Black-White Racial Differences in Asthma Medication Receipt among Medicaid-Enrolled Children

Analysis of Medicaid Claims Data from 11 States

Laura Barrie Smith and Claire O'Brien

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Asthma—a chronic lung disease causing breathing difficulties that can significantly disrupt daily life—affects nearly 5 million children in the United States.[1] Asthma is more prevalent among children with Medicaid health insurance coverage than those with private health insurance and among Black, non-Hispanic (hereafter, Black) children than white, non-Hispanic (hereafter, white) children.[2] With access to proper treatment, asthma symptoms can typically be well controlled, and asthma-related hospital or emergency department (ED) visits can often be avoided. However, recent evidence shows that asthma-related hospitalizations and ED visits remain very common, and there are considerable Black-white racial disparities in the occurrence of these acute events (Binney et al. 2024; Malhotra et al. 2014; Silber et al. 2017; Smith et al. 2024).

The Black-white racial disparities in asthma hospitalizations and ED visits are likely a result of long-standing forces of systemic racism (such as historical redlining) that put Black children at increased risk of exposure to asthma triggers such as air pollution, dust, and mold, as well as barriers to accessing high-quality health care (Bailey et al. 2017; Gaskin et al. 2012; Liu et al. 2021). In this paper, we test one

potential driver of racial disparities in asthma hospitalizations and ED visits: differences in the receipt of recommended asthma medications for children with persistent asthma.

Asthma medications fall into two general categories: short-term "relievers" and long-term "controllers." Although relievers provide quick relief from episodes of wheezing or shortness of breath, controllers are designed to be taken daily to prevent the onset of asthma symptoms and are recommended for children with persistent asthma symptoms (NHLBI 2007). However, health insurance coverage of controller medications and other guideline-based asthma treatment varies across states and health plans, including within Medicaid and the Children's Health Insurance Plan (CHIP). For example, as of 2022, 29 states provided complete coverage of all types of controller medications to all Medicaid/CHIP enrollees, while in the remaining 23 states (including the District of Columbia and Puerto Rico), coverage of controller medications was variable (i.e., some controller medications were not covered by one or multiple Medicaid managed care plans within the state; Link et al. 2023). Even in states with complete coverage of controller medications, barriers such as copayments or quantity limits may limit access to treatment (Link et al. 2023).

Previous research on racial differences in receipt of recommended asthma medications found that Black publicly-insured children were less likely to use asthma controller medications compared with white publicly-insured children (Sarpong and Miller 2013), and that lower rates of asthma controller medications contribute to increases in ED visits and hospitalizations (Kim et al. 2023; Kim, Pirritano, and Parrish 2022). However, these studies use outdated data and/or are limited to data from a single state.[3]

In this analysis, we assess differences in receipt of recommended asthma medications among a large, 11-state population of children enrolled in Medicaid/CHIP with persistent asthma, using modernized Medicaid claims and encounter data from the Transformed Medicaid Statistical Information System (T-MSIS). We examine whether Black, Medicaid-enrolled children with persistent asthma were more or less likely than white, Medicaid-enrolled children with persistent asthma to receive recommended asthma medications in 2019, and we assess the extent to which differences in receipt of recommended medications explained the Black-white racial disparity in asthma hospitalizations and ED visits.

We find the following among Medicaid-enrolled children with persistent asthma in 2019:

- Only 43.1 percent received the recommended asthma prescription medications.
- Adjusting for other sociodemographic and enrollment characteristics, Black enrollees were 9.1 percentage points less likely than white enrollees to receive the recommended asthma prescription medications (p <0.001).
- Receiving the recommended asthma prescription medications decreased the probability of a subsequent asthma hospitalization or ED visit by 1.4 percentage points (p <0.001).

- Black enrollees were 3.1 percentage points more likely than white enrollees to have an asthma hospitalization or ED visit, even after controlling for receipt of recommended prescription medications (p <0.001).

Methods

Data and Study Population

We used data from the T-MSIS Analytic Files (TAF) for calendar years 2018 and 2019 (100 percent, Release 2 files for 2018 and Release 1 files for 2019). The TAF files include enrollee characteristics and records of all covered services provided for Medicaid/CHIP enrollees in the US. We followed the TAF Analysis Reporting checklist in designing our study (appendix A).

We used the TAF Demographics and Eligibility (DE) file to identify Medicaid/CHIP enrollees and their age, sex, state, zip code, and race/ethnicity. We linked the TAF DE file to the TAF pharmacy claims file using a beneficiary identifier to identify asthma prescription medication fills and details about each prescription, including the National Drug Code and days supplied. We also used the TAF inpatient and other services files to identify hospitalizations, ED visits, and outpatient visits.

To account for variability in TAF data quality across states, we excluded states with data quality concerns for key enrollee characteristics (e.g., zip code) or pharmacy and outpatient claims.[4] We also excluded states with poor-quality data for identifying Black and white Medicaid/CHIP-enrolled children, as identified through previous research, which compared the racial-ethnic composition of Medicaid/CHIP-enrolled children in each state to external benchmarks from the nationally representative American Community Survey (Smith, O'Brien, and Kenney 2023).- This process resulted in 11 states included in the analysis: California, Delaware, Indiana, Michigan, Mississippi, Nebraska, New Mexico, Nevada, Pennsylvania, Texas, and Washington (appendix B).

The study population included Black and white children ages 5 to 18 continuously enrolled in full-benefit Medicaid/CHIP from January 2018 through December 2019 with persistent asthma as of 2018 (see appendix C for details). We followed the Healthcare Effectiveness Data and Information Set (HEDIS) claims-based definition of persistent asthma used for the denominator of the Centers for Medicare and Medicaid Services (CMS) Core Set of Children's Health Care Quality Measures for Medicaid and CHIP (Child Core Set) Asthma Medication Ratio (AMR) measure to identify enrollees with mild, moderate, or severe persistent asthma in 2018 (appendix D).[5]

Variables

Based on the AMR measure definition, we created a binary, enrollee-level indicator for receipt of recommended asthma medications, defined as having a ratio of filled prescriptions for controller medications to filled prescriptions for all asthma medications of 0.50 or greater (appendix D). We calculated this measure using two time periods. For our descriptive analysis on the share of enrollees

receiving recommended prescriptions and for comparing differences in this metric by race, we calculated this measure across all of 2019 to be consistent with the AMR measure specifications. For the regression analyses where we predicted the occurrence of asthma hospitalizations or ED visits, we calculated the medication ratio based on the first half of 2019 (January–June), and we identified hospitalizations/ED visits occurring during the second half of 2019 (July–December; Andrews et al. 2018).

