Research Paper

Physician Payment Incentives and Associated Healthcare Utilization Outcomes in Medicaid Enrolled Asthmatic Children

J. J. CHANG, ISHA PATEL[1], R. BALKRISHNAN[2] AND W. S. SUH[3]*

Humana - Comprehensive Health Insights, Louisville, KY 40202, [1]Department of Biopharmaceutical Sciences, Bernard J. Dunn School of Pharmacy, Shenandoah University, Winchester, VA 22601, [2]Department of Public Health Sciences, School of Medicine, University of Virginia, Charlottsville, VA 22908, USA, [3]Department of Healthcare Management, Gachon University, Seongnam-si, Gyeonggi-do, Korea

Very few studies have captured the differences in the outcomes of Medicaid patients between fee-for-service and capitation plan. This study measures the impact of fee-for-service vs. capitation plan on the healthcare utilization and medication adherence in asthmatic children enrolled in Medicaid. A retrospective cohort study was utilized to analyze Medicaid data from 8 states. The data were comprised of medical records such as healthcare utilization, medication and eligibility records of 6435 Medicaid enrolled asthmatic children that had newly started pharmacotherapy for asthma. Quantile regression was used to study medication adherence and Poisson regression was used to determine healthcare utilization. Patients in fee-for-service plans were significantly associated with higher medication adherence rates ($p<0.05$). Compared to patients in fee-for-service plans, patients in capitation plans had 52% ($p<0.05$) more hospitalizations, 52% fewer outpatient visits and 32% ($p<0.05$) more emergency department visits. Medicaid programs primarily use capitation based managed care plans for keeping a check on the healthcare costs. Yet, these plans might not be that cost-effective for the long-term management of asthma. Hence, the policy makers and third party payers should consider disease specific needs of children in order to achieve improved access to care and medication for better management of a particular disease.

Key words: Healthcare utilization, child, asthma, Medicaid, medication adherence, payment incentives

Asthma is a chronic respiratory disease characterized by episodes of inflammation and narrowing of small airways in respiratory system[1]. National estimate suggests that lifetime asthma prevalence for children under the age of 18 y was approximately 12.5%[1]. Children from poor and minority families tend to bear a disproportionate share of the population burden of asthma. This is reflected in higher rates of hospitalization and emergency room visits for asthma, lower utilization of pharmaceutical agents known to improve control of asthma, higher prevalence and severity of the disease, and lower rates of utilization of primary care services related to asthma[2-5]. These trends have been attributed to the characteristic and financing of the US medical care system and their associated impact on access to medical care[6] and to individual characteristics of the population[7].

Lack of insurance or limited insurance results in patients having a higher out-of-pocket expenditure and thereby decreases medication adherence[8-10]. Hence, the type of insurance coverage can be a limiting factor that governs the access to innovative healthcare services. When managing their chronic disease, patients with government-funded insurance such as Medicare and Medicaid are less likely to receive newly launched medications in the market[11,12].

Ever since the Medicaid program was launched by the government, the budget limit has always exceeded the allotted amount for the program[6,13]. The Medicaid managed care plans implemented by the states were mainly comprised of Capitated (prepaid) plans and

***Address for correspondence**
E-mail: suhw@gachon.ac.kr

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Fee-for-Service (FFS) plans[14]. The prepaid care plans provide fixed payments (capitation) to physicians to provide healthcare services. The impact of capitated plans on the health outcomes of the Medicaid patients with chronic disease condition like asthma is yet to be explored[15-20]. The impact of the type of health plan, particularly capitation on medication adherence and healthcare service utilization, is not investigated as well. In the presence of limited health care resources and ever-escalating health care expenses, further research can aid the policy makers to implement reimbursement policies that ensure effective distribution of the inadequate resources among the vulnerable population. This study examines the impact of the type of health plan (FFS vs. capitated) on the economic outcomes, mainly medication adherence and healthcare utilization in the Medicaid enrolled pediatric population with asthma.

