Neighborhood Socioeconomic Disadvantage and Acute Care Utilization in Washington State Medicaid: A Retrospective Cohort Study

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Abstract

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Background: Neighborhood disadvantage has been associated with potentially preventable acute care utilization among Medicare beneficiaries but this association has not been studied in a Medicaid population, which is important for informing more equitable care and policies for this population.

Methods: We conducted a retrospective cohort study of 100% Medicaid claims for 1.5 million unique adult beneficiaries enrolled for at least 11 months of a calendar year during the period 2017-2021. Mixed effects logistic regression was applied to estimate the association between state-level ADI decile and Emergency Department (ED) visits, low acuity ED visits, and hospitalizations in a calendar year, adjusting for patient characteristics. Standard errors were clustered at the Census block group level.

Results: Increasing levels of neighborhood socioeconomic disadvantage (by ADI decile) were associated with greater odds of any ED visits (adjusted OR 1.07, 1.06-1.07), low acuity ED visits (1.08, 1.08-1.08), and any hospitalizations (1.02, 1.02-1.02).

Conclusions: Among Medicaid beneficiaries, greater neighborhood socioeconomic disadvantage was associated with increased acute care utilization, including potentially preventable ED visits.

These findings signal potential barriers to outpatient care access that could be amenable to future interventions by health systems and payers.

Introduction

Neighborhood disadvantage can adversely affect health. In particular, health outcomes can be affected by factors such as access to transportation, housing, education, and jobs, as well as health care.[1] Part of these neighborhood-level effects relate to individual socioeconomic status (SES), a fundamental driver of health outcomes in its own right[2] as well as an important means by which individuals access health-promoting resources within neighborhoods and afford to live in well-resourced neighborhoods. However, existing research suggests that higher neighborhood disadvantage may also be associated with worse disease outcomes regardless of individual SES.[3–5]

Higher degrees of neighborhood disadvantage, as captured by measures such as the Area Deprivation Index (ADI)[3], have been associated with greater rates of potentially avoidable health care utilization, such as low acuity Emergency Department (ED) visits and hospitalizations for ambulatory care sensitive conditions (ACSC) among older adults insured through Medicare and at two medical centers.[6,7] However, little is known about this relationship in other populations including individuals insured through Medicaid. Addressing this knowledge gap is important because, by virtue of low-income and program eligibility, Medicaid beneficiaries may be disproportionately vulnerable to the impacts of neighborhood disadvantage. Prior research on cardiac health outcomes suggests that low individual SES increases vulnerability to the effects of neighborhood socioeconomic disadvantage[8,9]—a form of negative synergism between individual and neighborhood SES particularly relevant to the Medicaid population. For example, the social stressors posed by neighborhood disadvantage—such as limited job opportunities or poor access to housing—may impose additional allostatic and cognitive load on individuals with low SES.[10]

Additionally, system factors (e.g., comparatively low Medicaid reimbursement rates, high administrative burden[11,12]) may disproportionately impede Medicaid beneficiaries' ability to access primary and dental health care and increase the risk for potentially avoidable acute care utilization. Neighborhood disadvantage specifically may shape access in multiple ways, including the presence of clinics in a certain geographic area,[13] the accessibility of care at those clinics (e.g., insurances accepted, cultural congruence of clinicians, interpreter services), transportation options to reach in-person care, and telephone or broadband access to access telemedicine.[14] Even if individuals have access—as one single-city study found that neighborhood disadvantage was not correlated with lacking a usual source of care[15]—access may not be timely for urgent concerns, and quality of care may also vary by neighborhood disadvantage.[16] Indeed, prior work has demonstrated that dissatisfaction with one's usual source of care, difficulty scheduling an appointment, or long waiting times are associated with low acuity ED visits.[17]