To classify each enrollee's race/ethnicity, we used the "race and ethnicity constructed code" variable on the TAF DE file. This variable is intended to reflect self-reported data from Medicaid applicants (or those who completed the application on their behalf) but is standardized to seven mutually exclusive categories, including "Black, non-Hispanic" (Black) and "white, non-Hispanic" (white). We classified states as having "complete coverage" or "variable coverage" of asthma controller medications according to a recent study that reviewed publicly available plan documents and engaged with Medicaid programs in all states (Link 2023). Other covariates from the TAF DE file included sex (male or female), plan type (comprehensive managed care or fee-for-service), eligibility group (income-based [Medicaid]; income-based [CHIP]; Supplemental Security Income [SSI] or disability; adoption, foster, or guardianship), and urban versus rural residence based on zip code of residence.[6] Additionally, we classified the percentage of residents living below the poverty line in the enrollee's zip code using data from the Public Health Geocoding Disparities Project using American Community Survey data from 2014 to 2018.[7]

Statistical Analysis

We tabulated the share of enrollees in our sample who received the recommended asthma medications in 2019, overall and by sex, age, plan type, eligibility group, urban versus rural, zip code poverty level, and state. We also compared the share of Black versus white enrollees within each of these characteristics who received the recommended medications in 2019. Next, we compared the share of all enrollees in our sample who had an asthma hospitalization or ED visit in 2019 by each characteristic of interest and compared the share of Black versus white enrollees within each characteristic who had one of these events in 2019.

We conducted multivariate regression analyses to estimate the associations between (1) receipt of recommended asthma medications and enrollee race (Black or white), and (2) occurrence of an asthma hospitalization or ED visit and enrollee race. We then estimated a model to assess the extent to which controlling for receipt of recommended asthma medications in the first half of the year mediated the association between enrollee race and the occurrence of an asthma hospitalization or ED visit in the second half of the year. In sensitivity analyses, we added zip code fixed effects to the models to assess whether the Black-white differences were similar when comparing enrollees living in the same zip code, and we estimated models stratified by whether the state provided complete or variable coverage of asthma controller medications. We estimated all models using ordinary least squares linear regression for ease of interpretation, following prior literature; sensitivity analyses using logistic regression yielded similar results. All models controlled for sex, age in years, plan type, eligibility group, urban versus rural,

zip code poverty level, and state. Standard errors were clustered by enrollee zip code to account for potential correlation in outcomes across enrollees in the same zip code. Results from the sensitivity analyses are available on request.

Results

We identified 198,184 Black and white Medicaid-enrolled children with persistent asthma in 2018 in our 11 study states (table 1). Just over half the enrollees (56.8 percent) were white, while the remaining 43.2 percent were Black. Male enrollees made up a larger share of the sample than female enrollees (56.0 percent compared with 44.0 percent). Most enrollees were enrolled in comprehensive managed care (94.0 percent), and more than 4 in 5 enrollees (82.5 percent) were eligible through an income-based Medicaid or CHIP pathway. Black enrollees were more likely to live in urban zip codes (87.8 percent) than white enrollees (74.5 percent). Enrollees in the sample disproportionately lived in zip codes with high poverty rates. This was especially true for Black enrollees, among whom 50.3 percent lived in the highest poverty quintile compared with only 4.9 percent in the lowest poverty quintile. Reflecting overall state population sizes, the largest share of enrollees lived in California (23.4 percent), Texas (15.8 percent), and Michigan (15.1 percent), while the smallest share lived in New Mexico (1.4 percent), Delaware (1.7 percent), and Nebraska (1.9 percent).

TABLE 1

Characteristics of Medicaid/CHIP Enrollees Ages 5 to 18 with Persistent Asthma in Analytic Sample, 2019

	All Black and white enrollees in sample		Black enrollees		White enrollees	
	Number	%	Number	%	Number	%
All	198,184		85,616		112,568	
Sex						
Female	87,240	44.0%	37,092	43.3%	50,148	44.5%
Male	110,944	56.0%	48,524	56.7%	62,420	55.5%
Age in years						
5–11	115,657	58.4%	52,203	61.0%	63,454	56.4%
12–18	82,527	41.6%	33,413	39.0%	49,114	43.6%
Managed care versus fee-for-service						
Comprehensive managed care	186,265	94.0%	80,967	94.6%	105,298	93.5%
Fee-for-service	11,919	6.0%	4,649	5.4%	7,270	6.5%
Eligibility group						
Income-based (Medicaid)	143,204	72.3%	62,038	72.5%	81,166	72.1%
Income-based (CHIP)	20,177	10.2%	7,229	8.4%	12,948	11.5%
SSI or disability	25,370	12.8%	11,979	14.0%	13,391	11.9%
Adoption, foster, or guardianship	9,433	4.8%	4,370	5.1%	5,063	4.5%
Urban/rural residence						
Urban	159,077	80.3%	75,171	87.8%	83,906	74.5%
Rural	39,107	19.7%	10,445	12.2%	28,662	25.5%
Percent living below the federal poverty line in zip code						
Lowest poverty rates	17,971	9.1%	4,197	4.9%	13,774	12.2%
↓	28,846	14.6%	7,630	8.9%	21,216	18.8%

