

Impact of Geographic Access to Primary Care provider on Pediatric Behavioral Health Screening

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Abstract

Objective : To assess the impact of geographic access to primary care providers (PCPs) on the receipt of behavioral disorder screening among children and adolescents from different racial/ethnic groups. **Data Sources/Study Setting:** The primary data source was 2013-2016 administrative claims data from a large pediatric Medicaid Managed Care Plan linked to the US Census data and the National Provider Identifier (NPI) Registry. **Study Design:** The study was a retrospective cohort design which was conducted using data obtained from multiple sources. **Data Collection/Extraction Methods :** Geographic access was measured as one way travel distance to the nearest PCP estimated based on google map, and the PCP density per 10,000 population within a 10-mile travel radius from the population weighted centroid of each individual's zip code. **Multivariate logistic regression** was conducted to examine the association between the geographic access measures and the likelihood of receiving behavioral disorder screening within each racial/ethnic group. **Principal Findings :** Behavioral disorder screening rate was 12.6% among 457,870 children and adolescents who met the inclusion criteria. Multivariable analyses revealed that the travel distance to the nearest PCP was negatively associated with the screening uptake among Hispanics (10-20 vs. 0-10 miles: OR=0.78, 95%CI [0.71-0.86]; 20-30 vs. 0-10 miles: OR=0.35, 95%CI [0.23-0.54]). Similar effects associated with the travel distance were not observed in Blacks and Whites. Among those having access to ≥ 1 PCP within 10 miles of travel distance, the increase in PCP density had a greater positive impact on the receipt of behavioral disorder screening in minorities than that in Whites. **Conclusion :** Minorities, especially Hispanics, were more sensitive than Whites to the geographic access barriers to PCPs for pediatric behavioral disorder screening.

Introduction

Pediatric behavioral health screening at primary care setting has long been promoted to increase the early detection and management of mental disorders by American Academy of Pediatrics and other bodies.(1, 2) Similarly, Medicaid's Early and Periodic, Screening, Diagnosis, and Testing (EPSDT) statute requires mental assessment of all Medicaid covered individual under 21 years of age.(3, 4) The uptake rates of pediatric behavioral health screening, however, are very poor (~ 15%) and depend significantly on the state policy, primary care providers' training in behavioral health and reimbursement of screening services.(5–8)At patient level, lack of awareness, race/ethnicity, socioeconomic status and insurance status have been identified as the strong predictors of receiving general health screening services. (9, 10) The association of geographic access to primary care providers (PCPs) with pediatric behavior disorder screening is yet to be examined.

Geographic access which can be defined as geographic distribution of providers in relation to patients' location is often measured in two terms; first, geographic accessibility that is defined as a travel distance between the patients and the providers; second, geographic availability referred as the number of providers available to patients to choose from.(11) Studies that have investigated the impact of provider access on mental health care reported that shorter travel distance to mental health specialists and high mental health care provider density are associated with higher services utilization.(12–14)

Geographical distribution of providers and health care facilities are strongly associated with the race/ethnicity and socioeconomic status.(15) Individual with similar race/ethnicity and economic status tends to live together; in turn, clusters of minorities living in poor neighborhood can be observed in all major metropolitan areas in the United States.(15) Minorities living in poor neighborhoods often have lesser travel means, access to non-existent or inconsistent public transport system and lesser time flexibility.(16–18) Combined with the sparser availability of providers in these neighborhoods, geographic access to providers could potentially affect minorities more than whites.(15, 19) To test this hypothesis, the objective of our study was to investigate the impact of geographic access to PCP on odds of receiving behavioral health screening among pediatric population across race/ethnicity.

Methods

Study Setting and Data Sources

The study was a retrospective in nature which was conducted using data obtained from multiple sources. The primary data source was the medical insurance claims data from 2013 to 2016 obtained from Texas Children's Health Plan (TCHP), a Houston based pediatric Medicaid managed care program that offers Medicaid and Children's Health Insurance Program (CHIP) in more than 20 counties of Southeast Texas. In Texas, 40% of children below age 21 are covered by Medicaid and CHIP. (20) TCHP data included characteristics of providers who were actively serving the TCHP enrollees, medical claim details of enrollees and enrollees' characteristics (date of birth, gender, race/ethnicity) and zip code of the enrollees' residence. Zip code of enrollees' residence was used to ascertain the location of study population.

