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Pattern of Medication Use in Children with Very Poorly Controlled Asthma

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Among the 8 million U.S. children with asthma, approximately 50% experience an acute exacerbation each year.¹ Recurrent emergency department (ED) visits and hospital admissions often result from poorly controlled asthma. National and International guidelines advise that the goal of asthma management is to achieve well-controlled (WC) asthma.^{2,3} Yet, approximately 50% of adult and pediatric patients with asthma remain not well or very poorly controlled.⁴ Achieving WC asthma requires adept use of stepwise therapy and sufficient provider time for patient counseling to implement step-up and step-down therapy.⁵ Missed opportunities to adjust medications and provide appropriate medication instructions in acute care settings may also contribute to very poorly controlled (VPC) asthma. Further, asthma guidelines recommend specialty care for children with VPC asthma, yet specialty care is often underutilized in low-income minority children.⁶ Our study aims to examine patterns of asthma medication fills in low-income minority children by level of asthma control defined as Well Controlled (WC), Not Well Controlled (NWC) or VPC and determine factors associated with VPC asthma.

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Conflicts of interest: none

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Health and pharmacy record data were examined for children with persistent asthma, aged 3–12 years and enrolled in a randomized controlled trial testing the efficacy of an ED/ home behavioral environmental control intervention.⁷ Sociodemographic, asthma history including atopic, family and environmental exposure histories, healthcare utilization and caregiver medication use beliefs were obtained from interviews and electronic medical record review. Pharmacy records included the dispensing date, product name, strength, dosage form, and quantity dispensed. Subjects were tested for indoor and outdoor specific IgE allergens using serum tested by ImmunoCap® and second hand smoke exposure using salivary cotinine tests. Asthma control and severity measures were based on The Asthma Control Test.⁸ Institutional Review Boards of two large urban universities approved the study protocol; written informed consent was obtained from each child's caregiver/legal guardian.

Rescue medications were defined as short-acting beta-agonist (SABA) and controller medication therapy was categorized as none, monotherapy (inhaled corticosteroid [ICS] only) or leukotriene receptor antagonist [LTRA] only) or combination therapy (ICS + long acting beta agonist (LABA) or ICS + LTRA). The asthma medication ratio (AMR) was calculated at baseline for the medications filled in the prior 12 months.⁹ Caregiver concern over side effects of asthma medication was ascertained by asking, "How worried or concerned were you about your child's asthma medications and side effects?" Baseline asthma control was either NWC or VPC. At 12 months, all baseline VPC children were categorized as improved (WC/NWC) or non-improved (VPC). Mean number of asthma medication prescription fills for each type of medication were assessed over 12 months and by level of control. Odds of VPC asthma control relative to reference category across variables were examined based on generalized linear models (GLM) analyses with specification of binomial distribution using SPSS Version 22 software.

Overall, children were primarily male (65%), African American (94%), Medicaid insured (94%), low income (71%) with a mean age of 6.4 (SD 2.7) years. At baseline, over half of children (55%) were categorized with VPC asthma and most (74%) were atopic (1 positive environmental allergen tested). Over half (54%) tested positive for SHS exposure. Few children (22%) reported care by an asthma specialist. Asthma medication fills were low prior to baseline, i.e. number of controller medication fills/past 12 months had a median of 2 fills/12 months. AMRs corroborated low controller medication use with AMR < 0.50 in more than half of children (57%). SABA fills were high with 40% filling four or more prescriptions over the prior 12 months. Further, over one-third of caregivers reported they worried about asthma medication side effects.

At 12 months, just over half (54%) of the children categorized as VPC at baseline improved to WC/NWC and 46% remained as VPC (non-improved). As shown in Table 1, over 1 out of 4 non-improved VPC children had either no asthma medication or SABA only (Step 1 therapy) fills over the 12 months. Overall, the improved group (WC/NWC) had a higher percentage (51.7%) of Steps 4 or higher fills, such as SABA+ ICS + LTRA Combo, than the non-improved VPC group (33.3%). However, this difference was not statistically significant (p=0.11). Children seen by an asthma specialist over the past 2 years had significantly higher rates of combination therapy (52.1%) versus mono-therapy (25.5%) within the past 3 months versus children with no specialty care (p<0.001). Caregiver worry about asthma medication

side effects nearly doubled the odds of remaining VPC at 12 months (OR: 1.83, 95% CI: 0.99, 3.40, $p=0.05$).

Several factors were associated with appropriate step-up therapy in our data. Receipt of asthma specialty care was associated with a medication regimen of combination or higher step-wise therapy. Yet, specialty care in our study sample did not independently relate to VPC at 12 months ($p = 0.17$) and was underutilized (22%); comparable to low rates of specialty care noted in studies of low income and Medicaid insured children.⁷ Caregivers who reported worry about medication side effects were twice as likely to have children with VPC asthma than caregivers did not worry about side effects, consistent with prior studies.¹⁰ In an actual comparison of steroid exposure using a daily, low-dose inhaled fluticasone lung exposure for a full year (i.e., 44 mcg at 2 puffs at twice a day for 1 year = 64.24 mg) versus a 5 day course of oral systemic steroid (60 mg prednisone x 5 days = 300 mg) demonstrates the significantly lower corticosteroid exposure in patients treated with low-dose inhaled corticosteroids.⁷ Caregiver communication about the difference between regular use of inhaled corticosteroids versus rescue oral steroid exposure and the effectiveness of daily inhaled corticosteroid use in preventing acute exacerbations may motivate caregivers to administer daily inhaled corticosteroids rather than rely on intermittent oral steroid courses..

In summary, a substantial number of young children continue to have VPC asthma, despite contact with the medical community. Further, many did not receive guideline-based stepwise therapy. Receipt of asthma specialty care and addressing caregiver worry about medication side effects should be major considerations for children with VPC asthma.

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Table 1.

Very Poorly Controlled (VPC) at baseline (n= 111): Pattern of asthma medication fills in the post 12 month period based status of asthma control at 12 months (Improved vs. Non-improved). Unadjusted.

	Asthma control status @ 12 months			P-value ^a
	Overall	WC/NWC Improved	VPC Non-improved	
	N=111	N=60	N=51	
Post 12 month period:				P=0.11
1. No medication	13.5%	13.3%	13.7%	
2. SABA only (Step 1)	6.3%	1.7%	11.8%	
3. SABA + ICS only (Step2)	27.0%	21.7%	33.3%	
4. SABA + ICS + Combo ^b (Step 3)	6.3%	8.3%	3.9%	
5. SABA + LTRA + Combo (Step 3)	1.8%	1.7%	2.0%	
6. SABA + LTRA only (Step 3)	4.5%	5.0%	3.9%	
7. SABA + ICS + LTRA (Step 3)	25.2%	30.0%	19.6%	
8. SABA + ICS + LTRA + Combo (Step 4)	11.7%	15.0%	7.8%	
9. Controllers only	3.6%	3.3%	3.9%	

^aP-value based on Chi-square test and collapsed categories 5–8 (LTRA included in therapy) [i.e. 6 categories]

^b 5 patients had Combo only listed with SABA (not ICS as additional separate medication during year)