Insight about the relationship between neighborhood disadvantage and acute care utilization among Medicaid beneficiaries is needed. Such insight could guide policy and practice leaders implementing care delivery and payment innovations that incorporate measures of neighborhood disadvantage to account for the effect of social drivers on health and patient outcomes[18,19,20] For instance, the Centers for Medicare & Medicaid Services' new primary care payment model, Making Care Primary, which launches in July 2024, uses ADI to adjust per-patient-per-month payments to practices.[19] This study sought to fill these critical knowledge gaps by evaluating the association between neighborhood disadvantage and acute care utilization among Medicaid beneficiaries in Washington State. Our hypothesis was that independent of individual-level SES and clinical factors, increasing levels of neighborhood-level socioeconomic disadvantage would be associated with increased overall and potentially preventable acute care utilization among Medicaid beneficiaries.

Methods

Study Period, Sample, and Data Sources

We performed a retrospective study of 100% 2017-2021 Washington State Medicaid claims from 1,497,048 unique individuals who were enrolled at least 11 months out of a calendar year and who were 18 years of age or older as of first enrollment date in a given year. Given that some individuals were enrolled for multiple years over the study period, our study included a total of 4,518,329 person-year observations. Medicaid enrollees included both those enrolled in fee-for-service or Medicaid Managed Care Organization (MCO) plans. Records were excluded if the individual's ADI was not computable due to small population size in a block group (fewer than 100 individuals or less than 30 housing units; N=20,285), greater than 33% of the population living in group quarters (N=35,667), or Census data missing in the core component variables (N=3750), which are all specified in the Neighborhood Atlas that manages ADI data.[21]

Medicaid inpatient and outpatient claims were provided via secure file transfer from the Washington State Health Care Authority. Claims files included de-identified client ID, diagnosis codes, procedure codes, code modifiers, and billing and servicing provider information. Client Medicaid Eligibility and Demographic Files included de-identified client ID, eligibility start and end date, and demographic information including last available residential address with 9-digit ZIP code. If residential address was not available, mailing address was used.

Exposure

The exposure of interest was neighborhood disadvantage, captured by the Area Deprivation Index (ADI).[3] ADI is a composite measure of 17 Census-based measures of socioeconomic disadvantage.[21] ADI was selected based on its origin (as a measure created to capture disadvantage as it relates to health outcomes[3]), components (multiple facets including income, employment, education, home value, and transportation), and use in contemporary value-based payment models to account for neighborhood disadvantage.[18,19,22]

Our exposure of interest was state-level deciles, ranging from the lowest degree of disadvantage (decile 1) to the highest degree of disadvantage (decile 10). Although Census block group is the geographic unit of construction for ADI, the Neighborhood Atlas also makes available a crosswalk mapping 9-digit ZIP codes to ADI. Using 9-digit ZIP codes, Medicaid records were linked to the corresponding year of ADI that was available or the closest prior year of ADI. Thus, the 2015 ADI version was used for 2017-2019 Medicaid data, 2020 ADI for 2020 Medicaid data, and 2021 ADI for 2021 Medicaid data.

Outcomes

Study outcomes included total ED visits and hospitalizations, as well as potentially preventable care defined as low acuity ED visits and hospitalizations for ACSC. ED visits were identified by Current Procedural Terminology codes 99281-99285 for outpatient claims and revenue codes 0450-0459 or 0981 for inpatient claims per best practice guidance for identifying ED visits from claims data.[23]

Low acuity ED visits and hospitalizations for ACSC are two categories of utilization sensitive to access to primary care,[24–27] which can be influenced by elements of neighborhood disadvantage. Low acuity ED visits were defined as patients who arrived to the ED by means other than transfer from another hospital, health care facility (including skilled nursing facility), or outpatient clinic, were ultimately not admitted to the hospital, and whose discharge diagnoses were one of pre-specified International Classification of Diseases, Tenth Revision (ICD-10) diagnoses from previous studies of low acuity ED utilization.[6,28] These conditions, such as an upper respiratory infection, cellulitis, dental concerns, or laceration, were determined to be conditions that could be managed in lower resource facilities such as outpatient clinics or urgent care centers.

