

Epinephrine autoinjector prescription filling after pediatric emergency department discharge

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ABSTRACT

Background: There are known racial and socioeconomic disparities in the use of epinephrine autoinjectors (EAI) for anaphylaxis.

Objective: To measure the rates of EAI prescription filling and identify patient demographic factors associated with filling rates among patients discharged from the pediatric emergency department.

Methods: This was a retrospective observational cohort study of all patients discharged from a pediatric emergency department who received an outpatient prescription for an EAI between January 1, 2018, and October 31, 2019. The rates of prescription filling were calculated, and multivariable logistic regression was performed to identify sociodemographic factors associated with prescription filling.

Results: Of 717 patients included in the analysis, 54.8% (95% confidence interval [CI], 51.1%–58.5%) filled their prescription. There were no significant associations between EAI fill rates and patient age or sex. In bivariable analysis, non-Hispanic white patients were more likely to fill EAI prescriptions compared with non-Hispanic Black patients (odds ratio [OR] 1.89 [95% CI, 1.11–3.20]), and patients with in-state Medicaid were significantly less likely to fill EAI prescriptions compared with those patients with private insurance (OR 0.69 [95% CI, 0.48–0.98]). However, after multivariable adjustment, there was no significant difference in filling by age, insurance status, or race or ethnicity.

Conclusions: Only approximately half the patients had their EAI prescriptions filled after discharge. Filling rates did not vary by sociodemographic characteristics.

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Anaphylaxis is a rapid-onset, potentially life-threatening systemic allergic reaction.^{1,2} Immediate administration of intramuscular epinephrine can prevent mortality, hospitalization, and biphasic reactions.^{3–5} For these reasons, national and international guidelines recommend prescribing an epinephrine autoinjector (EAI) to any patient at increased risk for anaphylaxis^{6,7} and specify that all patients who have experienced an anaphylactic reaction should be provided an action plan, instructing them on how and when to administer epinephrine.⁸ Despite these recommendations, for a multitude of reasons, EAI are underused in the treatment of anaphylaxis.⁹

Socioeconomic status likely influences accessibility to EAI. Since 2007, the average wholesale price of the

EpiPen® (epinephrine injection, USP), the most commonly prescribed EAI, increased by 545% to approximately \$730 for a two-pack in 2016.¹⁰ Children from higher income households are more likely to be prescribed an EAI,¹¹ and children with private insurance are more likely to receive early epinephrine administration for anaphylaxis.¹² In addition to socioeconomic disparities, racial and ethnic disparities in anaphylaxis treatment also exist. Non-white children are less likely to receive early epinephrine administration.⁵

It is unclear if these disparities are attributable to prescribing practices, the lack of prescription filling, lack of EAI availability when needed, or lack of use when needed despite availability. The primary aim of this study was to measure the rates of EAI prescription filling and to determine if there are differences in the rate of filling of EAI prescriptions among patients of different socioeconomic characteristics discharged from the pediatric emergency department (ED) after a visit for anaphylaxis.

METHODS

Study Design and Population

This study was a retrospective observational cohort study of patients discharged after an emergency visit with an EAI prescription from either of two affiliated

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pediatric EDs: an academic urban pediatric ED with an annual census of 90,000 patient visits and a satellite urban free-standing pediatric ED with an additional 30,000 annual patient visits. In the study site, EAI prescriptions are prescribed exclusively for anaphylaxis or a history of anaphylaxis. We included data from patients who presented over a 22-month period from January 1, 2018, to October 31, 2019. Patients were excluded if they were not prescribed an EAI or if we could not determine their prescription fill status.

The EAI prescription fill status could be indeterminate because the patient received a handwritten prescription, had a prescription called into the pharmacy by telephone, or used a pharmacy that did not participate in using SureScripts (SureScripts, Arlington, VA) electronic prescribing (e-prescribing) during the study period. The institutional review board at Children's National Medical Center in Washington, D.C., approved this study (Pro00012908).

Data Collection

We collected patient demographic data, including age, sex, race, and insurance information from the electronic medical record (EMR) and determined prescription filling from an information technology company that works in conjunction with the EMR, SureScripts. SureScripts supports e-prescriptions, the electronic transmission of prescriptions between the EDs and pharmacies. As of 2018, >90% of pharmacies in the study region had the capability to receive e-prescriptions from SureScripts.

Data Analysis

The outcome of interest was filling of an EAI prescription after discharge from the ED. The variables of interest included the following patient characteristics: age, sex, race, ethnicity, and insurance type. We re-categorized race and ethnicity into a single variable: non-Hispanic white, Non-Hispanic Black, Hispanic, and other. Insurance status was categorized as commercial or Tricare, Medicaid-in-state, Medicaid-out-of-state, self-pay, and other/unknown. Patient age was treated as a continuous variable. We used IBM SPSS Statistics for Windows version 26 (SPSS Inc., Chicago, IL) to perform descriptive statistics and logistic regression to measure associations between prescription fill rates and demographic factors. We performed bivariable logistic regression to assess for differences in prescription filling by patient demographics and performed multivariable logistic regression to adjust for potential confounding by all covariables. Regression models were fitted to derive adjusted odds ratios (OR) with 95% confidence intervals (CI).

