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Prescription fill patterns in underserved children with asthma receiving subspecialty care

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ABSTRACT

Background: Children with asthma receiving specialty care have been found to have improved asthma outcomes. However, these outcomes can be adversely affected by poor adherence with controller medications. **Objective:** To analyze pharmacy fill patterns as a measure of primary adherence in a group of underserved minority children receiving allergy subspecialty care.

Methods: As part of a larger 18-month nebulizer use study in underserved children (ages 2–8 years) with persistent asthma, 53 children were recruited from an urban allergy practice. Pharmacy records were compared with prescribing records for all asthma medications.

Results: Allergist controller prescriptions were written in 30-day quantities with refills and short-acting β -agonists (SABAs) with no refills. Only 49.1% of inhaled corticosteroid (ICS), 49.5% of combination ICS and long-acting β -agonist, and 64.5% of leukotriene modifier (LTM) initial and refill prescriptions were ever filled during the 18-month period. A mean of 5.1 refills (range, 0–14) for SABAs were obtained during 18 months, although only 1.28 SABA prescriptions were prescribed by the allergist. Mean times between first asthma prescription and actual filling were 30 days (range, 0–177 days) for ICSs, 26.6 days (range, 0–156 days) for LTM, and 16.8 days (range, 0–139 days) for SABAs.

Conclusion: Underserved children with asthma receiving allergy subspecialty care suboptimally filled controller prescriptions, yet filled abundant rescue medications from other prescribers. Limiting albuterol prescriptions to one canister without additional refills may provide an opportunity to monitor fill rates of both rescue and controller medications and provide education to patients about appropriate use of medications to improve adherence.

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Introduction

Asthma is the most common chronic disorder in pediatrics, affecting more than 1 of 10 children in Maryland¹ and as many as 1 of 5 children in Baltimore, Maryland.² The current asthma treatment guidelines recommend that persistent asthma should be treated as a chronic illness with daily inhaled steroid therapy rather than urgently, when exacerbations occur.³ Improved asthma outcomes are clearly related to asthma controller medication use.^{4–6} Adherence to controller asthma medication regimens is less than ideal, especially in underserved populations.^{7–9} Theories as to the causes of secondary or tertiary nonadherence are well represented in the literature. Primary nonadherence, or not obtaining or filling the medication as prescribed, is not well understood.

Adherence may be affected by many variables, including access to quality care,^{10–12} nonadherence to asthma guidelines by prescribing physicians,^{13–15} patient-physician relationships,¹⁶ cost of asthma medications,^{17–19} and patient- and caregiver-related medication preferences, beliefs or misconceptions.^{20–22} The purpose of this study is to evaluate primary nonadherence in underserved children with asthma cared for by an allergist by determining whether asthma medication prescriptions that are written are ever filled, whether prescriptions for controllers are refilled, and whether families deploy a “selective” filling pattern.

Methods

Data for this study were collected from a convenience sample of patients treated in an urban subspecialty allergy practice and enrolled in a nebulizer education intervention trial.²³ Briefly, the nebulizer study evaluated the effect of a nebulizer use–focused asthma education intervention on asthma outcomes in inner-city children 2 to 8 years old with persistent asthma. Children were defined as having persistent asthma based on national guideline³ criteria using caregiver-reported daytime and nighttime symptom

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frequency. The study was approved by the institutional review boards of The Johns Hopkins Medical Institution and the University of Maryland School of Medicine. Informed consent from all patients was obtained in writing before enrollment in the study. As part of the intervention trial, caregivers completed administered questionnaires at baseline and 6, 12, and 18 months. They were also asked to provide the names of all the pharmacies used in the year before the start of the study and during the 18-month study period. Pharmacy records were collected from every pharmacy identified by the child's caregiver at each data collection point as described previously.²⁴ Briefly, all pharmacies identified by the caregiver as used to fill their child's asthma medications were initially contacted via fax to request refill records. Those that did not respond to multiple fax requests were contacted by telephone. Pharmacy records were considered complete for a child if responses were obtained from all pharmacies identified by the caregiver. Only patients with complete pharmacy refill data were included in the analysis ($n = 53$).