Using zip code of the enrollees' residence, the data was also linked to 2010 US Census data to identify the neighborhood related information of the study population and geodata of the study area.(21)

The data was further linked with the National Provider Identifier (NPI) Registry to ascertain provider's primary practice location.(22) This study only included those PCPs who had provided at least one service to the TCHP pediatric enrollees in a year.

Study Population

The study period was between January 2013 and December 2016. As children and adolescents could receive behavioral health screening multiple times during the four years of study period, we created three distinct study periods (2013-14, 2014-15, and 2015-16) for the calculation of behavioral health screening rate. A study period constituted of two years, first year was defined as a wash-out period and second year was defined as a measurement period. Inclusion criteria used in the study were (a) had at least 10 months of enrollment in both measurement period and washout period; b) had absence of mental disorder diagnosis or treatment during the washout period; and c) age of enrollees between 4- and 18-years during measurement period. Enrollees were allowed to be included in multiple study periods based on if they met the inclusion criteria of more than one study period.

Dependent Variable/Outcome Measure

Behavioral health screening

Individuals having at least one CPT[®] (Current Procedural Terminology)/HCPCS (Healthcare Common Procedure Coding System) code of behavioral health screening (reported in appendix) during the measurement period were considered as screened individuals. In case of those individuals who also received mental health services other than screening during the measurement period, only those who received screening prior to the first visit relevant to any other mental health services were considered as screened. The yearly screening rates was calculated as total screened in the measurement period divided by the number of eligible individuals in a given study period.

Main Independent Variables

Geographic access measures

Geographic accessibility (one-way travel distance to PCP) and geographic availability (PCP density per 10,000 residents) were geographic access measures used in the study. The PCPs included in the study were physicians with specialty of family medicine, general practice, internal medicine, pediatrics or adolescent medicine, nurse practitioners (adult and pediatric), and physician assistants.

One-travel distance to the nearest PCP (geographic accessibility)

The one-way travel distance to the nearest PCP was measured for each individual identified. Travel distance was defined as the shortest route by a car (different from straight-line distance between two points) from the geocode of enrollees' residence zip code to geocode of provider's practice locations. To calculate the one-way travel distance, first step was to geo-locate the population weighted center of zip code tabulation area (ZCTA) by geo-averaging the geocodes of all the population center of census blocks that were within the boundary of zip code tabulation area while using the population of census block as a weight.(23) This exercise was conducted on ArcGIS using the geo-information (maps) provided by UScensus.gov. The second step was to assign a geocode to each provider's practice locations (street address). Lastly, the travel distance between two points was estimated using a SAS[®] algorithm that calculates the shortest route possible between two locations based on average speed and the maximum speed limit of the road obtained from Google Map[®]. (24)

PCP Density per 10,000 residents within 10-mile travel distance (geographic availability)

PCP density per 10,000 residents within 10-mile travel distance of enrollees' residence was used to measure geographic availability of PCPs. A 10-mile distance was chosen for this measure based on an assumption that anything within travel distance of 10-mile of enrollees could be considered as vicinity to enrollees. It was calculated using the geographic information system-based floating catchment method. (25) This method identify provider to population ratio within a pre-determined (say 10 mile) travel distance circle (called as catchment area) around enrollee's residence. This method handles the issue of

border crossing in aggregate measure such as “provider to population ratio within a zip code”, while being still easy to understand.

The measure was calculated by dividing count of PCPs within 10-mile travel distance from the population weighted center of zip code of enrollees’ residence by the census population within the 10-mile radius of that zip code. First step was to determine the count of PCPs within 10-mile travel distance of enrollees. To calculate travel distance between providers and enrollees’ zip code, same method was applied as described in travel distance to nearest PCP measure earlier in the study. After that, count of PCPs within 10-mile travel distance radius was computed for each enrollees’ zip code. Second step was to calculate the population within 10-mile radius from population center of zip code. For this, number of census blocks that were partial or completely part of 10-mile radius circle were identified.(26) Census block population was attributed to the catchment’s population based on extent they were the part of 10-mile radius circle. For instance, if the 0.5 census block coincides the 10-mile radius circle then only half of the population of census block was used for the calculation of circle’s population.

The sub-cohort of study population that had at least one PCP within 10 mile of travel distance, were categorized into following subcategories based on the empirical distribution of the data: ≤ 2 PCPs; 2.1-5 PCPs; 5.1-10 PCPs; >10 PCPs

Enrollees’ race/ethnicity

Whites, Blacks, Hispanics, Others (Asian, American Indians; Pacific Islanders; other races) and unknown were the categories of race/ethnicity included in the study.