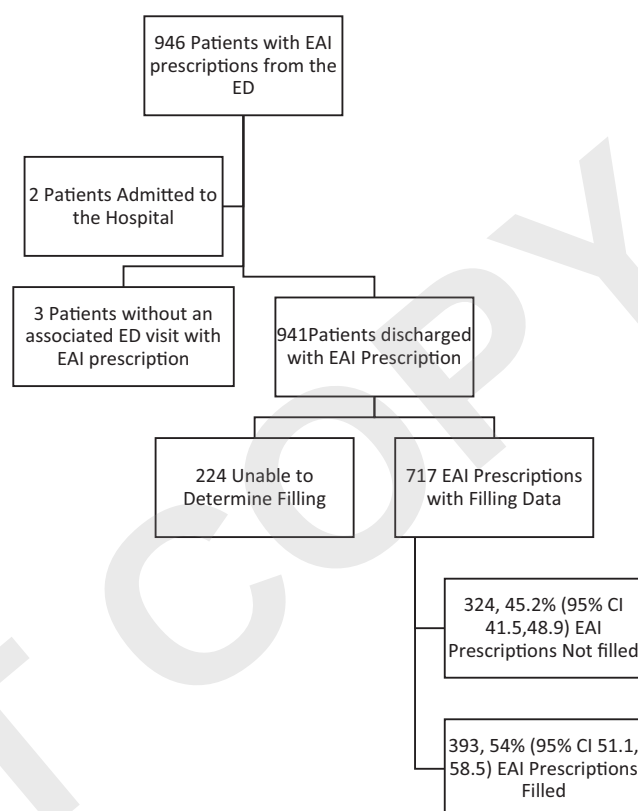


Figure 1. Included patients.

RESULTS

During the study period, there were 946 patient visits identified as having an EAI prescribed from the ED. Five visits were excluded because the EAI was not prescribed on ED discharge. Two of these patients were admitted to the hospital, and three additional patients were either prescribed EAIs from the ED during a non-visit encounter or were prescribed in error and discontinued before ED discharge. An additional 224 visits were excluded because we could not determine if the prescriptions were filled in SureScripts. The final analysis included 717 patients (Fig. 1). The mean $\pm$ standard deviation age of included patients was 8.1 ± 5.7 years. Approximately half of the patients were boys, 71% were non-Hispanic Black, and 60% had either in-state Medicaid or out-of-state Medicaid. Fifty-four percent (95% CI, 51.1–58.5) of EAI prescriptions were filled (Table 1).

There were no significant associations between EAI fill rates and patient age (mean difference 0.99 years [95% CI, 0.96–1.01 years]) or sex ($p = 0.82$). In the bivariate analysis, non-Hispanic white patients were more likely to fill EAI prescriptions compared with non-Hispanic Black patients (OR 1.89 [95% CI, 1.11–3.20]), and patients with in-state Medicaid were significantly less likely to fill EAI prescriptions compared with those patients with commercial or Tricare insurance (OR 0.69

Table 1 Patient demographics

	All Patients (N = 941)	All Patients with Known Filling Status (n = 717)	EAI Prescribed but Unable to Determine Filling Status (n = 224)
Age, mean $\pm$ SD, y	8.1 $\pm$ 5.5	8.1 $\pm$ 5.7	8.0 $\pm$ 5.1
Sex, n (%)			
Girls	428 (45.2)	328 (45.8)	96 (42.9)
Boys	518 (54.8)	389 (54.3)	128 (57.1)
Insurance type, n (%)			
Commercial or Tricare	274 (29.0)	211 (29.4)	63 (28.1)
Medicaid-in-state	395 (41.8)	317 (44.2)	76 (33.9)
Medicaid-out-of-state	173 (18.3)	115 (16.0)	56 (25.0)
Self-pay	45 (4.8)	27 (3.8)	18 (8.0)
Other or unknown	59 (6.2)	47 (6.6)	11 (4.9)
Race or ethnicity, n (%)			
Non-Hispanic Black	672 (71.0)	512 (71.4)	157 (70.0)
Non-Hispanic white	84 (8.9)	70 (9.8)	14 (6.3)
Hispanic	108 (11.4)	72 (10.0)	34 (15.2)
Other	82 (8.7)	63 (8.8)	19 (8.5)

Table 2 Prescription filling by race, age, and insurance type

	OR (95% CI)	aOR (95% CI)
Non-Hispanic Black (reference standard)		
Non-Hispanic white	1.89 (1.11–3.20)*	1.73 (0.96–3.15)
Hispanic	1.54 (0.93–2.56)	1.24 (0.96–0.73)
Other	1.16 (0.68–1.96)	1.05 (0.60–1.85)
Commercial or Tricare (reference standard)		
Medicaid in-state	0.69 (0.48–0.98)*	0.81 (0.54–1.21)
Medicaid out-of-state	1.42 (0.88–2.29)	1.57 (0.94–2.64)
Self-pay	0.56 (0.25–1.26)	0.62 (0.27–1.42)
Other or Unknown	0.67 (0.36–1.27)	0.75 (0.39–1.43)
Age (years)	0.99 (0.96–1.01)	1.0 (0.97–1.02)

OR = Odds ratio; CI = confidence interval; aOR = adjusted odds ratio.