Hospitalizations for ACSCs were defined based on the Agency for Healthcare Research and Quality's Prevention Quality Indicators, which classify specific admission ICD-10 diagnoses that may have been avoidable with adequate ambulatory health care.[29] This methodology requires excluding hospitalizations based on secondary diagnoses for a relatively narrow set of conditions, but secondary diagnoses were not available for this analysis.

Covariates

Covariates included age, sex (male or female), five categories for self-identified race (American Indian or Alaska Native [AI/AN], Asian, Black, White, or Other which included Native Hawaiian or Pacific Islander due to small sample size, Multiracial, or Other), self-identified ethnicity (Hispanic or non-Hispanic), clinical complexity defined using the Charlson Comorbidity Index (CCI)[30], primary spoken language (English or non-English), homelessness (defined as being homeless for at least 1 month out of the past 12 months), and rurality (defined using Rural-Urban Commuting Area codes assigned at the ZIP code level wherein large rural, small rural, and isolated areas are considered rural and metropolitan areas, urban[31]). Race and ethnicity are optionally self-reported at time of Medicaid enrollment. In addition, individual

Federal Poverty Level (FPL) was controlled for, allowing us to isolate the effect of neighborhood SES from individual SES.

Conceptual Model

A conceptual model was developed to explore how ADI may potentially influence health care utilization and to identify individual and area-level factors which may confound and modify this relationship (Figure 1). This conceptual model was informed by prior work by Diez-Roux & Mair on the neighborhood effects on health, which postulates that both neighborhood physical and social environments influence behavioral mediators and stress, which in turn influence health outcomes.[1] Our outcome of interest was health care utilization, including both acute care utilization (of any kind) and potentially preventable acute care utilization, which according to Andersen's seminal conceptual model of health care utilization, are shaped by one's predisposing characteristics (such as age and education), enabling resources (such as family and neighborhood resources), and need.[32]

Thus, in bringing together these two models, we theorize that neighborhood socioeconomic disadvantage may influence enabling resources in terms of poor access to non-urgent means to address medical concerns or manage chronic disease (such as primary or dental care, telemedicine, or informal social networks of knowledge), as well as poor access to health-promoting resources in a community (such as a clean environment for wound care or grocery stores for healthier food). Even if and when individuals have access, taking the next step of utilizing health care or a health-promoting resource may also vary by neighborhood disadvantage through the mechanisms of (1) acceptability of the resources and (2) stress and cognitive load.[33,34] We conceptualized that neighborhood socioeconomic disadvantage could contribute to additional allostatic load on top of the allostatic load already known to be associated with individual poverty,[10] which in turn could lead to (1) delays or interruptions in care-seeking or disease self-management and (2) worse health outcomes directly.[35] Given that *individual* poverty is strongly correlated with our exposure of neighborhood socioeconomic disadvantage, we identified individual poverty as an important covariate in both our conceptual model and analytic plan. Conditioning on individual poverty was necessary to attempt to disentangle effects of individual versus neighborhood socioeconomic status on health care utilization.

Statistical Analysis

We estimated separate mixed effects logistic regressions to evaluate the association between ADI and each outcome measure. Hospitalizations for ACSC were not ultimately included as an outcome in the regression analyses due to their rare occurrence (≤1% of individuals). We analyzed binary measures because greater than 50% of individuals did not have any ED visits or hospitalizations. Regression models were adjusted for age, sex, race, ethnicity, primary spoken language, rurality, FPL, CCI, and study year. We also included a random intercept to account for unobserved individual effects given the potential for repeated measures per person with multiple years of data. Models included clustered standard errors by Census block group, corresponding to the level of measure of the key explanatory variable, ADI. We estimated parameters in terms of odds ratios (ORs) of having the health care utilization of interest or not (i.e., any low acuity ED visit or not).