	All Black and white enrollees in sample		Black enrollees		White enrollees	
	Number	%	Number	%	Number	%
	38,231	19.3%	11,816	13.8%	26,415	23.5%
	48,471	24.5%	18,491	21.6%	29,980	26.6%
Highest poverty rates	63,766	32.2%	43,068	50.3%	20,698	18.4%
Missing zip code poverty rate	899	0.5%	414	0.5%	485	0.4%
State-level generosity of coverage for asthma controller medications						
Variable coverage	40,602	20.5%	16,730	19.5%	23,872	21.2%
Complete coverage	157,582	79.5%	68,886	80.5%	88,696	78.8%
State						
California	46,329	23.4%	20,812	24.3%	25,517	22.7%
Delaware	3,327	1.7%	1,940	2.3%	1,387	1.2%
Indiana	18,624	9.4%	5,557	6.5%	13,067	11.6%
Michigan	29,915	15.1%	12,017	14.0%	17,898	15.9%
Mississippi	17,682	8.9%	11,847	13.8%	5,835	5.2%
Nebraska	3,688	1.9%	1,076	1.3%	2,612	2.3%
New Mexico	2,862	1.4%	326	0.4%	2,536	2.3%
Nevada	4,498	2.3%	2,447	2.9%	2,051	1.8%
Pennsylvania	29,146	14.7%	11,245	13.1%	17,901	15.9%
Texas	31,231	15.8%	16,616	19.4%	14,615	13.0%
Washington	10,882	5.5%	1,733	2.0%	9,149	8.1%

Source: 2018–19 Transformed Medicaid Statistical Information System Analytic Files from 11 states.
Notes: CHIP = Children's Health Insurance Program; SSI = Supplemental Security Income. Sample includes children ages 5 to 18 who were continuously enrolled in Medicaid or CHIP from 2018 to 2019 and had persistent asthma in 2018 (see methods for details). State-level generosity of coverage for asthma controller medications is assigned based on a recent study that reviewed publicly available plan documents and engaged with Medicaid programs in all states, see Jacqueline Link, Hannah Green, Barbara Kaplan, et al., "Medicaid Coverage of Guidelines-Based Asthma Care across 50 States, the District of Columbia, and Puerto Rico, 2021–2022," *Preventing Chronic Disease* 20 (2023), https://doi.org/10.5888/pcd20.230022.

The first three columns of table 2 show the shares (unadjusted) of Black and white Medicaid-enrolled children with persistent asthma who received the recommended asthma medications in 2019, overall and by race. Overall, only 43.1 percent of enrollees in the sample received the recommended asthma medications, and this share was significantly lower among Black enrollees than white enrollees (37.4 percent versus 47.4 percent, respectively). Enrollees in study states with variable coverage of asthma controller medications were slightly less likely than enrollees in states with complete coverage to receive the recommended medications in 2019 (42.2 percent versus 43.3 percent, respectively).

Males were slightly more likely than females to receive the recommended medications (43.9 percent versus 42.1 percent); enrollees ages 5 to 11 were more likely than enrollees ages 12 to 18 (45.4 percent versus 39.9 percent) to receive them; and enrollees in fee-for-service plans were more likely than enrollees in comprehensive managed care plans (53.9 percent versus 42.4 percent) to receive them. Enrollees eligible through adoption, foster, or guardianship were more likely to receive the recommended asthma medications than those eligible through income-based Medicaid, income-based CHIP, or SSI/ disability (53.5 percent versus 41.1 percent, 49.0 percent, and 45.9 percent, respectively).

Enrollees living in rural areas were considerably more likely to receive the recommended asthma medication than those in urban areas (51.8 percent versus 41.0 percent, respectively). Enrollees living in

zip codes with high levels of poverty were far less likely to receive the recommended asthma medication than those living in zip codes with low levels of poverty (37.0 percent in the highest poverty quintile compared with 50.1 percent in the lowest poverty quintile). There was considerable variation in the share of enrollees receiving the recommended asthma medications across states. Across every characteristic we considered, Black children were significantly less likely to have the recommended medications than white children.

TABLE 2

Receipt of Recommended Asthma Medications and Asthma-Related Hospitalizations and ED Visits among Medicaid/CHIP Enrollees Ages 5 to 11 with Persistent Asthma, 2019

	Received recommended asthma medications				Had asthma hospitalization or ED visit			
	All Black and white enrollees in sample	Black enrollees^	White enrollees		All Black and white enrollees in sample	Black enrollees^	White enrollees	
All	43.1%	37.4%	47.4%	***	6.6%	10.0%	3.9%	***
Sex								
Female	42.1%	36.8%	45.9%	***	6.4%	9.7%	3.9%	***
Male	43.9%	37.9%	48.7%	***	6.7%	10.3%	3.9%	***
Age in years								
5–11	45.4%	39.1%	50.6%	***	7.5%	11.4%	4.3%	***
12–18	39.9%	34.8%	43.3%	***	5.2%	7.9%	3.3%	***
Managed care versus fee-for-service								
Comprehensive managed care	42.4%	37.0%	46.6%	***	6.7%	10.2%	4.0%	***
Fee-for-service	53.9%	45.4%	59.3%	***	4.9%	7.8%	3.1%	***
Eligibility group								
Income-based (Medicaid)	41.1%	35.5%	45.4%	***	6.9%	10.5%	4.2%	***
Income-based (CHIP)	49.0%	45.4%	51.0%	***	5.1%	8.0%	3.5%	***
SSI or disability	45.9%	38.2%	52.9%	***	6.3%	10.3%	2.8%	***
Adoption, foster, or guardianship	53.5%	49.7%	56.8%	***	4.8%	6.5%	3.4%	***
Urban/rural residence								
Urban	41.0%	36.0%	45.5%	***	7.0%	10.3%	4.1%	***
Rural	51.8%	47.9%	53.3%	***	4.6%	7.8%	3.4%	***
Percent living below the federal poverty line in zip code								
Lowest poverty rates	50.1%	45.6%	51.5%	***	4.1%	7.5%	3.1%	***
	47.5%	43.9%	48.7%	***	4.8%	8.3%	3.6%	***
↓	45.9%	39.5%	48.7%	***	5.2%	8.9%	3.6%	***
	43.7%	38.4%	47.0%	***	6.3%	9.6%	4.2%	***
Highest poverty rates	37.0%	34.5%	42.3%	***	9.1%	11.1%	4.8%	***
Missing zip code poverty rate	42.5%	35.3%	48.7%	***	7.2%	10.9%	4.1%	***
State-level generosity of coverage for asthma controller medications								
Variable coverage	42.2%	33.6%	48.3%	***	7.4%	12.0%	4.2%	***
Complete coverage	43.3%	38.4%	47.2%	***	6.3%	9.5%	3.8%	***