*Represents statistical significance.

[95% CI, 0.48–0.98]). However, when adjusting for covariables, there was no significant difference in filling by insurance status or by race or ethnicity (Table 2).

DISCUSSION

In this cohort of pediatric ED visits, only approximately half of EAI prescriptions were filled after ED discharge. Non-Hispanic white children were more likely to have EAI prescriptions filled after an ED visit for anaphylaxis than non-Hispanic Black children, and patients with private insurance were more likely than patients with in-state Medicaid to have an EAI prescription filled. However, when adjusting for multiple variables, these differences were no longer significant.

The low EAI fill rate in this study was inconsistent with a previous study that estimated pediatric EAI fill rates closer to 90%; however, this study included only patients with private insurance.¹³ Similar to our population, previous large data base adult studies that included patients with a variety of pharmacy coverage found that approximately half of patients fill their EAI.¹⁴ It is likely that the EAI fill rate in our study was similar to that seen in adult data because of the diversity of insurance and/or socioeconomic status in our population. Although the insurance type may be a specific barrier to prescription filling, it may also be a marker for lower socioeconomic status, which can confer an independent risk factor for low filling rates if, for instance, pharmacies in low-income areas are less likely to carry

EAI or patients of lower socioeconomic status are less likely to have transportation to get to a pharmacy.

Identifying risk factors associated with poor rates of EAI prescription filling is imperative to create targeted strategies for improving them. The objective of this study was to identify predictors associated with EAI prescription filling. We found that, although non-Hispanic white patients had a higher fill rate compared with non-Hispanic Black patients and having in-state public insurance was associated with a lower fill rate than having private insurance, there was likely a concordance between being non-Hispanic Black and having public in-state insurance. This was consistent with the knowledge that minority children are significantly more likely to have public insurance compared with white children.¹⁵ Interestingly, patients with out-of-state Medicaid did not have the same risk of low fill rates as those patients with in-state Medicaid. This study was conducted in Washington, D.C., which is unique in that in-state Medicaid is restricted to District of Columbia residents and, therefore, encompasses an entirely urban population; whereas out-of-state Medicaid is likely to be held by patients who live in the Maryland and Virginia suburbs.

To address low fill rates of EAI prescriptions, further studies should be aimed at assessing to what extent disparities in filling are related to patient education, medication availability, and cost. This could be accomplished through a more comprehensive prospective survey study to determine specific barriers to filling. In addition to targeting interventions aimed at educating patients at risk for not filling EAI prescriptions, interventions aimed at improving EAI fill rates should consider changes to the system that is serving largely minority and publicly insured patients.¹⁶ For instance, providing an EAI on discharge from the ED as an alternative to providing a prescription or partnering with local pharmacies to determine availability may be beneficial.

Limitations

This study had several important limitations. Most importantly, this was a retrospective cohort, reliant on the EMR and e-prescribing records to obtain information. This resulted in a large number of excluded patient visits for which we could not determine prescription filling. In addition, patients in whom we could not determine EAI filling were slightly more likely to have out-of-state Medicaid or self-pay insurance and slightly more likely to be Hispanic. It is possible that this patient demographic was less likely to use e-prescribing or less likely to use pharmacies that participate in SureScripts, possibly because SureScripts is less common outside of the study region. This could create a selection bias, with a trend toward a lower reported EAI fill rate because this patient demographic is somewhat more likely to fill

EAI prescriptions. However, the overall number of these patients was small compared with the larger population.

We were also unable to determine if patients already had EAI at home or if they had previously, or after the ED visit, received a prescription from their primary care physician or another health care provider that they may have filled. Our sample size was limited by the capabilities of retrospectively reviewing data within SureScripts, which is only maintained temporarily, so it is possible that our sample size was not large enough to detect a statistically significant difference in demographic factors associated with prescription filling.

In addition, we were only able to collect a limited amount of data from the EMR and, therefore, had no first-hand knowledge as to the barriers to EAI filling. Furthermore, we did not determine the type of EAI prescribed and, therefore, were unable to determine if certain types of EAI were more likely to be filled or if they were to be filled by different mechanisms, *e.g.*, by mail. Also, the unique definition of Washington, D.C., as an urban district that lies outside of any state, lends itself to creating variables that might not be generalizable to the greater population.

CONCLUSION

In this cohort of pediatric patients prescribed an EAI on ED discharge from the pediatric ED, only approximately half of the patients had their EAI prescriptions filled. Further studies that examine predictors of EAI filling are needed to develop patient- and system-oriented strategies to improve prescription filling.

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