A total of 295,257 records (6.5%) were missing ADI from individuals who were disproportionately homeless, Black, and AI/AN compared to the overall cohort, suggesting that data were not missing completely at random. For records with 5-digit ZIP code only, we imputed the highest ADI score for the corresponding 9-digit ZIP codes (N=88,733). For the remaining records, we performed multiple imputation using chained equations. We analyzed five replications of data and calculated standard errors using Rubin's rules.[36] A sensitivity analysis was performed with a complete case analysis, excluding records missing ADI.

All analyses were conducted in SAS 9.4. The study was approved by the University of Washington Institutional Review Board. This analysis was consistent with Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines.[37]

Results

Cohort Characteristics

The study cohort included nearly 1.5 million unique adults enrolled in Medicaid for at least 11 months in a calendar year from 2017-2021 with a total of 4,445,627 records. The median enrollment period was 3 years (interquartile range 1-5 years). The study cohort consisted of 831,625 individuals in 2017 and 1,096,756 individuals in 2021.

Characteristics of the populations for each year 2017-2021 remained stable across all years (Table 1). In 2017, mean state ADI of the population was 6.6 (standard deviation [SD] 2.7). Mean age was 42.4 years (SD 17.3). 57.3% were female, and in terms of race, 4.3% of individuals identified as American Indian or Alaska Native (AI/AN), 6.4% as Asian, 8.0% as Black, 69% as White, and 12% as Other race (including multi-racial and Native Hawaiian and Pacific Islander due to small sample size). In terms of ethnicity, 84.9% identified as non-Hispanic. 94.1% preferred English as their spoken language, 6.6% were homeless, and 15.7% lived in a rural area. Mean Federal Poverty Level (FPL) was 35.9%.

Some cohort characteristics varied across highest, middle, and lowest deciles of neighborhood disadvantage (Table S1) . In 2017, those living in areas of highest disadvantage (decile 10) versus lowest disadvantage (decile 1) were more likely to be AI/AN (6.4% vs 2.2%), less likely to be Asian (2.1% vs 13.7%), less likely to be Black (4.8% vs 8.1%), more likely to be White (67.8% vs 61.6%), and more likely to be Other race (16.6% vs 8.3%, standardized mean difference (SMD) for race 0.61). Those in the highest disadvantage areas were also more likely to be Hispanic (23.4% vs 7.1%, SMD 0.67) and non-English speaking (7.6% vs 4.2%, SMD 0.22). Rural residence was more prevalent among those in the highest versus lowest disadvantage areas (28.1% vs 1.2%, SMD 0.82). Individual FPL was similar between highest and lowest disadvantage deciles (SMD 0.03). Trends by highest, middle, and lowest ADI deciles were similar in 2021 (Table S2). In 2021, differences in rural residence by ADI were even more pronounced with 37.2% of individuals from highest disadvantage areas residing in a rural area compared to 0% of those in the lowest disadvantage areas.

Unadjusted Outcomes

In 2017, 32.9% of individuals had any ED visit, which declined to 27.2% in 2021 (Table 1). For 2017, mean number of ED visits per person was 0.75 (SD 1.91). In 2017, 7.0% of individuals had at least one ED visit for a low acuity concern, which declined to 3.9% in 2021. Mean number of low acuity ED visits per person was 0.09 (SD 0.36).

In 2017, 10.2% of individuals were hospitalized at least once (for any cause) with a mean hospitalization count of 0.14 per person (SD 0.54), which declined to 8.1% in 2021. Lastly, in 2017, 1% of individuals were hospitalized for an ACSC in 2017 with a mean ACSC hospitalization count of 0.01 per person (SD 0.16), and 0.7% of individuals were hospitalized for an ACSC in 2021. Stratifying by ADI, 1.2% of individuals in the highest decile ADI areas were hospitalized for an ACSC compared to 0.6% of those in the lowest decile ADI areas in 2017 (SMD 0.06). In 2021, these percentages were 0.8% and 0.5%, respectively (SMD 0.04).