MATERIALS AND METHODS

This study used the MarketScan® Medicaid claims dataset licensed from Thomson Medstat. It consisted of the data from 8 different states of varying size dispersed all across United States of America[21]. While the states were de-identified, the dataset included at least one state from each US region. The database was comprised of medical services and prescription drug and eligibility records of enrollees from selected states. The available data were from 2005 to 2007, representing around 5.4 million individuals in USA[21]. For the purpose of this study, the Medicaid database was updated and queried from January 1, 2005 to December 31, 2007.

The study population was comprised of children between the ages 0 to 18 yr. Patients with a diagnosis of asthma and a prescription of a new antiasthma medication (inhaled bronchodilator, antiinflammatory, systemic bronchodilator, systemic corticosteroid and/or leukotriene modifiers) during the study period were included. Subjects diagnosed either primary or secondary asthma using the International Classification of Diseases Code 9th Revision (ICD-9: 493.XX) claims data during the study period were included. Only subjects who have maintained continuous eligibility for 1 year period between January 1, 2005 and December 31, 2005 were included in the study. The date for the first prescription claim for antiasthmatic medication usage was designated as an index date, where the medication identified using relevant National Drug Codes (NDC) recorded in the claim records. To ensure that each patient's index date presented a reasonable marker for treatment initiation and to make sure that any observed lack of health care events were due to a lack of medical activity and not due to cessation of insurance, all patients were required to have continuous health plan enrollment for at least a year prior to and following their index date. The identification period ranged from January 1, 2006 to December 31, 2007. During this time period, any patients with asthma diagnosis and antiasthmatic medication prescription were included in the dataset.

Measurement and outcomes:

The operational definitions and measurements of the variables utilized in this study are discussed in this section. The dependent variables for this study are medication adherence and rate of hospitalization and emergency room (ER) visits. The independent variable tested in this study is the payment mechanism. Independent covariates included are age, gender, access to specialty care, and disease severity. The operational definitions of key variables are described in the following sections.

Medication adherence:

Medication adherence in this study is indicated by patient's intake of antiasthmatic prescription medication. The data from the pharmacy claims database can be used to measure medication adherence in different ways. Medication possession ratio (MPR) is one such measure used to calculate medication adherence. For the purposes of this study, MPR is calculated as the days of antiasthmatic medication supply dispensed divided by the number of days in the observation period (#365) minus the number of days in the hospital[22-25]. Previous studies have shown that medication adherence measurement for the entire study period, when used as a denominator, predicts hospitalization and healthcare costs in a more appropriate manner compared to adherence measures considering the period between the first and last refill[22,26,27]. Therefore, MPR for this study is defined as MPR=(No. of days supply of antiasthmatic medication in the post-index period)/No. of days in the study period (365 days).

The observation period in this study included the post-index period or 12 month follow up period, which was consistent for each patient. The number of hospital days was subtracted from the denominator as any drug taken during this period was given to the patient by the hospital and was not possible to capture in the pharmacy

records. The information on each filled prescription included of dispensing, quantity dispensed, and days' supply of medication. Medications used were placed into 2 categories namely asthma controller medications and reliever medications. Controller medications consisted of inhaled corticosteroids (ICSs), long-acting β-agonists (LABAs), ICSs/LABAs, leukotriene receptor antagonists (LTRAs) and theophylline. Reliever medications included short-acting β-agonists (SABAs) and systemic corticosteroids. We examined the distribution of the day of supply for asthma medications, summing for each patient the number of days supplied by their prescriptions for the 365 days of follow up. The MPR was calculated for any asthma medication possession on a given day of the year and avoided double counting of multiple asthma medication use on the same day by the same patient.

Healthcare service utilization:

Patients were followed during pre-index and postindex period (i.e. 12 month before and 12 months after the index date) to assess their healthcare utilization in terms of hospitalizations, ER visits, and outpatient visits. Variables related to hospitalizations, ER visits and outpatient visits were used as a proxy for health care service utilization. To identify hospitalizations in patients, their admission and discharge dates recorded in inpatient service files were used.