	Received recommended asthma medications				Had asthma hospitalization or ED visit			
	All Black and white enrollees in sample	Black enrollees^	White enrollees		All Black and white enrollees in sample	Black enrollees^	White enrollees	
State								
California	35.3%	33.0%	37.1%	***	6.7%	9.4%	4.6%	***
Delaware	46.9%	41.4%	54.5%	***	7.5%	9.5%	4.8%	***
Indiana	41.7%	30.0%	46.6%	***	5.7%	11.1%	3.4%	***
Michigan	41.6%	32.2%	48.0%	***	7.7%	13.1%	4.1%	***
Mississippi	55.3%	49.9%	66.2%	***	6.2%	7.8%	2.9%	***
Nebraska	64.7%	45.4%	72.7%	***	5.9%	12.2%	3.4%	***
New Mexico	44.9%	36.5%	46.0%	***	4.8%	6.4%	4.6%	
Nevada	41.2%	33.8%	50.1%	***	7.4%	9.8%	4.5%	***
Pennsylvania	42.6%	31.4%	49.7%	***	4.9%	9.0%	2.4%	***
Texas	52.7%	45.6%	60.8%	***	8.0%	10.7%	4.8%	***
Washington	28.7%	21.0%	30.2%	***	5.1%	8.8%	4.4%	***

Source: 2018–19 Transformed Medicaid Statistical Information System Analytic Files from 11 states. Study population includes 198,184 total enrollees, including 85,616 Black enrollees and 112,568 white enrollees.

Notes: CHIP = Children's Health Insurance Program; ED = emergency department; SSI = Supplemental Security Income. Sample includes children ages 5-18 continuously enrolled in Medicaid or CHIP from 2018 to 2019 who had persistent asthma in 2018 (see methods for details). State-level generosity of coverage for asthma controller medications is assigned based on a recent study that reviewed publicly-available plan documents and engaged with Medicaid programs in all states, see Jacqueline Link, Hannah Green, Barbara Kaplan, et al., "Medicaid Coverage of Guidelines-Based Asthma Care across 50 States, the District of Columbia, and Puerto Rico, 2021–2022," *Preventing Chronic Disease* 20 (2023), https://doi.org/10.5888/pcd20.230022.

*/**/*** Estimate differs significantly at the 0.10/0.05/0.01 level, using two-tailed tests.

The second three columns of table 2 show the unadjusted shares of Black and white Medicaid-enrolled children who had an asthma hospitalization or ED visit in 2019, overall and by race. Black enrollees were more than twice as likely as white enrollees (10.0 percent versus 3.9 percent, respectively; $p<0.001$) to have one of these events. This pattern was consistent across coverage generosity, enrollee sex, age, plan type, eligibility category, rurality, zip code characteristics, and state. Enrollees in study states with variable coverage of asthma controller medications were slightly more likely than enrollees in states with complete coverage to have had an asthma hospitalization or ED visit in 2019 (7.4 percent versus 6.3 percent, respectively), and the difference in the chances of an asthma hospitalization or ED visit between Black and white enrollees was larger in states with variable coverage compared with states with complete coverage.

Results from the regression analyses are provided in table 3. After adjusting for demographic and enrollment characteristics, the probability of Black enrollees receiving recommended asthma medications during the first six months of 2019 was 9.1 percentage points (95 percent CI -9.7 to -8.4) less than the probability for white enrollees. This association was similar for medications received during the full year. After adjusting for demographic and enrollment characteristics, the probability of Black enrollees having an asthma hospitalization or ED visit during the last six months of 2019 was 3.2 percentage points (95 percent CI 3.0 to 3.4) more than the probability for white enrollees. This association was similar when considering events occurring at any time in 2019. When additionally

controlling for receipt of recommended asthma medications during the first six months of 2019, Black enrollees were still 3.1 percentage points (95 percent CI 2.9 to 3.3) more likely to have an asthma ED visit or hospitalization during the last six months of 2019 compared with white enrollees.

Sensitivity analyses adding zip code fixed effects to the regression models found that each key coefficient was slightly smaller in magnitude but revealed similar patterns overall to the main specifications, suggesting that the Black-white differences we estimated exist even among enrollees living in the same zip code. Results from sensitivity analyses stratifying the regression models by complete versus variable coverage of controller medications found that the adjusted Black-white differences in receipt of recommended asthma medications and in the probability of having an acute asthma event were slightly larger in states with variable coverage than in those with complete coverage. However, in both variable- and complete-coverage states, the Black-white difference in the likelihood of an acute event was only slightly lower after controlling for receipt of recommended medications.

TABLE 3

Characteristics Associated with Receipt of Recommended Asthma Medications and Asthma-Related Hospitalizations and ED Visits among Medicaid/CHIP Enrollees Ages 5 to 18 with Persistent Asthma, Adjusting for Other Observable Characteristics, 2019

	Difference in expected probability of receiving the recommended asthma medication in the first six months of 2019	Difference in expected probability of an asthma hospitalization or ED visit in the last six months of 2019 (not controlling for medication receipt)	Difference in expected probability of an asthma hospitalization or ED visit in the last six months of 2019 (controlling for medication receipt)
Race/ethnicity			
White	REF	REF	REF
Black	-9.1*** (-9.7, -8.4)	3.2*** (3.0, 3.4)	3.1*** (2.9, 3.3)
Received recommended asthma medications			-1.4*** (-1.5, -1.2)
Sex			
Male	REF	REF	REF
Female	-1.4*** (-1.8, -1.0)	-0.1 (-0.2, 0.1)	-0.1 (-0.2, 0.1)
Age in years			
5	REF	REF	REF
6	2.1*** (1.0, 3.2)	-1.2*** (-1.7, -0.7)	-1.1*** (-1.6, -0.6)
7	2.5*** (1.4, 3.6)	-1.2*** (-1.7, -0.7)	-1.1*** (-1.6, -0.6)
8	1.8*** (0.7, 2.9)	-1.5*** (-2.0, -1.1)	-1.5*** (-2.0, -1.0)
9	1.6*** (0.5, 2.7)	-1.6*** (-2.1, -1.1)	-1.6*** (-2.0, -1.1)
10	-0.2 (-1.3, 0.8)	-2.2*** (-2.7, -1.8)	-2.2*** (-2.7, -1.8)
11	-1.2** (-2.2, -0.1)	-2.4*** (-2.9, -1.9)	-2.4*** (-2.9, -2.0)
12	-2.3*** (-3.4, -1.2)	-2.8*** (-3.2, -2.3)	-2.8*** (-3.3, -2.4)
13	-4.3*** (-5.4, -3.2)	-2.9*** (-3.3, -2.4)	-2.9*** (-3.4, -2.5)
14	-4.7*** (-5.8, -3.5)	-2.6*** (-3.1, -2.2)	-2.7*** (-3.2, -2.2)
15	-5.1*** (-6.3, -3.9)	-3.0*** (-3.4, -2.5)	-3.0*** (-3.5, -2.6)
16	-6.1*** (-7.3, -4.9)	-2.6*** (-3.0, -2.1)	-2.6*** (-3.1, -2.2)