Covariates

Other variables controlled in the study were demographics of individuals (age, gender, and Medicaid eligibility categories), neighborhood poverty level, and urban influence.

Age of enrollees were categorized into three categories 4-6 years; 7-12 years; and 13-18 years. Medicaid eligibility of the study population were of two types: CHIP (family income above poverty level) and STAR (family income below poverty level).(27, 28) Therefore, Medicaid’s eligibility could be assumed proxy measure for family poverty level.

Neighborhood poverty level was calculated based on the percentage of households living below poverty level in enrollee’s zip code provided by US Census data.(29) Urban influence was categorized based on the Urban Influence Code 2013, divided as those living in large metro (area of 1+million residents); or those who are living adjacent to large metro; and those living in small metro (area of <1 million residents) or adjacent to small metro.(30)

Statistical Analysis

The study has evaluated the association of primary independent measure (geographic access measures, race/ethnicity, and the interaction between geographic access measures and race/ethnicity) with the likelihood of receiving behavioral health screening using multivariable logistic regression.(31) Because, the study included both individual-level and zip code-level variables, we first utilized two-level model where zip code was at higher level and individuals were nested within the zip codes. Intraclass correlation was used to assess the performance of zip code as a higher level in explaining the variation which was only 5% for the empty two-level model.(32) Based on that one-level model was used in which zip code level variables and individual level variable were at one level.

ArcGIS® was used for all geographic information system functions, except travel distance that was calculated using Google Map®. All statistical analyses were carried out using SAS®. This study was approved by our University Institutional Review Board.

Results

Study Population

Table 1 presents the process of cohort identification. The final cohorts consisted of 130,992 eligible population in 2014, 133,429 in 2015 and 160,272 in 2016 with the total of 402,655 children and adolescents. Table 2 presents the cohort demographics and distribution of independent variables. Of the children and adolescents identified, 61.7% were Hispanics, 75.8% were between ages of 7-18 years, 50.7% were male, and 83.0% were below poverty level. Approximately, 92.4% of the study population resided in large metros; 40.9% had a residence in neighborhoods where 30% or more households had income below poverty level.

Despite that 96% of study population had access to at least one PCP within 10 miles of travel distance, the considerably large number of enrollees were living between 10-20 miles (n=12,242) or more than 20 miles (n=1,765) of travel distance from the nearest PCP. Across races, most of the Blacks and Hispanics were living within 10-mile travel distance of the nearest PCP (~97%); whereas, disproportionately, 89% of the Whites were living within 10-mile travel distance of the nearest PCP. Similarly, 1.48% (n=796) of Whites had to travel more than 20 miles for PCP, 0.13% (n=97) of Blacks had to travel more than 20 miles and 0.31% (n=778) of Hispanics had to travel more than 20 miles for the nearest PCP.

Behavioral health screening rate among study population was 12.6% (n=50,721), However, with the increase in travel distance screening rates decreased substantially. Those who had to travel not more than 10 miles to access the nearest PCP had screening rate of 12.7%, whereas those who had to travel 10-20 miles distance for nearest PCP had screening rate of 10.3% and those who had to travel more than 20 miles for nearest PCP had screening rate of 8.9%.

Impact of travel distance on the likelihood of receiving behavioral screening

The interaction effect between race/ethnicity and travel distance was statistically significant (race/ethnicity and travel distance: Beta estimate -0.17, p value<0.01). Therefore, the study cohort was stratified by race/ethnicity and separate multivariable logistic regression models were conducted within each racial/ethnic group to assess the association of travel distance on the odds of receiving screening across races/ethnicities.

Table 3 presents the results of three separate logistic regression models fitted for Whites, Blacks and Hispanics. Using 0-10 miles travel distance as the reference, the increased distance to nearest providers was negatively associated with the likelihood of receiving screening among Hispanics (10.1-20 miles: OR=0.76, 95%CI [0.69-0.84]; 20.1-30 mile: OR=0.36, 95%CI [0.24-0.55]), and had no statistically significant effects among Blacks and Whites.

Impact of PCP density on the likelihood of receiving behavioral screening

Similar with the analysis for the impact of travel distance, there were statistically significant interactions between race/ethnicity and PCP density. Table 4 presents the effects of PCP's density on the odds of receiving screening stratified by race/ethnicity. Blacks and Hispanics were more sensitive for odds of receiving screening with the increase in PCP density.