Proxy for asthma severity:

Based on the established relationship between disease severity and intensity of treatment, severity of a condition in the current period is inferred by a risk of an exacerbation in the future. Some of the independent predictors widely used in the literature for ascertaining future asthma-related emergency hospital utilization (EHU) are inpatient hospitalizations, use of emergency department and use of oral corticosteroids[28]. Severity of asthma in the current period is assessed by determining high risk of EHU. Risk stratification schemes are developed using pharmacy claims or facility claims or a combination of both. Combination of pharmacy and facility claims are more successful in stratifying risk compared to using pharmacy or facility claims single-handedly[28]. A popular type of risk stratification scheme used is a simple three-level risk stratification which ranks risk of future EHU based on a point system applied to a period of current utilization. Points are assigned to different indicators of future asthma related EHU. Asthma hospitalizations or ED encounters in the 12-month base period are assigned 2 points, 15 or more β-agonist canisters in the base period are assigned 1 point and one or more filled prescriptions for oral corticosteroids are assigned 1 point. Members are differentiated on the basis of assignment of points. Members with 2 or more points, 1 point and 0 point are classified as high risk, medium risk and low risk groups respectively[28]. Consequently, the measurement of asthma severity is defined as the probability of an asthmatic member having a risk score (severity proxy) of 0, 1, or 2 (Table 1).

Statistical analysis:

Descriptive statistics was performed to compare the baseline characteristics in the study cohorts. Continuous data were described by means and standard deviations, and nominal and categorical data were described by frequencies and percentages. Unadjusted demographic, clinical, and medication characteristic comparisons between groups were completed using independent sample t-tests for evaluation of continuous variables and chi-square tests for categorical variables. The data were analyzed using STATA software version 10 (Stata Corp, College Station, TX). All univariate, bivariate, and multivariate analyses were conducted at a set a priori level of significance (0.05).

After controlling for potential covariates, quantile regression was used to evaluate the relationship between the type of health plan and medication

TABLE 1: THREE-LEVEL RISK STRATIFICATION OF ASTHMA SEVERITY

Event per 12- month base period	Potential Point Assignment	Low Risk 0 Points	Medium Risk 1 Points	High Risk 2 or more Points
A. ED visits asthma encounter	2	0	0	2
B. IP visits asthma encounter	2	0	0	2
C. 15 or more β-agonist canisters dispensed	1	0	1	1
D. Any oral corticosteroid prescriptions dispensed	1	0	1	1
Required events for risk level		No listed events	Either C or D	Either A or B and/or C and D

adherence. Quantile regression provided a convenient linear framework for examining how the quantile of a dependent variable changes in response to a set of independent variable using linear conditional quantile function. The primary independent variable was the type of health plan (FFS vs. capitation). Other covariates included in the model were demographic variables (age, sex and race/ethnicity), clinical variables such as severity index including health care resource utilization in pre-index period (hospitalizations and ER visits), and therapy-related variables (asthma drug ratio). Logistic regression model was used to predict the likelihood of healthcare utilizations (outpatient, inpatient, and ER visits). The Poisson regression was performed to model predictors of the frequency of healthcare utilizations (outpatient, inpatient, and ER visits) while the zero-inflated Poisson regression model was used to predict the number of hospitalizations. Adequacy of model was examined using the Vuong test.

RESULTS AND DISCUSSION

The study cohort consisted of 6435 children with asthma. The mean age of the cohort was 8.1±6.7 y and comprised 61.8% females (n=3966). The majority of children were white (49.8%) followed by black (43.8%); only 6.3% were of Hispanic ethnicity. A total of 2607 (40.5%) children were enrolled in capitated health plans and the remaining children (59.5%) were enrolled in traditional FFS plans.

Bivariate analysis showed that the mean age of patients enrolled in capitated plan (7.5±6.4 y) was a little lower than that of patients enrolled in FFS plans (8.7±7.1 y; $p<0.05$). The proportion of female (62.5%) was slightly higher in capitated plans compared to FFS plans (61.2%; $p<0.05$). Capitated plans had slightly lower percentage of Black (43.4%) patients than FFS plans (44.3%; $p<0.05$). When medication adherence was examined, patients in FFS plans had a somewhat higher MPR (45.49%) than those in capitated plans (34.72%; $p<0.05$). When we examined health care service utilization in the pre-index period, visits to pediatricians were somewhat higher in FFS plans than in capitated plans (77.7% vs. 75.9%; $p<0.05$). Compared to patients in capitated plans, patients in FFS plan had significantly higher MPR values (34.72 vs. 45.49, $p<0.05$). The number of ER visits was slightly higher in capitated plans compared to FFS plans (76.0% vs. 46.4%; $p<0.05$); however, there was no significant difference in the number of hospitalizations (Table 2).