	Difference in expected probability of receiving the recommended asthma medication in the first six months of 2019	Difference in expected probability of an asthma hospitalization or ED visit in the last six months of 2019 (not controlling for medication receipt)	Difference in expected probability of an asthma hospitalization or ED visit in the last six months of 2019 (controlling for medication receipt)
17	-4.9*** (-6.2, -3.5)	-2.2*** (-2.7, -1.6)	-2.2*** (-2.8, -1.7)
18	-7.0*** (-8.6, -5.4)	-1.0*** (-1.7, -0.3)	-1.1*** (-1.8, -0.4)
Plan type			
Comprehensive managed care	REF	REF	REF
Fee-for-service	7.4*** (6.3, 8.5)	-0.6*** (-0.9, -0.2)	-0.5*** (-0.8, -0.1)
Eligibility group			
Income-based (Medicaid)	REF	REF	REF
Income-based (CHIP)	4.9*** (4.1, 5.7)	-0.5*** (-0.8, -0.3)	-0.5*** (-0.7, -0.2)
SSI or disability	5.6*** (4.9, 6.3)	0.0 (-0.3, 0.2)	0.0 (-0.2, 0.3)
Adoption, foster, or guardianship	7.5*** (6.4, 8.7)	-1.3*** (-1.6, -0.9)	-1.2*** (-1.5, -0.8)
Urban/rural residence			
Urban	REF	REF	REF
Rural	4.1*** (3.2, 5.0)	-0.5*** (-0.7, -0.3)	-0.5*** (-0.7, -0.3)
Percent living below the federal poverty line in zip code			
Lowest poverty rates	REF	REF	REF
↓	-1.0 (-2.2, 0.3)	0.2 (-0.1, 0.5)	0.2 (-0.1, 0.5)
	-2.9*** (-4.1, -1.7)	0.3** (0.0, 0.6)	0.3* (0.0, 0.6)
	-5.2*** (-6.4, -4.0)	0.7*** (0.4, 1.0)	0.7*** (0.4, 1.0)
Highest poverty rates	-9.4*** (-10.7, -8.1)	1.5*** (1.2, 1.8)	1.4*** (1.1, 1.7)
Missing zip code poverty rate	-2.9 (-6.7, 1.0)	2.2*** (0.7, 3.6)	2.1*** (0.7, 3.6)
State			
California	REF	REF	REF
Delaware	9.9*** (7.1, 12.6)	0.9 (-0.2, 2.0)	1.0* (0.0, 2.1)
Indiana	4.7*** (3.3, 6.1)	0.9*** (0.5, 1.2)	0.9*** (0.6, 1.3)
Michigan	6.8*** (5.5, 8.1)	1.2*** (0.8, 1.6)	1.3*** (0.9, 1.7)
Mississippi	19.8*** (18.2, 21.4)	-0.5*** (-0.9, -0.1)	-0.3 (-0.7, 0.1)
Nebraska	23.3*** (20.3, 26.3)	1.1*** (0.5, 1.6)	1.4*** (0.8, 1.9)
New Mexico	5.0*** (2.2, 7.8)	0.6 (-0.1, 1.4)	0.7* (0.0, 1.5)
Nevada	6.4*** (4.5, 8.3)	0.4 (-0.2, 1.0)	0.5 (-0.1, 1.1)
Pennsylvania	7.4*** (6.2, 8.6)	0.2 (-0.1, 0.5)	0.3** (0.0, 0.6)
Texas	15.2*** (14.0, 16.3)	0.9*** (0.6, 1.2)	1.1*** (0.8, 1.5)
Washington	-6.5*** (-7.8, -5.1)	0.7*** (0.4, 1.1)	0.6*** (0.3, 1.0)
Constant	40.3*** (38.7, 41.9)	3.3*** (2.8, 3.7)	3.8*** (3.3, 4.3)

Source: 2018-2019 Transformed Medicaid Statistical Information System Analytic Files from 11 states.

Notes: CHIP = Children's Health Insurance Program; ED = emergency department; SSI = Supplemental Security Income. Sample includes children ages 5 to 18 continuously enrolled in Medicaid or CHIP from 2018 to 2019 who had persistent asthma in 2018 (see methods for details). Estimates represent estimated percentage point differences in the probability of the outcome. REF is the reference group. CI is confidence interval. Urban and rural are defined according to rural-urban commuting area primary codes associated with residential zip code. Estimates come from linear regression models with standard errors clustered by enrollee zip code. */**/*** Estimate differs significantly at the 0.10/0.05/0.01 level.

Discussion

Our analysis of nearly 200,000 enrollees suggests that over half of Medicaid-enrolled children with persistent asthma did not receive the recommended asthma prescription medications in 2019. Black enrollees were at substantially higher risk of not receiving the recommended medications compared with white enrollees, even after adjusting for other sociodemographic and enrollment characteristics and when comparing enrollees living in the same zip code. Since not all Medicaid managed care plans in all states cover all asthma controller medications, the Black-white differences in receipt of recommended asthma medications could be partially explained by differences in coverage generosity by Medicaid managed care plans in which Black versus white children tend to be enrolled. However, the patterns we observe are similar in states with variable versus complete coverage of asthma controller medications, suggesting coverage of controller medications is not the sole driver of differences.