The likelihoods of receiving screening among Blacks living in neighborhood with PCP density of 2.1-5.0 PCPs and 5.1-10 PCPs were 26% and 33% higher respectively, compared to the Blacks who were residing in neighborhood within provider density of up to 2 PCPs (2.1-5 PCPs vs. ≤ 2 PCPs: OR=1.26, 95%CI [1.17-1.35]; 5.1-10 PCPs vs. ≤ 2 PCPs: OR=1.33, 95%CI [1.17-1.43]; and >10 PCPs vs. ≤ 2 PCPs: OR=1.26, 95%CI [1.16-1.38]).

Similarly, odds among Hispanics living in proximity of 2.1-5 PCPs, 5.1-10 PCPs and > 10 PCPs were higher up by 25% to receive behavioral screening compared to those who live in the neighborhood with density of up to 2 PCPs (2.1-5 PCPs vs. ≤ 2 PCPs: OR=1.25, 95%CI [1.20-1.37]; 5.1-10 PCPs vs. ≤ 2 PCPs: OR=1.19, 95%CI [1.14-1.24]; and >10 PCPs vs. ≤ 2 PCPs: OR=1.28, 95%CI [1.22-1.34]).

However, in Whites, statistically significant difference was not detected between those who were living in neighborhood with PCP density of 2.1-5 PCPs and 5.1-10 PCPs who live in the neighborhood with density of up to 2 PCPs. Only those who were living in 10-mile proximity of more than 10 PCPs were 30% more likely to receive screening compared to Whites who had proximity of up to 2 PCPs (>10 PCPs vs. ≤ 2 PCPs: OR=1.32, 95%CI [1.19-1.47]).

Covariates and Odds of Behavioral health Screening

Neighborhood level variables

Decreased urban influence and increase in the poverty level in neighborhood was associated with lesser odds of receiving screening among study population. Those who lived in small metros or adjacent to small metros had approximately 25% lesser odds of receiving screening among Blacks and Whites

compare to those who are living in large metro. However, the extent of the effect was higher among Hispanics, who were living adjacent to large metros or living in small metros or adjacent to small metros had 35% and 39% lesser odds of receiving screening respectively.

Individual level variables

Other factors significantly associated with the receipt of behavioral health screening were enrollees' age, gender, and Medicaid eligibility categories. In all racial/ethnic groups the chance of receiving behavioral screening was the highest among the 4-6 years age group, followed by 13-18 years age group, and lowest among those between 7 and 12 years of age. Compared to those who were above poverty level (CHIP), individuals below poverty level (STAR) had up to 11-32% lower odds of receiving behavioral health screening across all racial/ethnic groups.

Discussion

Although pediatric behavioral health screening in primary care settings has been universally recommended for early diagnosis and treatment, the screening uptake rate (12.6%) was poor in the study population. The screening rates found in this study are similar to the screening rate (16%) reported in the only other population based study conducted in Massachusetts Medicaid enrollees aged below 21 years. (5)

The primary finding of the study was that minorities were more sensitive to geographic barriers compared to Whites. Hispanics were the only racial/ethnic group whose screening rate decreased sharply with the increasing travel distance to the nearest PCP. Their screening rates declined by 75% when the travel distance to the nearest PCP increased from less than 10 miles to more than 20 miles. Previous research has consistently reported that minorities, especially Hispanics, are more likely to lack private vehicle and have greater transportation barriers compared to Whites.(33, 34) As a result, minorities were less likely to travel long distances for care compared to Whites even after controlling for socio-economic status. Moreover, both Hispanics and Blacks were more sensitive than Whites to the PCP density. Their likelihood of receiving screening increased by 20-30% when the PCP density increased from <2 PCPs to ≥ 2 PCPs per 10,000 residents.