Table 3 shows the comparison of antiasthma medication adherence rates in asthmatic children across the health plans. Quantile regression analysis was conducted to

TABLE 2: PATIENT CHARACTERISTICS ACROSS HEALTH PLANS

Variables	Measure	Capitation (n=2607)	FFS (n=3828)	p-value
		N (%)/mean (SD)	N(%)/mean (SD)	
Age in years	Continuous	7.5 (6.4)	8.7 (7.1)	<0.01
Sex	Male	980 (37.5%)	1489 (38.8%)	<0.01
	Female	1627 (62.5%)	2339 (61.2%)	
Race/ethnicity	White	1320 (50.6%)	1872 (48.9%)	<0.01
	Black	1132 (43.4%)	1698 (44.3%)	
	Hispanic	155 (6.0%)	258 (6.7%)	
Visit to pediatrician	(yes/no)	1980 (75.9%)	2976 (77.7%)	<0.01
Hospitalization	(yes/no)	960 (36.8%)	1172 (30.6%)	0.187
ER visit	(yes/no)	1982 (76.0%)	1779 (46.4%)	<0.05
Medication Possession Ratio	Continuous	34.72 (29.53)	45.49 (41.11)	<0.01
MPR				
<40%	Categorical	1987 (76.2%)	2234 (58.3%)	<0.05
<80%		459 (17.6%)	689 (18%)	
>80%		161 (6.2%)	905 (23.7%)	
Asthma drug ratio>0.5	(yes/no)	1182 (45.3%)	2367 (61.8%)	<0.01
Severity Index				
1	Categorical	860 (32.9%)	1362 (35.6%)	<0.01
2		884 (33.9%)	1287 (33.4%)	
3		863 (33.2%)	1179 (31.0%)	
Total number of prescriptions	Continuous	22.3 (19.3)	29.4 (26.4)	<0.01
Number of outpatient visits	Count	7.2 (11.2)	10.7 (14.6)	<0.01

*p<0.05; Severity index: 1. No events, 2. 15 or more beta-agonist canisters or 1 or more filled prescriptions for oral corticosteroids, 3. Hospitalization or Emergency Department encounters

measure the association between the type of health plan and MPR. The dependent variables were two quantile points set at 40% and 80%, which indicated low and high rates of medication adherence. Several factors were associated with medication adherence at quantile 40%. Firstly, being female, African American, and Hispanic were negatively associated with medication adherence rates at quantile 40% ($p<0.05$). Secondly, asthma drug ratio (ratio of controller to total medication) was negatively associated with medication adherence rates ($p<0.05$). Thirdly, total expenditure was positively associated with medication adherence rates ($p<0.05$). There was no significant difference in adherence between severity index, age, and total number of prescriptions.

We also evaluated the effect of the type of health plan on medication adherence rates on quantile 80%. There were several factors that influenced medication adherence of 80%. First, patients with capitated plans were negatively associated with medication adherence of 80% ($p<0.05$). Second, patients between the ages 5-18 y were positively associated with medication adherence rates of 80%. Third, patients belonging to African American race or Hispanic ethnicity were negatively associated with higher medication adherence. Fourth, patients with more severe symptoms had a positive association with medication adherence rate ($p<0.05$). Finally, patients with prior outpatient visits were positively associated with medication adherence of 80% ($p<0.05$).

Table 4 shows the results of logistic regression measuring the association between the type of Medicaid payment mechanism and the likelihood of health care utilization. In this case, the dependent variable was the likelihood of health care utilization (office visit, hospitalization, and ER visit). Patients on capitated plans were 26% less likely to visit outpatient clinics as compared to those with FFS plans ($p<0.05$). Female children were 100% more likely to visit outpatient clinics as compared to male children. African American and Hispanic children were less likely to visit outpatient clinics than White patients (44% and 11% respectively, $p<0.05$). Patients with higher medication possession rates were 31% less likely to visit to the outpatient clinics. Patients with more severe conditions were 92% more likely to visit the outpatient clinic than those with no conditions ($p<0.05$). There was no significant effect of total number of prescriptions, prior number of outpatient visits and total expenditure on the number of office visits.