Confirming findings from prior studies, our analysis finds that Black Medicaid-enrolled children were significantly more likely than white Medicaid-enrolled children to experience a hospitalization or ED visit for their asthma (Binney et al. 2024; Malhotra et al. 2014; Silber et al. 2017; Smith et al. 2024). Our analysis further shows that receipt of recommended asthma medications was associated with a significantly lower chance of a hospitalization or ED visit, but the difference by race in receipt of recommended medications did not fully explain the higher asthma hospitalization and ED visit rates among Black enrollees compared with white enrollees. This suggests that while access to recommended asthma medications is important for preventing acute asthma events, and Black children are at disproportionate risk for not receiving these medications, there are additional factors beyond medication access that drive the stark Black-white racial disparity in asthma ED visits and hospitalizations.

This analysis builds on prior studies of racial disparities in asthma medication receipt by using recent data representing Medicaid-enrolled children with persistent asthma living in 11 different states to confirm that Black-white racial disparities in access to asthma medications are widespread and continue to persist. Although the disparities may be driven by more clinically severe cases of asthma among Black relative to white enrollees, our findings nonetheless suggest that states, Medicaid managed care organizations, providers, and other stakeholders may need to consider new strategies to increase access to appropriate asthma treatment, especially for Black Medicaid-enrolled children. For example, comprehensive coverage of asthma controller medications and other guidelines-based asthma care could be required by all plans and all states to ensure equitable access to controller medications and other effective treatment strategies (Link 2023). States may also have options to consider that could reduce children's exposure to asthma triggers. For example, evidence-based interventions for remediating asthma triggers in the home—such as air filtration, air conditioning and ventilation improvements, and mold or pest removal—can be covered via Section 1115 waiver authority (as in New York),[8] as an optional managed care service ("in lieu of services"; as in California; DHCS 2025), or via a CHIP Health Services Initiative[9] (as in Wisconsin).[10] Additionally, states or managed care plans could be held accountable to publicly report on their asthma medication ratio measure among Medicaid enrollees by race and ethnicity (Bailit Health 2024).[11] Innovative delivery system tools to increase the

accessibility of medication refills, such as telehealth (Persaud 2022), school-based care (Adams et al. 2022), or mobile applications (Kagen and Garland 2019), could also be considered to increase the receipt of recommended asthma medications.

Although increasing access to asthma medications for Medicaid-enrolled children, and especially Black Medicaid-enrolled children, is undoubtedly important, our analysis also suggests that this alone will not remedy the racial disparity in asthma hospitalizations and ED visits. Rather, Black children likely face other systemic barriers (such as barriers to accessing care, discrimination by or lack of trust in providers, and disproportionate exposure to environmental asthma triggers) that put them at increased risk of experiencing poor asthma outcomes even when they do receive the recommended medications. Given the substantial negative impacts that persistent asthma can have on children's quality of life and long-term well-being, it is critical that these other factors—many of which lie outside the purview of the health care system—are addressed.

This study has several limitations. First, because of data quality concerns, we could only include 11 states and two racial/ethnic groups (non-Hispanic Black and non-Hispanic white) in our analysis. Outcomes for children in other states and of other races and ethnicities will be important for future research to prioritize. Second, while we followed previously validated claims-based measures to identify children with persistent asthma and to measure access to recommended asthma medications, it is possible that we did not capture all enrollees with persistent asthma or adequately measure children's asthma medication use. Relatedly, we could not distinguish different classifications of persistent asthma (i.e., mild, moderate, or severe) by enrollee or race, so it is possible that Black enrollees had more severe cases of persistent asthma than the white enrollees in our sample. Third, the TAF pharmacy file includes filled prescriptions only, so we could not observe prescriptions that were prescribed but never filled. Finally, our sample was limited to children with continuous Medicaid/CHIP enrollment, which was necessary to capture their complete claims history, but children with discontinuous coverage may be at especially high risk of experiencing gaps in access to proper asthma care.

Conclusion

This study uses a large, multistate Medicaid claims dataset to examine differences in receipt of recommended prescription medications for controlling persistent asthma between Black and white Medicaid-enrolled children. We find that Black enrollees are considerably less likely than white enrollees to receive the recommended medications, even after adjusting for other observable characteristics. Furthermore, Black enrollees are more likely than white enrollees to need hospital or ED care for their asthma even after controlling for medication receipt. Concerted efforts on behalf of Medicaid policymakers, plans, providers, and other stakeholders will be needed to improve access to asthma medications and address racial disparities in asthma outcomes.

Appendix

Appendix A: Reporting Checklist

TABLE A.1

T-MSIS Analytic Files (TAF) Analysis Reporting Checklist

Category	Description	Location(s) in the manuscript where items are reported
	Data	
Files, years, release versions, and data extract	▪ Indicate which TAF files were used in the analysis (e.g., Demographic and Eligibility File, Inpatient File, Other Services File) ▪ Indicate which years of TAF data were included in the analysis ▪ Indicate which file versions were included in the analysis (e.g., preliminary, release 1, release 2) ▪ Indicate whether the study drew from 100 percent TAF files or prespecified extracts	Methods
	Analytic sample	
Eligibility criteria	▪ If applicable, describe what eligibility category codes were used to identify the study sample and whether they were used in combination with any other variables (e.g., age, receipt of specific medical services)	N/A (sample not restricted by eligibility category)
Enrollment span	▪ If applicable, indicate the minimum period of enrollment required for an enrollee to be included in the study sample and how the enrollment period was defined	Methods and appendix C
Scope of benefits	▪ If applicable, indicate whether the analysis included enrollees with full scope, comprehensive, or restricted benefits	Methods and appendix C
Encounter data	▪ Indicate whether the analysis excluded either fee-for-service or managed care enrollees; if managed care enrollees were excluded, define the criteria used to do so ▪ Indicate which types of claims records (e.g., fee-for-service claims, service tracking claims, capitation payments; see variable CLM_TYPE_CD) were included in the analysis	Appendix C and appendix D
Dual eligibility	▪ Describe whether individuals dually enrolled in Medicare and Medicaid were included in or excluded from the study sample and, if applicable, how dual eligibility was defined	Methods and appendix C
	State and territory exclusions	
Criteria	▪ Indicate which states and/or territories were included (or excluded) from the analysis on the basis of data quality concerns ▪ Indicate the criteria by which state exclusions were made, including measures, data sources, and thresholds	Methods and appendix B
State variation table	▪ Consider including a state-level table (which may appear in an appendix) summarizing the number of observations, means, medians, and missingness for key study measures	Table 2