The vulnerability of minority families to geographic barriers in PCP access may not only cause racial/ethnic disparity in health care but might also contribute to the racial/ethnic inequality in socioeconomic status. Minorities have higher delays in initiation of mental health treatment compared to Whites.(35) The failure to identify and intervene symptoms of mental disorders early and adequately has been linked to several adverse consequences such as school dropouts, suicide, involvement in substance use, overuse of traditional medical services, reduced adherence to treatment for somatic problems, problems in social life.(21, 36, 37)

Improving geographic access to PCPs could be challenging and may involve several policy level initiatives. An example of a public program to improve primary care access are the Rural and Urban

Community Health Centers (CHC) which are designed to provide care in neighborhoods with high poverty rates which are also likely to have a higher density of minorities. (38) Increasing the number of CHC may improve the geographic access in neighborhoods with sparse distribution of PCPs. Other solutions could be improving the public transport system or providing reimbursement for travel to reduce the travel burden faced by patients. Tierney et al. reported that positive association between Medicaid transportation reimbursements on office-visits for primary care.(39)

Our study is the first to have investigated the association between pediatric behavioral health screening and the geographic access to PCPs. This study used more sophisticated geographic measures than prior studies. For instance, using one-way travel distance between a provider and the population-weighted centroid of the zip code of enrollee's residence is a superior measure than the straight line distance between the two points.(5) Similarly, using floating-catchment method for provider density measurement instead of using a provider-to-population ratio within a defined geographic unit (e.g. providers density in county or zip code) reflects actual geographic availability of providers to an individual and handles the problem of border crossing by residents for health care.(25)

The findings from this study are subject to several limitations. Family history of mental disorders may affect health seeking behavior for mental disorders, but this variable was not included in the analysis. The study did not control for transport medium in the family. Transportation medium (public transport vs. self-owned vehicle) changes the travel time. However, this study had a homogenous mix of enrollees (84% were below poverty level) which may reduce the differential impact of this limitation on the findings. The enrollees' geolocation was based on zip code of enrollees' residence, instead of street address. Therefore, the study assumed that all enrollees living in a same zip code had traveled similar distance for the providers. However, the use of population weighted centroid of zip codes instead of geo-centered centroid minimized the effect of this limitation.

Conclusion

In summary, only thirteen percent of Medicaid pediatric population received behavioral health screening. As compared to Whites, minorities were more prone to be adversely affected by the geographic barrier to the access of primary care. Further studies are warranted to assess the effect of improving public transport system and Community Health Clinics in minority dominant neighborhoods on the uptake of behavioral health screening.

Declarations

Ethics approval and consent to participate

This study was approved by University of Houston Institutional Review Board.

Consent for publication

“Not applicable”

Availability of data and materials

All data generated or analyzed during this study are included in this published article

Competing interests

Conflict of Interest Statement: The authors have no conflicts of interest relevant to this article to disclose.

Funding: The project was done without funding

Authors' contributions:

As part of NU's dissertation work, he has conceptualized the research idea, analyzed the data, and drafted the manuscript. HC was NU's dissertation committee chair and other coauthors have all served on NU's dissertation committee. As a team, they have supervised and assisted NU in project conceptualization, data acquisition, data analysis, and manuscript development.

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Tables

Table 1. Consort table for the study population identification (n=402,655).

| | Years | 2013 | 2014 | 2015 | 2016 |
|--|-------|--------|----------------|---------|---------|
| Inclusion Criteria | | | | | |
| Enrolled for 10 months in a given year | | 241,97 | 239,683 | 255,642 | 264,911 |
| Enrolled in given and previous year | | | 171,968 | 175,851 | 190,039 |
| Excluding members who had mental disorder in wash-out period | | | 155,905 | 159,978 | 174,118 |
| Including ages of 4- 18 years in given year | | | 130,992 | 133,429 | 160,272 |
| Total study population | | | 402,655 | | |

Table 2. Characteristics of study sample (n=402,655).

| Categories | n (%) |
|---|----------------|
| Overall | 402,655 (100) |
| <i>Screening Rate</i> | 50,721 (12.6) |
| <u>Main Independent variables</u> | |
| <i>Travel Distance to the nearest primary care provider</i> | |
| ≤10 mile | 388,216 (96.5) |
| 10.1-20 mile | 12,424 (3.1) |
| 20.1-30 mile | 1,765 (0.4) |
| <i>Primary care provider density (per 10,000)</i> | |
| ≤2 PCPs | 88,946 (23.2) |
| 2.1-5 PCPs | 116,857 (30.5) |
| 5.1-10 PCPs | 112,777 (29.4) |
| >10 PCPs | 646,40 (16.9) |
| <i>Race/ethnicity*</i> | |
| Whites | 51,902 (12.9) |
| Blacks | 72,919 (18.1) |
| Hispanics | 248,392 (61.7) |
| Others | 14,002 (3.5) |
| <u>Individual Level variables</u> | |
| <i>Age category (in years)</i> | |
| 4-6 | 97,346 (24.2) |
| 7-12 | 156,101 (38.8) |
| 13-18 | 149,208 (37.1) |
| <i>Sex</i> | |
| Male | 203,962 (50.7) |
| Female | 198,681 (49.3) |
| <i>Medicaid eligibility category</i> | |
| STAR (below poverty level) | 72,051 (17.0) |
| CHIP (above poverty level) | 352,641 (83.0) |
| <u>Neighborhood Level variables</u> | |
| <i>Urban influence*</i> | |
| Large metro | 365,123 (92.4) |
| Adjacent to large metro | 27,633 (6.8) |
| Small metro | 2,268 (0.6) |
| Rural | 32 (<0.1) |
| <i>Poverty level*</i> | |
| ≤10 percent | 33,345 (8.3) |
| 11-20 percent | 113,683 (28.3) |
| 21-30 percent | 90,031 (22.4) |
| >30 percent | 164,246 (40.9) |