TABLE 3: COMPARISON OF PREDICTORS OF MEDICATION ADHERENCE RATES ACROSS HEALTH PLANS USING QUANTILE REGRESSION

Variables	MPR - 40 % (quantile)		MPR - 80% (quantile)	
	B (SE)	95% CI	B(SE)	95% CI
Type of health plan				
FFS	Ref		Ref	
Capitated	0.08 (0.52)	(-0.93, 1.10)	-1.14 (0.58)**	(-2.28, -0.01)
Age group:				
1-4	Ref		Ref	
5-18	2.01 (0.53)	(0.97, 3.03)	2.35 (0.72)**	(0.94, 3.77)
Sex				
Male	Ref	(-1.68, -0.01)	Ref	
Female	-0.84 (0.43)*		-0.02(0.44)	(-0.88, 0.84)
Race/ethnicity				
White	Ref		Ref	
Black	-1.21 (0.44)**	(-2.08, -0.34)	-0.23 (1.57)	(-3.32, 2.85)
Hispanic	-1.81 (0.98)*	(-3.74, 0.13)	-0.88 (0.37)*	(-1.89, -0.11)
Visit to pediatrician	6.75 (1.04)**	(4.71, 8.79)	7.71(0.87)**	(6.00, 9.42)
Asthma drug ratio > 0.50	-13.08 (1.45)**	(-15.92, -10.24)	27.74 (1.43)**	(24.92, 30.56)
Severity Index				
1	Ref		Ref	
2	-1.99 (1.36)	(-4.66, 0.66)	0.06 (0.01)**	(0.05, 2.07)
3	-1.55 (1.41)	(-4.31, 1.27)	0.09 (0.04)*	(0.01. 3.18)
Total number of prescriptions	0.18 (0.28)	(-0.38, 0.72)	0.19 (0.04)*	(0.11, 1.26)
Number of outpatient visits	-0.03 (0.06)	(-0.22, 0.03)	0.02 (0.002)**	(0.01, 2.03)
Total expenditure	0.18 (0.01)**	(0.15, 0.19)	0.15 (0.04)**	(0.06, 1.24)
Constant	21.97 (2.80)	(16.48, 27.46)	41.64(3.44)	(34.88, 48.41)

*p<0.05 Severity index: 1. No events, 2. 15 or more beta-agonist canisters or 1 or more filled prescriptions for oral corticosteroids, 3. Hospitalization or Emergency Department encounters