Adjusted Outcomes

In adjusted analysis, greater ADI (i.e., higher socioeconomic disadvantage) was associated with increased likelihood of any ED visit (adjusted OR [aOR] 1.07, 95% CI 1.06-1.07) (Table 2). Increasing age, AI/AN race, Black race, female sex, English as primary spoken language, homelessness, urban residence, and increasing CCI were also associated with higher odds of any ED visit in a calendar year. Asian race, Other race, non-Hispanic ethnicity, higher FPL, and years 2020-2021 were associated with lower odds of an ED visit.

Increasing ADI was associated with 8% higher adjusted odds of a low acuity ED visit (95% CI 1.08-1.08). Similar to overall ED visits, increasing age, AI/AN race, Black race, female sex, English as primary spoken language, homelessness, urban residence, and increasing CCI were associated with higher odds of a low acuity ED visit. Asian race, Other race, non-Hispanic ethnicity, and years 2018-2021 were associated with lower odds of a low acuity ED visit.

Increasing ADI was also associated with greater odds of any hospitalization (aOR 1.02, 95% CI 1.02-1.02). Additionally, AI/AN race, Black race, female sex, homelessness, urban residence, and increasing CCI were associated with higher odds of hospitalization. Increasing age, Asian race, non-Hispanic ethnicity, English as primary language, and years 2020-2021 were associated with lower odds of hospitalization.

Sensitivity Analysis

Complete case analysis (excluding data with missing ADI) yielded similar results as the main analyses using imputation (Table S3).

Discussion

In this study of 1.5 million individuals enrolled in Medicaid in Washington State, increasing neighborhood socioeconomic disadvantage was associated with increased likelihood of acute care utilization independent of clinical or sociodemographic variables (including individual income and rurality). While acute care utilization is not uniformly undesirable depending on an individual's medical needs or risk factors for trauma, differences in utilization by neighborhood disadvantage persisted despite controlling for comorbidities. Furthermore, some forms of acute care utilization can belie primary care and other health care access barriers. This concern is underscored by our findings that neighborhood disadvantage was associated with low acuity ED visits. Descriptively, hospitalizations for ACSC increased slightly with increasing neighborhood disadvantage, but the standardized mean difference between lowest and highest disadvantage deciles was not meaningful in 2017 or 2021and rarity of this outcome precluded regression analysis. Thus, conclusions cannot be drawn about the effect of ADI on ACSC hospitalizations. Several factors may underlie these findings.

Individuals on Medicaid can experience extreme individual poverty (e.g., the mean Federal Poverty Levels among Washingtonians insured through Medicaid was 35-41%), which may increase susceptibility to the stress and allostatic load of neighborhood disadvantage.[34] Collectively, these stressors may limit cognitive bandwidth[10] for (1) managing chronic disease and (2) navigating and accessing primary, dental, and other ambulatory care, which could reduce ED or hospital care. Importantly, health systems-level factors, such as clinic accessibility or wait times, which may be worse in disadvantaged areas where clinics are overburdened, make navigating and accessing health care even more challenging.[39] This reflects that neighborhood socioeconomic disadvantage may compound the deleterious effects of individual socioeconomic disadvantage, which has been highlighted in other work examining cardiac health outcomes.[8,9] Viewed alternatively, there may be a protective effect for low-income individuals of residing in less disadvantaged neighborhoods.[38]

Our effects are stronger than those found in an analysis of Medicare beneficiaries, which demonstrated that beneficiaries residing in highest disadvantage areas had a 1.28% higher probability of potentially preventable ED visits than those in average disadvantage areas.[7] We found 8% higher odds of potentially preventable ED visits with each decile increase in ADI, which may reflect that the Medicaid population is more vulnerable to the effects of neighborhood socioeconomic disadvantage. More broadly, our findings complement prior work within a large health care system demonstrating an association between residence in high disadvantage areas and reduced primary care quality and likelihood of receiving preventive services.[40,16]