Notes: PCP, Primary Care Provider; CHIP, Children's Health Insurance Plan *percentages do not add up to 100 due to missing or unknown values

Table 3. Impact of travel distance to the nearest primary care provider (PCP) (geographic accessibility) and other predictors on the likelihood of receiving screening within each race/ethnicity.

| Predictors | Race/Ethnicity | | |
|---|--------------------------------|--------------------------------|--------------------------------|
| | Whites n=51,902 | Blacks n=72,919 | Hispanics n=248,392 |
| | OR (95% CI) | OR (95% CI) | OR (95% CI) |
| <u>Main Independent</u> | | | |
| <i>Travel distance to the nearest PCP</i> | | | |
| ≤10 mile | Ref | | |
| 10.1-20 mile | 0.90 (0.82-0.99) | 0.93 (0.78-1.1) ^{NS} | 0.76 (0.69-0.84) |
| 20.1-30 mile | 1.07 (0.86-1.35) ^{NS} | 0.91 (0.43-1.94) ^{NS} | 0.36 (0.24-0.55) |
| <u>Individual Level</u> | | | |
| <i>Age (in Years)</i> | | | |
| 4-6 | Ref | | |
| 7-12 | 0.31 (0.29-0.33) | 0.23 (0.22-0.25) | 0.25 (0.20-0.21) |
| 13-18 | 0.34 (0.32-0.36) | 0.33 (0.31-0.35) | 0.34 (0.33-0.35) |
| <i>Sex</i> | | | |
| Male | Ref | | |
| Female | 0.96 (0.91-1.01) ^{NS} | 0.92 (0.88-0.97) | 0.96 (0.93-0.98) |
| <i>Medicaid Eligibility</i> | | | |
| Above poverty level | Ref | | |
| Below poverty level | 0.89 (0.85-0.94) | 0.68 (0.64-0.73) | 0.75 (0.73-0.78) |
| <u>Neighborhood Level</u> | | | |
| <i>Poverty level</i> | | | |
| ≤10 percent | Ref | | |
| 11-20 percent | 0.78 (0.72-0.84) | 1.32 (1.19-1.47) | 0.93 (0.88-0.98) |
| 21-30 percent | 0.89 (0.82-0.97) | 1.18 (1.06-1.31) | 0.75 (0.71-0.79) |
| >30 percent | 0.84 (0.77-0.92) | 1.28 (1.15-1.42) | 0.82 (0.78-0.87) |
| <i>Urban influence</i> | | | |
| Large metro | Ref | | |
| Adjacent to metro | 0.85 (0.79-0.92) | 0.73 (0.68-0.79) | 0.45 (0.41-0.5) |
| Small metro | 0.72 (0.59-0.87) | 0.57 (0.41-0.78) | 0.61 (0.35-1.06) ^{NS} |

Notes: Ref, Reference category; ^{NS}, Not statistically significant (p value>0.05); Other values are statistically significant ((p value≤0.05).