TABLE 4: COMPARISON OF HEALTH CARE UTILIZATION ACROSS HEALTH PLANS USING LOGISTIC AND POISSON REGRESSION

Variables	Office visit				Hospitalization				ER visits			
	OR	95% CI	IRR	95% CI	OR	95% CI	IRR	95% CI	OR	95% CI	IRR	95% CI
Type of health plan												
FFS	Ref		Ref		Ref		Ref		Ref		Ref	
Capitated	0.74*	(0.59, 0.98)	0.48*	(0.28, 0.67)	1.34**	(1.07, 1.59)	1.52**	(1.16, 1.89)	1.25**	(1.03, 1.57)	1.32**	(1.22, 1.46)
Age group												
1-4	Ref		Ref		Ref		Ref		Ref		Ref	
5-18	0.79	(0.61, 1.03)	0.89	(0.72, 1.04)	1.29	(0.71, 2.33)	1.16	(0.91, 1.52)	0.39**	(0.13, 0.67)	0.78	(0.52, 1.15)
Sex												
Male	Ref		Ref		Ref		Ref		Ref		Ref	
Female	2.14**	(1.69, 2.87)	1.18*	(1.07, 1.31)	0.84	(0.65, 1.09)	0.93	(0.76, 1.18)	0.84	(0.53, 1.39)	0.96	(0.73, 1.26)
Race/Ethnicity												
White	Ref		Ref		Ref		Ref		Ref		Ref	
Black	0.56*	(0.27, 0.89)	0.82**	(0.70, 0.89)	0.79	(0.54, 1.07)	0.94	(0.75, 1.23)	1.07**	(1.02, 1.35)	1.23**	(1.10, 1.37)
Hispanic	0.89*	(0.62, 0.97)	0.69**	(0.44, 0.87)	1.43**	(1.02, 1.98)	1.09*	(1.07, 1.11)	1.16**	(1.04, 1.47)	1.19**	(1.04, 1.39)
Visit to beta-agonist	1.27	(0.73, 2.22)	1.06	(0.88, 1.21)	0.76*	(0.62, 0.98)	0.88	(0.56, 1.37)	1.01	(0.91, 1.23)	0.91	(0.54, 1.53)
Asthma drug ratio> 0.5	1.11	(0.74, 1.76)	1.01	(0.99, 1.02)	0.23**	(0.04, 0.42)	0.59**	(0.42, 0.72)	0.39**	(0.24, 0.59)	0.48**	(0.40, 0.54)
MPR	0.69*	(0.27, 0.99)	0.34**	(0.24, 0.45)	0.82*	(0.71, 0.99)	0.56**	(0.46, 0.69)	0.64**	(0.48, 0.75)	0.58**	(0.45, 0.73)
Severity Index												
1	Ref		Ref		Ref		Ref		Ref		Ref	
2	1.92**	(1.43, 2.49)	1.23**	(1.07, 1.38)	1.46**	(1.08, 1.89)	1.12	(0.79, 1.54)	1.24**	(1.06, 1.53)	1.07**	(1.02, 1.09)
3	1.27	(0.89, 1.75)	1.19**	(1.06, 1.31)	1.39**	(1.03, 1.76)	1.58**	(1.12, 2.64)	1.79**	(1.42, 2.31)	1.57**	(1.14, 2.34)
Total number of Prescriptions	1.05	(0.65, 1.46)	1.02	(0.89, 1.16)	1.42**	(1.18, 1.74)	1.06**	(1.02, 1.12)	1.61**	(1.29, 1.97)	1.11**	(1.04, 1.18)
Number of Outpatient visits	1.01	(0.79, 1.37)	1.36	(0.72, 2.43)	0.81*	(0.66, 0.98)	1.10	(0.88, 1.44)	0.57**	(0.32, 0.86)	0.47**	(0.38, 0.57)
Total expenditure	0.91	(0.64, 1.28)	0.99	(0.91, 1.08)	0.84	(0.63, 1.04)	0.91	(0.74, 1.13)	0.61	(0.21, 1.83)	0.76	(0.48, 1.19)

*p<0.05, Severity index: 1. No events, 2. 15 or more beta- agonist canisters or 1 or more filled prescriptions for oral corticosteroids, 3. Hospitalization or Emergency Department encounters

The study also performed Poisson regressions to find the association between the type of Medicaid payment mechanisms and the number of outpatient visits. Table 4 shows that the number of outpatient visit made by capitated plan enrollees were 52% lower than those on FFS (p<0.05). The number of outpatient visits made by female patients were 18% higher compared to male patients (p<0.05). African American and Hispanic patients (18% and 31% respectively, p<0.01) were less likely to visit the outpatient clinic than White patients.

When predictors of hospitalizations were examined, patients in capitated health plans were 34% more likely to be hospitalized than those in FFS (p<0.05). Hispanic children were 43% more likely to get hospitalized than White (p<0.05) children with asthma. Patients who had a higher medication possession rates were 18% less likely to be hospitalized (p<0.05). The patients who had a prior outpatient visit were 19% less likely to get hospitalized than those who had not (p<0.05).

Examining the frequency of hospitalization, patients enrolled in capitated plans were 52% more likely to be hospitalized compared to those with FFS. Hispanic children had been 9% more frequently hospitalized compared to White (p<0.05) children with asthma.

Patients who had a higher controller asthma drug ratio (the ratio of controller medication to total medications >0.5) were 41% less frequently hospitalized compared to those who did not ($p<0.05$). Patients who had a higher medication possession rates were 44% less frequently hospitalized ($p<0.05$). There were no significant effect of prior number of outpatient visits and total expenditures on the number of hospitalizations.