In terms of next steps, our findings highlight a need for partnering with affected communities to (1) identify gaps in access to outpatient care (including dental care) for Medicaid beneficiaries in high ADI areas, which could be related to factors such as geographic accessibility, acceptability of care, or clinic bandwidth/wait-times, and (2) address health-related social needs (HRSN) at both an individual and neighborhood level. While health systems and payers may feel unequipped to fundamentally change patients' neighborhood environments, small steps forward may nonetheless may beneficial. First, health systems can appraise their own accessibility to patients from high ADI areas and remedy gaps through new clinic locations, mobile unit outreach, expanded hours, or ways to address HRSN that impede access (such as transportation barriers). For payers, Section 1115 waivers have been one way that Medicaid agencies are striving to address beneficiaries' HRSN.[41] For example, Washington State Health Care Authority developed the Foundational Community Supports program under one such waiver, which provides supported employment and supportive housing services to beneficiaries with certain risk factors.[42] The supportive housing services were associated with promising reductions in ED utilization and inpatient hospitalizations.[42]

Second, potential interventions serving individuals in high ADI areas may be able to leverage insights from social service navigation with social workers or community health workers, which have surprisingly demonstrated positive health effects even without receipt of the social service.[43] This suggests an alternative pathway of benefit from emotional support and trust-building even when a social need cannot be addressed[43]—and this may hold true for neighborhood-level social needs as well. Lastly, in striving to move more upstream to the neighborhood level, successful interventions may foster individuals' autonomy, voice, and self-efficacy to build community power in order to reform neighborhood policies (for example, by supporting voting or participation in clinic-based community organizing).[44–47] Such efforts may be able to be supported by reforms in payment and care model policy that account for neighborhood disadvantage, as well as non-medical drivers of health.

Limitations

First, as with all observational studies, these findings represent associations rather than causality. Second, data limitations precluded our ability to capture if and when individuals moved—and if their ADI changed as a result. However, U.S. Census Bureau data suggest that during our study period, 83% of individuals in Washington State resided in the same home as the year prior and 10% moved within the same county; the number residing within the same home further increased after the COVID-19 pandemic.[48] Third, given the use and limitations of claims data, we were unable to assess individuals' primary care access and continuity prior to acute care utilization.

Conclusion

In Washington State, higher levels of neighborhood socioeconomic disadvantage were associated with increased low acuity ED visits and inpatient hospitalizations among individuals with low income insured through Medicaid. In disentangling the effects of individual and neighborhood socioeconomic status, this paper calls attention to the added, deleterious impact of neighborhood socioeconomic disadvantage on patterns of health care utilization for an already vulnerable population. The results underscore the need for programs and policies that improve outcomes by accounting for patients' lived environments and non-medical drivers of health, as well as by supporting partnerships with affected communities to design future interventions.

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Figure 1. Conceptual Model of the Relationship Between Neighborhood Socioeconomic Disadvantage and Health Care Utilization