Category	Description	Location(s) in the manuscript where items are reported
	Special Considerations	
Spending	▪ Indicate which types of claims records (e.g., fee-for-service claims, service tracking claims, capitation payments; see variable CLM_TYPE_CD) were included to measure spending	N/A
	▪ If including service-specific spending for managed care encounters, indicate how spending was imputed (payments from plans to health care facilities and professionals on encounter records are generally redacted)	
Using TAF with predecessor MAX data	▪ Indicate if the analysis included data from the MAX files and, if so, for what years and which states	N/A
	▪ If applicable, include an exhibit examining trends in key measures by state over time and particularly during any transition from MAX to TAF	

Source: William L. Schpero, K. John McConnell, Greta Bushnell, et al., "The T-MSIS Analytic Files (TAF) Analysis Reporting Checklist: A Guide for Research Using Medicaid Claims Data," *JAMA Health Forum* 6 (10, 2025): e253622, https://doi.org/10.1001/jamahealthforum.2025.3622.

Notes: MAX = Medicaid Analytic eXtract; TAF = Transformed Medicaid Statistical Information System Analytic Files.

Appendix B: State Selection Process

TABLE B.1

Selection of States for Analysis

Criterion	Remaining states	Count of remaining states
All states	AK, AL, AZ, AR, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, and WY	51
"Low concern" on beneficiary age in 2018 and 2019	AK, AL, AZ, AR, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NM, NV, NY, OH, OK, OR, PA, RI, SC, SD, TN, TX, UT, VA, VT, WA, WI, WV, and WY	51
"Low concern" on total Medicaid and CHIP enrollment in 2018 and 2019	AK, AL, AZ, AR, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, LA, MA, MD, MI, MN, MO, MS, MT, NC, ND, NE, NH, NM, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, VT, WA, WI, and WY	46
"Low concern" on beneficiary zip code in 2018 and 2019	AK, AL, AZ, AR, CA, CO, CT, DC, DE, FL, GA, HI, IA, ID, IL, IN, KS, LA, MA, MD, MI, MN, MO, MS, MT, NC, ND, NE, NH, NM, NV, NY, OH, OK, OR, PA, SC, SD, TN, TX, UT, VA, WA, WI, and WY	45
"Low Concern" on RX claims volume in 2018 or 2019	AZ, CA, CT, DC, DE, GA, HI, IA, ID, IL, IN, KS, LA, MA, MD, MI, MO, MS, MT, ND, NE, NH, NM, NV, NY, OR, PA, TN, TX, UT, VA, WA, and WI	33
Exclude states with "high concern" or "unusable" IP claims volume in 2018 or 2019	AZ, CA, DC, DE, HI, IA, ID, IL, IN, KS, LA, MD, MI, MO, MS, MT, ND, NE, NM, NV, OR, PA, TN, TX, UT, VA, WA, and WI	28

Criterion	Remaining states	Count of remaining states
Exclude states with "high concern" or "unusable" OT claims volume in 2018 or 2019	AZ, CA, DC, DE, HI, IA, ID, IL, IN, KS, LA, MD, MI, MO, MS, MT, ND, NE, NM, NV, OR, PA, TN, TX, UT, VA, WA, and WI	28
Able to identify Black, non-Hispanic, and white, non-Hispanic enrollees based on data quality assessment of race and ethnicity variable, 2019+	CA, DE, IN, MI, MS, NE, NM, NV, PA, TX, and WA	11

Source: 2018 and 2019 Transformed Medicaid Statistical Information System Analytic Files (TAF), Smith, O'Brien, and Kenney 2023, and the Centers for Medicare and Medicaid Services Data Quality Atlas assessments for TAF, available at "Exploring Data Quality (DQ) Assessments by Topic," Medicaid, accessed October 30, 2025, https://www.medicaid.gov/dq-atlas/landing/topics/info.

Notes: OT = other services; IP = inpatient; RX = prescription. + We only included states in our analyses where less than 20 percent of children in the state had a missing value for race/ethnicity and where the share of children identified as white, non-Hispanic and Black, non-Hispanic was within 10 percentage points and 50 percent of estimates of the race/ethnicity distribution among Medicaid-enrolled children from the American Community Survey, see Laura Barrie Smith, Claire O'Brien, Genevieve M. Kenney, and Timothy A. Waidmann, "Black–White Disparities in Asthma Hospitalizations and ED Visits among Medicaid-Enrolled Children." Hospital Pediatrics 14 (6, 2023): 490–8, https://doi.org/10.1542/hpeds.2023-007477.

Appendix C: Definition of Study Population

TABLE C.1

Definition of Study Population

Exclusion	Number of enrollees remaining	Number excluded from last step	Share Excluded from Last Step		
			Overall	State lower range	State upper range
All enrollee records in the Demographics and Eligibility TAF file in our states with nonmissing birth date and enrollee ID, 2019	33,101,866	0	0.0%	0.0%	0.0%
Exclude enrollees age 4 or younger or 19 or older as of Jan 1, 2019	10,612,496	22,489,370	67.9%	53.1%	73.2%
Exclude enrollees with missing/invalid eligibility category, sex, or zip code	10,579,522	32,974	0.3%	0.0%	0.7%
Exclude enrollees not continuously enrolled in Medicaid or CHIP for 360 days in 2019	7,658,357	2,921,165	27.6%	18.7%	44.4%
Exclude enrollees dually eligible for Medicare in any month of 2019	7,656,994	1,363	0.0%	0.0%	0.1%
Exclude enrollees with restricted Medicaid benefits	7,523,316	133,678	1.7%	0.0%	8.1%
Exclude enrollees with duplicate eligibility records	7,522,927	389	0.0%	0.0%	0.1%
Exclude enrollees not identified as Black NH or white NH	3,058,167	4,464,760	59.3%	7.5%	78.9%
Exclude enrollees not continuously enrolled in Medicaid or CHIP for at least 360 days in 2018	2,611,886	446,281	14.6%	8.8%	26.5%
Exclude enrollees without persistent asthma+ in 2018	198,184	2,413,702	92.4%	91.1%	95.2%

Source: 2018–19 Transformed Medicaid Statistical Information System Analytic Files from 11 states.
Notes: TAF = Transformed Medicaid Statistical Information System Analytic Files; CHIP = Children's Health Insurance Program; NH = non-Hispanic. The analytic sample includes enrollees in fee-for-service and managed care Medicaid. State-specific sample creation tables are available on request. [+] See appendix D for details on the definition of persistent asthma.