Children with persistent asthma, who had complete pharmacy records, and who had at least one allergy subspecialty visit in the year before the start of the study were included in the analysis. Patients in the allergy practice were chosen because copies of all prescriptions written for the patients were kept in the medical record. Medical records were reviewed for the 53 patients to compare asthma medication prescriptions written during the study period and compared with asthma prescription fill patterns from pharmacy records. Data presented were collected during an 18-month period (182 days before baseline and 366 days after baseline) for each patient during the 3½-year study.

Medical records from patients seen in the pediatric allergy practice were reviewed for evidence of an asthma medication prescription (including number of refills) written either during a clinic visit or in response to a telephone call by the caregiver requesting asthma medication. Prescription fills from pharmacy records were categorized as subspecialty or other prescriber. Any prescription written by the allergy subspecialty and filled during the study period was considered a subspecialty prescription. Prescriptions filled with no corresponding subspecialty prescription in the medical record were considered to be other prescriber. Prescriptions documented in the allergy medical record with no refills that were subsequently refilled after the initial fill were considered to be in the other prescriber category.

Prescriptions that were documented in the allergy medical record but had no corresponding pharmacy record were considered never obtained or never filled. Total number of potential medication fills was determined for each drug class, including inhaled corticosteroids (ICS), leukotriene modifiers (LTM), ICS combined with long-acting β -agonist (ICS/LABA), short-acting β -agonist (SABA), and oral corticosteroids (OCS). The total number of potential fills included the initial prescription with number of refills documented in the allergy medical record. Thus, a medication written for an ICS medication with 5 refills would equal 6 potential medication fills. The time difference between when the prescription was written and when the prescription was filled was calculated by drug class (ICS, LTM, ICS/LABA, SABA, and OCS). All controller prescriptions written by the allergy subspecialist and documented in the allergy medical record were written in 30-day quantities with refills for all controller medications, and SABA prescriptions were written as single inhalers with no refills. For medications with documented refills, the time difference between the original prescription fill and subsequent refills was also calculated.

Results

Overall, 53 of 55 children receiving allergy care in the nebulizer study were enrolled. Two children were not included because of missing pharmacy data. No significant differences were found in

baseline characteristics between the 2 children who were excluded and the overall study group. Children had a mean age of 4.6 years (range, 2–8 years) and were primarily male (53%), African American (81%), and Medicaid insured (72%). All patients had persistent asthma, with a mean of 2.7 (range, 1–7) subspecialty visits during the 18-month study period. As indicated in Table 1, at baseline, this population did not have well-controlled asthma (eligibility criteria for the study), with frequent daytime and nighttime symptoms, almost half with activity limitation, and nearly 30% with an emergency department visit in the previous 6 months.

According to the allergy medical records, there were a total of 204 initial prescriptions for the 53 patients generated by the allergy subspecialty practice during the 18-month study period. Almost 30% and 7.3% of prescriptions written by the allergy practice were for LTMs ($n = 61$) and ICSs/LABAs ($n = 15$), respectively. The percentage of total prescriptions written by the allergy practice for rescue medications was 22.5% ($n = 46$) for SABAs and 2.4% ($n = 15$) for OCSs. Only 3 prescriptions were written for salmeterol, and these were not included in the analysis because of low prescribing in this young population. Of note, Maryland Medicaid only allows for dispensing of 30-day quantities of medication at a time.

Overall, 59 of 204 (28.9%) of the initial prescriptions documented in the allergy medical records were never filled according to the pharmacy records. Unfilled prescriptions by type of medication are listed in Table 2, indicating that 21 of 67 ICS prescriptions (31.3%), 13 of 61 LTM prescriptions (21.3%), 6 of 15 ICS/LABA prescriptions (40.0%), 13 of 46 SABA prescriptions (28.3%), and 6 of 15 OCS prescriptions (40.0%) were never filled. For all filled prescriptions, the mean number of days between the date the prescription was written and filled by drug was as follows: ICS, 30 days (range, 0–177 days); LTM, 26.6 days (range, 0–156 days); ICS/LABA, 37.3 days (range, 0–147 days); SABA, 16.8 days (range, 0–139 days); and OCS, 37.5 days (range, 0–157 days). For medications that were filled and refilled at least once, the mean number of days between date of refill availability (day 1) and date of refill was as follows: ICS, 91.29 days (range, 1–432 days); LTM, 65.2 days (range, 1–350 days); ICS/LABA, 63.8 days (range, 12–226 days); SABA, 92.42 days (range, 1–350 days); and OCS, 104.96 days (range, 2–400 days).