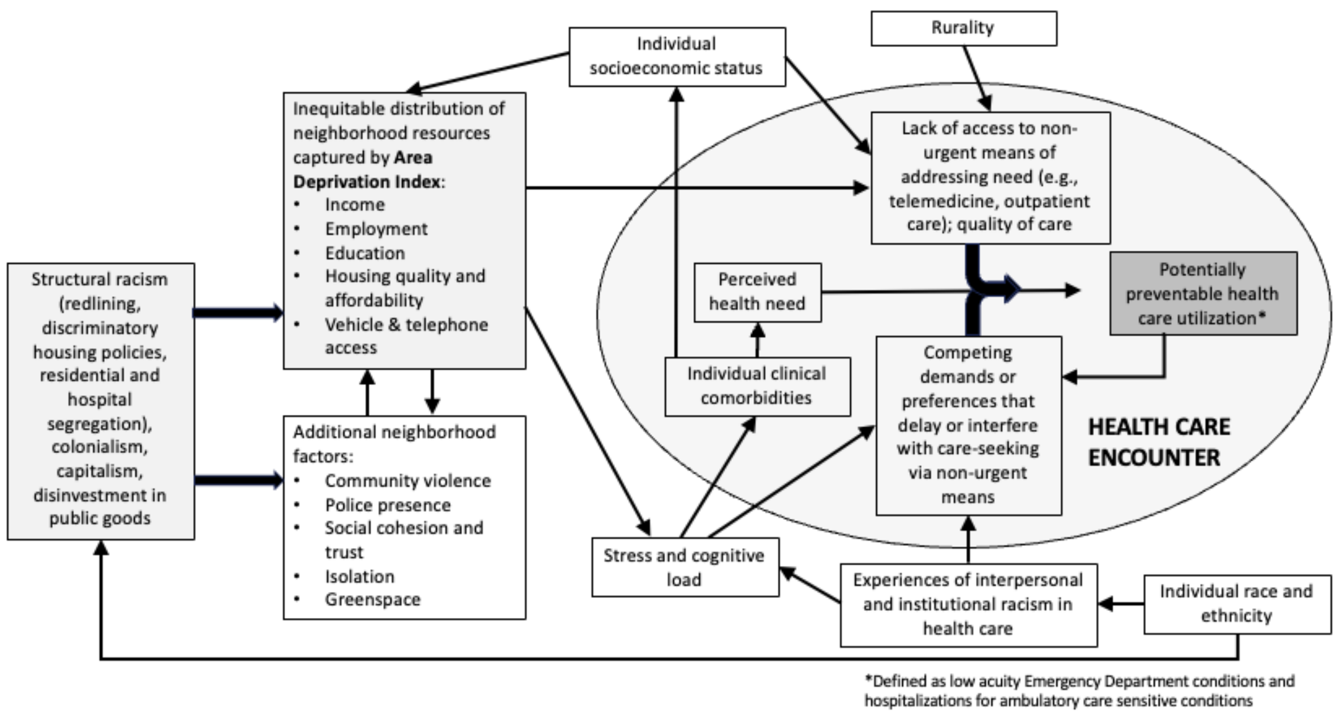

Table 1: Characteristics of Adults Insured At Least 11 Months by Washington State Medicaid, 2017-2021

Characteristics by Year *n (%) or mean (SD)*	2017 N=831,625	2018 N=822,655	2019 N=802,260	2020 N=905,331	2021 N=1,096,756
Area Deprivation Index (state decile)	6.6 (2.7)	6.6 (2.7)	6.6 (2.7)	6.6 (2.7)	6.6 (2.7)
Age (years)	42.4 (17.3)	42.7 (17.4)	43.0 (17.5)	42.3 (17.5)	41.5 (17.2)
Sex					
…Female	476392 (57.3)	469162 (57.0)	456486 (56.9)	510207 (56.4)	612692 (55.9)
…Male	355225 (42.7)	353486 (43.0)	345766 (43.1)	395046 (43.6)	483783 (44.1)
Race					
…Alaskan Native / American Indian	34508 (4.3)	35914 (4.5)	35819 (4.6)	39639 (4.5)	47162 (4.5)
…Asian	51880 (6.4)	51547 (6.5)	50512 (6.5)	56618 (6.5)	68754 (6.5)
…Black	64387 (8.0)	64857 (8.1)	63860 (8.2)	74307 (8.5)	90845 (8.6)
…White	555607 (69.0)	546972 (68.7)	531171 (68.3)	591144 (67.4)	703350 (66.4)
…Other	98626 (12.3)	97299 (12.2)	96070 (12.4)	115283 (13.1)	149356 (14.1)
Ethnicity					
…Non-Hispanic	640556 (84.9)	636262 (84.9)	620569 (84.5)	690404 (83.4)	817267 (82.1)
…Hispanic	114072 (15.1)	113587 (15.1)	113461 (15.5)	137299 (16.6)	178681 (17.9)
Charlson Comorbidity Index	0.6 (1.5)	0.6 (1.5)	0.6 (1.5)	0.5 (1.4)	0.5 (1.3)
Individual Federal Poverty Level (%)	35.9 (48.1)	35.3 (49.2)	35.4 (50.3)	37.7 (52.5)	40.9 (54.8)
Primary Spoken Language					
…English	777318 (94.1)	763065 (94.0)	740064 (93.9)	828852 (93.4)	998040 (92.8)
…Non-English	48547 (5.9)	48507 (6.0)	48097 (6.1)	58729 (6.6)	77103 (7.2)
Homeless	55197 (6.6)	58654 (7.1)	58732 (7.3)	63888 (7.1)	70180 (6.4)

