utilization and expenditures for children with mental health conditions. *Academic Pediatrics* 15 (1), 19–35.
- Uher, R., McGuffin, P., 2008. The moderation by the serotonin transporter gene of environmental adversity in the aetiology of mental illness: review and methodological analysis. *Mol. Psychiatry* 13 (2), 131.
- Ulrich, S.E., Sugg, M.M., Desjardins, M.R., Runkle, J.D., 2024. Disparities in spatiotemporal clustering of maternal mental health conditions before and during the COVID-19 pandemic. *Health & Place* 89, 103307.
- US Department of Labor, 2015. Transition to ICD-10. US Department of Labor. Transition to ICD-10. <http://www.dol.gov/agencies/owcp/FECA/ICD10transition>.
- Villas-Boas, S.B., Kaplan, S., White, J.S., Hsia, R.Y., 2023. Adolescent total and mental health-related emergency department visits during the COVID-19 pandemic. *JAMA Netw. Open* 6 (10), e2336463.
- Visser, K., Bolt, G., Finkenauer, C., Jonker, M., Weinberg, D., Stevens, G.W.J.M., 2021. Neighborhood deprivation effects on young people's mental health and well-being: a systematic review of the literature. *Soc. Sci. Med.* 270, 113542. <https://doi.org/10.1016/j.socscimed.2020.113542>.
- Walker, R., Francis, D., Brody, G., Simons, R., Cutrona, C., Gibbons, F., 2017. A longitudinal study of racial discrimination and risk for death ideation in African American youth. *Suicide Life-Threatening Behav.* 47 (1), 86–102.
- Williams, R., Williams-Morris, D., 2000. Racism and mental health: the African American experience. *Ethn. Health* 5 (3–4), 243–268. R.
- Xiao, Y., Cere, J., Mann, J.J., 2021. Temporal trends in suicidal ideation and attempts among US adolescents by sex and race/ethnicity, 1991-2019. *JAMA Netw. Open* 4 (6), e2113513.