Of the prescriptions documented in the allergy record, including all of the initial and refills for each of the medications, there were 965 potential medication fill opportunities for asthma medications. As shown in Figure 1, ICS and ICS/LABA prescriptions were filled at rates less than 50% (ICS: 403 total potential medication fill opportunities, $n = 198$ filled [49.1%]; ICS/LABA: 99 potential fill opportunities, $n = 49$ filled [49.5%]). For LTMs, the percentage filled was higher (380 potential fills, $n = 245$ filled [64.5%]). For the SABA medications, there were 68 potential medication fills available through allergy subspecialty and 269 were filled. For OCSs, there were 15 potential medication fill opportunities and 101 were filled. Almost every patient (94.3%) had at least 1 SABA prescription filled, yet only 28 of 53 patients (52.8%) had prescriptions documented in the allergy medical records for SABAs. Patients averaged 5.1 fills (range, 0–14) of SABA prescriptions during the study period even though only a mean of 1.28 (range, 0–8) SABA prescriptions were generated by the allergy subspecialty practice during the 18-month

Table 1
Study population baseline characteristics

Characteristic	Patients, % ($n = 53$)
Daytime asthma symptoms >2 times per week	36.7
Nighttime asthma symptoms >2 times per month	40.8
Activity limitation due to asthma	47.0
Hospitalization in the prior 6 months	4.0
ED visit in the prior 6 months	28.6

Abbreviation: ED, emergency department.

Table 2

Medication prescriptions written by allergist and fill patterns of underserved children with asthma

Prescription	Initial prescriptions written by allergist, No. (%) (n = 204)	Initial prescriptions written by allergist that were never filled, No. (%)	Time between prescription written and first fill, mean (range), days	Time between refills, mean (range), days
Inhaled corticosteroids	67 (32.8)	21/67 (31.3)	30 (0-177)	91.3 (1-432)
Leukotriene modifiers	61 (29.9)	13/61 (21.3)	26.6 (0-156)	65.2 (1-350)
Short-acting β -agonists	46 (22.5)	13/46 (28.3)	16.8 (0-139)	92.4 (1-350)
Oral corticosteroids	15 (2.4)	6/15 (40.0)	37.5 (0-157)	105.0 (2-400)
Combination of inhaled corticosteroids and long-acting β -agonists	15 (7.3)	6/15 (40.4)	37.3 (0-147)	63.8 (12-226)

study period. For OCS, 81.5% of patients filled at least one prescription for OCS during the 18-month study period, although only 28.3% were documented in the allergy medical records. Patients averaged 1.9 fills (range, 0-8) of OCS prescriptions, although only 0.8 (range, 0-2) were documented in the allergy medical records.

Discussion

Medicaid insured children with asthma have high asthma-related morbidity and mortality, and low adherence with controller medication therapy significantly affects asthma control.^{5,6,9} Strikingly, in our sample of Medicaid insured children with poorly controlled asthma seen by an allergy subspecialist during an 18-month study period, nearly 30% of all prescriptions written by an allergist were never filled. Higher rates of primary nonadherence (up to 40%) for controller medication prescriptions in this high-risk study population were detected. Poor adherence has been reported in other Medicaid population studies of children with asthma; however, studies investigating primary nonadherence in this population are limited.^{7,25–27} Riekert et al²⁶ studied primary nonadherence of controller medication in underserved children with asthma by comparing self-reported data from the caregivers of the children with the child's primary care practitioner self-report of prescribing. The study found that 38% of caregivers denied that their child had been prescribed a controller medication when the primary care practitioner claimed one had been prescribed. Bronstein et al²⁵ reported that 30% of prescriptions noted in the medical record of asthma patients did not have a corresponding Medicaid claim, although the study did not specifically investigate specialty care provider claims. Watts et al²⁸