Residing in a Rural Area	130708 (15.7)	129346 (15.7)	127216 (15.9)	141122 (15.6)	167131 (15.2)
Had ED Visit(s)	273335 (32.9)	267899 (32.6)	262095 (32.7)	249809 (27.6)	298516 (27.2)
Had Low Acuity ED Visit(s)	58393 (7.0)	53768 (6.5)	51019 (6.4)	41870 (4.6)	42468 (3.9)
Was Hospitalized At Least Once	84819 (10.2)	83297 (10.1)	82872 (10.3)	81366 (9.0)	89268 (8.1)
Was Hospitalized At Least Once for an ACSC	7874 (0.9)	8004 (1.0)	7975 (1.0)	6818 (0.8)	7493 (0.7)

ED=Emergency Department
ACSC=Ambulatory Care Sensitive Condition

Table 2: Multivariable Logistic Regression Results by Healthcare Utilization Outcome

Outcome *Adjusted OR (95% CI)*	Any Emergency Department (ED) Visit	Low Acuity ED Visit	Any Hospitalization
Area Deprivation Index by Decile	1.07 (1.06-1.07)	1.08 (1.08-1.08)	1.02 (1.02-1.02)
Age	1.01 (1.01-1.01)	1.02 (1.01-1.02)	0.97 (0.97-0.97)
Race			
White	*Ref*	*Ref*	*Ref*
AI/AN	1.27 (1.25-1.28)	1.26 (1.24-1.28)	1.22 (1.20-1.24)
Asian	0.52 (0.52-0.53)	0.46 (0.45-0.47)	0.60 (0.59-0.61)
Black	1.28 (1.27-1.29)	1.22 (1.20-1.24)	1.08 (1.07-1.10)
Other	0.94 (0.94-0.95)	0.95 (0.93-0.96)	0.99 (0.98-1.00)
Ethnicity			
Hispanic	*Ref*	*Ref*	*Ref*
Non-Hispanic	0.93 (0.93-0.94)	0.97 (0.95-0.98)	0.90 (0.89-0.91)
Sex			
Male	*Ref*	*Ref*	*Ref*
Female	1.32 (1.31-1.32)	1.27 (1.26-1.28)	1.65 (1.64-1.66)
Primary Language			
Non-English	*Ref*	*Ref*	*Ref*
English	1.21 (1.20-1.22)	1.34 (1.31-1.37)	0.79 (0.77-0.80)
Homeless	2.13 (2.12-2.15)	2.00 (1.97-2.02)	1.74 (1.72-1.76)
Urban Residence	1.07 (1.06-1.08)	1.10 (1.09-1.11)	1.12 (1.11-1.14)
Federal Poverty Level, %	0.997 (0.997-0.997)	1.00 (1.00-1.00)	1.00 (1.00-1.00)
CCI	1.29 (1.29-1.29)	1.17 (1.17-1.18)	1.44 (1.44-1.44)
Year	.	.	
2017	*Ref*	*Ref*	*Ref*
2018	0.99 (0.98-1.00)	0.93 (0.92-0.94)	1.00 (1.00-1.00)
2019	1.00 (0.99-1.00)	0.90 (0.89-0.91)	1.01 (1.00-1.03)
2020	0.79 (0.79-0.80)	0.65 (0.64-0.66)	0.90 (0.89-0.91)
2021	0.79 (0.78-0.80)	0.55 (0.54-0.56)	0.82 (0.81-0.83)

AI/AN=American Indian/Alaska Native

CCI=Charlson Comorbidity Index