Table 4. Impact of PCP density (geographic availability) and other predictors on the likelihood of receiving screening within each race/ethnicity (n=386,548).

| Predictors | Whites <i>OR (95% CI)</i> | Blacks <i>OR (95% CI)</i> | Hispanics <i>OR (95% CI)</i> |
|----------------------------------|-------------------------------------|-------------------------------------|--|
| <u>Area Independent</u> | | | |
| <i>PCP Density per 10,000</i> | | | |
| ≤2 PCPs | REF | | |
| 2.1-5 PCPs | 0.99 (0.92-1.06) | 1.26 (1.17-1.35) | 1.25 (1.20-1.37) |
| 5.1-10 PCPs | NS 0.97 (0.89-1.06) | 1.33 (1.17-1.43) | 1.19 (1.14-1.24) |
| >10 PCPs | 1.32 (1.19-1.47)... | 1.26 (1.16-1.38) | 1.28 (1.22-1.34) |
| <u>Individual Level</u> | | | |
| <i>Age (in Years)</i> | | | |
| 4-6 | REF | | |
| 7-12 | 0.30 (0.28-0.33) | 0.24 (0.22-0.25) | 0.20 (0.19-0.21) |
| 13-18 | 0.34 (0.32-0.36) | 0.33 (0.31-0.35) | 0.34 (0.33-0.35) |
| <i>Sex</i> | | | |
| Male | REF | | |
| Female | 0.96 (0.91-1.02) ^{NS} | 0.92 (0.88-0.97) | 0.95 (0.93-0.98) |
| <i>Medicaid Eligibility</i> | | | |
| CHIP (above poverty level) | REF | | |
| STAR (below poverty level) | 0.74 (0.69-0.79) | 0.68 (0.64-0.72) | 0.75 (0.72-0.77) |
| <u>Neighborhood Level</u> | | | |
| <i>Poverty level</i> | | | |
| ≤10 percent | REF | | |
| 11-20 percent | 0.79 (0.73-0.85) | 1.27 (1.14-1.41) | 0.94 (0.89-0.99) |
| 21-30 percent | 0.9 (0.82-0.99) | 1.08 (0.97-1.21) ^{NS} | 0.71 (0.67-0.75) |
| >30 percent | 0.82 (0.75-0.9) | 1.17 (1.05-1.3) | 0.78 (0.74-0.82) |
| <i>Urban influence</i> | | | |
| Large metro | REF | | |
| Adjacent to metro | 0.79 (0.73-0.87) | 0.83 (0.76-0.91) | 0.53 (0.48-0.58)... |
| Small metro | 0.73 (0.54-0.99) | 0.70 (0.49-0.98) | 0.65 (0.32-1.30) ^{NS} |

Notes: Ref, Reference category; ^{NS}, Not statistically significant (p value>0.05); other values are statistically significant ((p value≤0.05).

Appendix

Appendix

Table 1. CPT codes used identify behavioral health screening claims

| CPT code | Service Description | Reference |
|----------|--|--|
| 0791 | Psychiatric diagnostic evaluation | CPT Primer for Psychiatrists file:///C:/Users/upadhyna/Downloads/cpt-primer-for-psychiatrists.pdf |
| 0801 | Psychiatric diagnostic interview examination | Medicare CPT Codes |
| 6101 | Psychological testing | CPT Codes for Psychology Services https://psychcentral.com/lib/cpt-codes-for-psychology-services/ |
| 6110 | Developmental screening | American Academy of Pediatrics coding fact sheet |
| 6118 | Neuropsychological testing | CMS Medicare coverage policy |
| 6127 | Brief emotional/behavioral assessment | American Academy of Pediatrics coding fact sheet |
| 6150 | Health and behavior assessment | CPT Codes for Psychology Services https://psychcentral.com/lib/cpt-codes-for-psychology-services/ |
| 6151 | Health and behavior assessment | CPT Codes for Psychology Services https://psychcentral.com/lib/cpt-codes-for-psychology-services/ |
| 6161 | Administration of caregiver-focused health risk assessment | https://www.aap.org/en-us/Documents/coding_preventive_care.pdf |
| 9408 | Alcohol and/or substance (other than tobacco) abuse structured interview | CPT Primer for Psychiatrists file:///C:/Users/upadhyna/Downloads/cpt-primer-for-psychiatrists.pdf |
| 9409 | Alcohol and/or substance (other than tobacco) abuse structured interview | CPT Primer for Psychiatrists file:///C:/Users/upadhyna/Downloads/cpt-primer-for-psychiatrists.pdf |
| 9420 | Administration and interpretation of health risk assessment | It was applicable till 2016 |
| 0442 | Prevention: Screening for alcohol misuse in adults including pregnant | https://hcpcs.codes/g-codes/G0442/ |
| 0444 | Annual depression screening, 15 minutes | https://hcpcs.codes/g-codes/G0444/ |