Results of logistic regression showed that asthmatic children enrolled in capitated health plans had 25% increased odds of emergency room visit when compared to those in FFS ($p<0.05$). Children who were in the age group 5-18 were 61% less likely to have an emergency room visit when compared to those between the ages 1-4 ($p<0.05$). African American and Hispanic children with asthma were (7% and 16% respectively, $p<0.05$) more likely to visit the ER than White children. Children with asthma who took more controller medication were 61% less likely to visit the ER department than those who took more reliever medications ($p<0.05$). Children with either prior event of hospitalizations or ER visits were 79% more likely to have ER visits in follow up period ($p<0.05$). Each additional prescription was associated with 61% increase in likelihood of emergency room visit ($p<0.05$).

Patients with capitated plans were 32% more likely to have ER visits compared to patients enrolled in FFS plan ($p<0.05$). African American and Hispanics had more (23% and 19%, respectively) frequent ER visits compared with White ($p<0.05$) children. Patients who had higher controller use (the ratio of controller medication to total medications >0.5) had 52% less frequent ER visits ($p<0.05$). Children with more severe conditions were more (7% and 57%, respectively) frequently seen in ERs ($p<0.05$). However, patients who had prior outpatient visits had 53% less frequent ER visits ($p<0.05$). There was no significant effect of total expenditure on the number of ER visits.

There was a significant difference in antiasthmatic medication adherence across different health plans. The cutoff for the medication possession rate (MPR) was 80%. At quantile of 80% MPR, compared to FFS plans, capitated plan enrollees had significantly lower medication adherence. Capitated plans provide fixed dollar amount per member per month for all pharmaceutical services, which limit the prescription drug benefits for capitated plan enrollees. These plans have caps where the plan enrollees get some benefits on the basis of a predictable level of total expenditure in a market where medication costs are increasing rapidly. Once the limit is reached, the plan enrollees have to bear out of pocket expenses for covering their pharmaceutical care[29].

Pediatric asthmatic patients enrolled in capitated plans were more likely to visit ED and be hospitalized compared to FFS plan enrollees. Some of the negative aspects associated with enrolling in capitated plans are under-treatment, substitution due to inadequate health service coverage, cost shifting to other services, and poor treatment provision[29-31]. Our study demonstrated that children enrolled in capitated plans had lower medication adherence compared to children enrolled in FFS plans which indicate that poor healthcare outcomes and excessive healthcare utilization might be associated with capitated plans. Even though capitated plans have some negative aspects, they motivate providers and health plan coordinators by providing direct financial incentives to manage utilization[32]. Alternatively, this might lead to limited patient follow-up or shorter treatment duration, driving lower medication adherence in capitated patients[29]. Higher medication adherence was associated with lower hospitalizations and ED visits in asthma patients. This shows the importance to maintain medication adherence in pediatric asthma patients.

There were several limitations for this study. First, the states from which the Medicaid sample was drawn from were not individually identified due to patient privacy reasons. Thus, the study could not explore how eligibility requirements could vary study outcomes across the states. Second, like most studies that use claims data, specific clinical information that is only available from patient chart review or electronic medical record was not obtainable. As such, data concerning physician adherence to guideline was incomplete, and patients' severity of asthma and health beliefs were not included. So, asthma severity scores in the pre-index period were used as a proxy for patient risk. Finally, administrative data could have suffered from data entry errors or omissions that could be difficult to detect or evaluate.

Further research is necessary to understand the reasons for the higher health care utilization but lower medication adherence for capitated plan enrolled children with asthma compared to similarly placed children in FFS plans. In particular, it is important to decide whether lower medication adherence for capitated plan enrolled asthmatic children influences

higher health care utilization (hospitalizations and ER visits) for the same services provided in the long run. Lower medication adherence could potentially have adverse outcomes related to health care utilization. Alternatively, fixed payments may provide less intensive lower quality services to capitated plan enrolled asthmatic children. Further research is needed to assess the quality of care delivered to asthmatic children and its relation to health outcomes in capitated plan enrolled children with asthma.

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Conflicts of interest:

There are no conflicts of interest.

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