reported only 30% of the asthma medication prescriptions written by a primary care physician were actually filled during a 6-month study period, with higher rates of primary nonadherence in patients from lower socioeconomic background.²⁸ Studies of non-Medicaid populations have found much higher rates of primary adherence.^{29,30} For example, Williams et al²⁹ reported that 92% of patients with asthma from a large Michigan health maintenance organization database filled their ICS prescription. However, details were not included in the article regarding specific fill rates for children 1 to 9 years of age, and the population did not include underserved children. Studies specifically evaluating patients cared for by asthma subspecialists are limited. Sherman et al³¹ collected fill data from pharmacies for 116 Medicaid insured children followed up in a pulmonology practice and compared it with medical records. They reported a mean of 61.4% of patients prescribed ICS were 50% or more adherent with therapy.³¹ Details were not provided to determine how many patients never filled their ICS prescription. Similar published studies in patients receiving allergy subspecialty care could not be found.

Despite access to specialty asthma care that focused on prescribing and teaching appropriate medication use, few patients had appropriate asthma medication fill rates during the period of the study. The high rate of nonadherence with controller medications in underserved populations is alarming and may be explained by multiple barriers that these families encounter, such as Medicaid formulary limitations, access to pharmacies, and other socioeconomic stressors competing with obtaining medications. Additional factors that may affect adherence in this population include misunderstanding or distrust of the medical professionals regarding the asthma diagnosis and treatment and health care or cultural beliefs that question the need for preventive treatment. Parental concern regarding use of ICSs was investigated in the nebulizer study and was not found to affect prescription fill rates.²³ Although our observational study was not designed to investigate the effect of interventions on primary adherence, development of more culturally sensitive educational materials that address some of these concerns may lead to improved adherence in this population.

Because all patients in our study were classified with persistent asthma, based on National Asthma Education and Prevention Program (NAEPP) guidelines,³ their preventive care should include use of a daily controller medication. Although all patients were prescribed controller medications by the allergy subspecialist, fill rates for this high-risk population were poor.

On the other hand, in our study population only 28.3% of the OCS prescriptions filled by the study participants were prescribed by the allergy subspecialist. Thus, most participants received OCSs from other health care professionals, which is not surprising because patients are more likely to see their primary care physician or urgent care site than their asthma specialist for acute exacerbations. More important is the high rate of SABA use noted in this population. During the 18-month study period, participants received a mean of 5.1 fills of SABA prescriptions (510 doses for 547 days) or one dose every 1.07 days. These data indicate that most of the

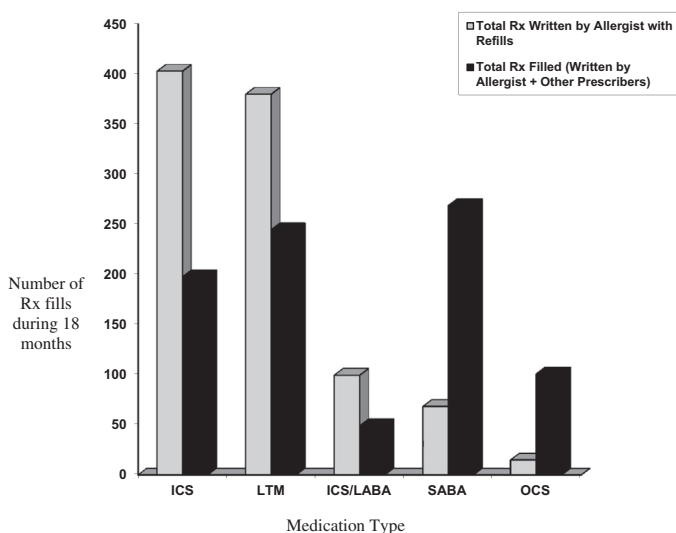


Figure 1. Number of prescriptions written by an allergist (initial and refills) vs prescriptions filled in underserved children with asthma.