Appendix D: Variable Definitions

Persistent asthma: To identify enrollees with mild, moderate, or severe persistent asthma in 2018, we followed the HEDIS claims-based definition of persistent asthma used for the denominator of the CMS Child Core Set AMR measure, applying these measure specifications to fee-for-service claims and managed care encounter records from the TAF. This definition of persistent asthma requires enrollees to have at least one ED or inpatient encounter with a principal diagnosis for asthma, at least four outpatient visits with a principal diagnosis for asthma, or at least four asthma medication events during 2018.[12] ICD-10 diagnosis codes for asthma included all diagnosis codes starting with J45 ("J4520," "J4521," "J4522," "J4530," "J4531," "J4532," "J4540," "J4541," "J4542," "J4550," "J4551," "J4552," "J45901," "J45902," "J45909," "J45990," "J45991," and "J45998").

AMR measure: We followed the HEDIS specifications used for the CMS Child Core Set AMR measure, applying them to fee-for-service claims and managed care encounter records from the TAF, to determine whether each enrollee with persistent asthma received a ratio of controller asthma medications to total asthma medications of 0.50 or greater.[13] Asthma controller medications include beclomethasone, benralizumab, budesonide, budesonide formoterol, ciclesonide, dupilumab, dyphylline guaifenesin, flunisolide, fluticasone, fluticasone salmeterol, fluticasone vilanterol, formoterol mometasone, mepolizumab, mometasone, montelukast, omalizumab, reslizumab, theophylline, zafirlukast, and zileuton. Asthma reliever medications include albuterol and levalbuterol. To identify these controller and reliever medications in the TAF pharmacy file, we used current and historical National Drug Code lists from the National Committee for Quality Assurance and Food and Drug Administration.

Notes

[1] "Most Recent National Asthma Data," Centers for Disease Control and Prevention, May 10, 2023, https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm.

[2] "Most Recent National Asthma Data," Centers for Disease Control and Prevention; "Child Asthma Prevalence by Race and State/Territory," Centers for Disease Control and Prevention, June 11, 2018, https://www.cdc.gov/asthma/asthmadata/Child_Prevalence_Race.html.

[3] Another recent study of Medicaid-enrolled children from Arkansas found that lower rates of asthma controller medications were associated with decreased asthma hospitalizations and ED visits; however, this analysis was not limited to children with persistent asthma, so children not receiving controller medications likely had milder cases of asthma, making this finding difficult to interpret (Jefferson et al. 2023).

[4] "Exploring Data Quality (DQ) Assessments by Topic," Medicaid, accessed October 30, 2025, https://www.medicaid.gov/dq-atlas/landing/topics/info.

[5] "Measure AMR-CH: Asthma Medication Ratio: Ages 5 to 18," National Committee for Quality Assurance, accessed October 30, 2025.

[6] "Rural-Urban Commuting Area Codes," US Department of Agriculture, Economic Research Service, accessed October 30, 2025, https://www.ers.usda.gov/data-products/rural-urban-commuting-area-codes/.

[7] "COVID-19 Resources (2020)," The Public Health Disparities Geocoding Project at the Harvard T.H. Chan School of Public Health, accessed October 20, 2025, https://www.hsph.harvard.edu/thegeocodingproject/covid-19-resources/.

[8] "Letter to Amir Bassiri," CMS, January 9, 2024.

[9] "CHIP Health Services Initiatives: What They Are and How States Use Them," Medicaid and CHIP Payment and Access Commission, July 2019.

[10] "State Plan Amendment (SPA) # WI-21-0015," Centers for Medicare and Medicaid Services, September 8, 2021.

[11] Beginning in 2024, states will be required to report to CMS on all Child Core Set measures including the asthma medication ratio measure, but stratification by race and ethnicity will not be required for the asthma medication ratio measure, see Elizabeth Lukanen and Lacey Hartman, "Changes to the Child and Adult Core Measure Sets to Advance Equity," State Health and Value Strategies, June 7, 2024, https://www.shvs.org/changes-to-child-and-adult-core-sets-to-advance-equity/.

[12] "Measure AMR-CH: Asthma Medication Ratio: Ages 5 to 18," National Committee for Quality Assurance.

[13] "Measure AMR-CH: Asthma Medication Ratio: Ages 5 to 18," National Committee for Quality Assurance.

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About the Authors

Laura Barrie Smith is a senior research associate in the Health Policy Division at the Urban Institute. Her research studies the impacts of health care policies on access to health care using quasi-experimental research designs and large datasets, such as electronic health records and health insurance claims. Her current work examines health equity in Medicaid, with a particular focus on children and pregnant and postpartum populations, and evaluates the effects of integrated care plans for individuals dually enrolled in Medicare and Medicaid. Other recent and ongoing work examines variation in telehealth use across populations, transportation and access to care, extreme climate events and acute health care use, and health information technology incentive programs in Medicaid. Smith holds a BA in mathematics from St. Olaf College and a PhD in health services research, with an emphasis in health economics, from the University of Minnesota.

Claire O'Brien is a research associate in the Health Policy Division. She uses Medicaid claims data to study racial, ethnic, and geographic disparities in the Medicaid program, studying outcomes such as preventable hospitalizations, well-child visits, and postpartum care access. Additionally, she has expertise in the Affordable Care Act, including providing technical assistance to state agencies and conducting both quantitative and qualitative research on state and federal Marketplaces. She also has

experience using national survey data to study mammogram usage, prescription drug access, telehealth, unfair treatment, and patient-provider racial concordance. She earned a bachelor's degree in economics and applied math from the University of Notre Dame and a master's degree in public policy from the George Washington University.

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