patients were not well controlled, which was in fact required for study eligibility. As important, 80% of the rescue medication was provided by “other health care providers.” Other pharmacy refill studies of similar underserved populations have found a high rate of rescue β -agonist fills and a low rate of controller medication fills with a negative effect on asthma control.^{8,18,32} One hypothesized scenario based on a prior study is that patients may receive “long-term” β -agonist refills or refills over the telephone without the knowledge of the physician.³³ Our study suggests that specialty and nonspecialty physicians should limit refills for rescue medications. If rescue inhalers are used at a rate of more than 1 inhaler equivalent every 6 months, controller therapy should be added or stepped up. Requiring patients to call for additional rescue medication refills also allows for an opportunity to reinforce the preventive management plan with the patient or advise the patient to attend clinic to reassess their asthma status. Not prescribing additional refills for rescue medication without evaluating the patient allows the physician to determine whether the level of therapy is maintaining adequate control, with rescue β -agonist requirement as a key component of that assessment. Pharmacists may also play a role in tracking overuse of β -agonists by notifying physicians when patients require more than 2 rescue inhalers per year.

Cost of medications is one of the many factors that may affect primary nonadherence.^{18,19} However, at the time these data were collected, a copayment fee was not required by the Medicaid system for any of the asthma medications. Furthermore, at that time most medications did not require prior authorization for access to ICSs or LTMs, so neither cost nor preauthorization should have contributed to nonadherence for this population.

Jones et al³⁴ found a difference in fill rates for types of controller medications in their study of a large population of children and adults with asthma with primary adherence of 67.7% for LTMs and 33.8% for ICSs. They suggested that a potential “aversion” to inhaled steroids was driving this type of filling pattern. Our study did not support a difference in ICS vs LTM fills for those filling their initial controller prescription, with 67.7% filling the first prescription for ICS and 77.7% filling for LTM.

Poor fill rates for controller medications and overfilling of β -agonist medications may explain the high morbidity detected in this underserved population. Without appropriate asthma medication use per national guidelines (NAEPP),³ these children will continue to have increased morbidity and, ultimately, higher cost of care.³⁵

Our study used pharmacy fill data as a measure of adherence but cannot account for drug wasting by the patient, actual use of the medication, poor technique in administration of drug, drug sharing, and drug loss. If a family did not identify a pharmacy, prescriptions that were actually filled would have been missed and be considered “written but not filled.” However, previous studies, including our prior data, have determined that pharmacy claims data correlate well with Medicaid claims and medical record data in this population.^{31,36}

We could not directly correlate the prescriptions written by the allergy subspecialist vs those written by nonspecialist practitioners because pharmacy records did not include information about the prescribing practitioner. Therefore, our controller medication fill rates for prescriptions written by the allergists may be overestimated. However, at best, the rate remains low. Medical assistance prescriptions are technically only valid for filling for 60 days after the date of the prescriptions.³⁷ Because the ranges for time to fill a prescription varied from 0 to 177 days, it could be estimated that the percentage of allergy subspecialist prescriptions never filled by class could be higher than what we report. Finally, this group of Medicaid insured patients receiving allergy subspecialty services may not be representative of the population because to be eligible for the study the patients had to have asthma that was not

well controlled. We did not have access to pharmacy data for ineligible patients (ie, those with better controlled asthma) from the practice for comparison.

Our study demonstrates that underserved children with poorly controlled asthma receiving allergy subspecialty care suboptimally fill controller medications and overfill rescue albuterol medications written by other practitioners. Pharmacy records are a rich source of data to assess medication adherence and are a basis for practicing guideline-based care. Our study suggests that keeping paper or electronic copies of prescriptions in the medical record or practice site is useful to track adherence. Limiting short-acting β -agonist refills and requiring parents to contact their child's health care practitioner for additional rescue medication refills may allow an opportunity to address adherence with preventive asthma medications and improve asthma control. Incorporating tracking and notification procedures by pharmacies and/or insurance companies to make health care practitioners and caregivers of children with asthma aware of the inadequate use of controller medications and overuse of rescue medications may improve asthma control in these high-risk children.

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