

## Original Article

# Very Poorly Controlled Asthma in Urban Minority Children: Lessons Learned

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**What is already known about this topic?** Very poorly controlled (VPC) asthma is associated with a higher risk of future asthma exacerbations and increased health care utilization. However, specific sociodemographic and health characteristics have been understudied as risk factors of VPC asthma.

**What does this article add to our knowledge?** Although children with VPC asthma may have increased acute and primary health care visits, this increased utilization does not translate into well-controlled asthma. Identifying and treating allergic comorbidities, addressing caregiver medication beliefs, and adept use of stepwise therapy are all indicated for treating children with VPC asthma.

**How does this study impact current management guidelines?** Identifying allergen sensitization and environmental exposures informs treatment decisions including stepwise therapy. Stepwise therapy may be underused in the acute and primary care settings and should be implemented for children with atopic asthma. Timing of step-up and step-down therapy is complex in managing children with VPC asthma.

**BACKGROUND:** Very poorly controlled (VPC) asthma in children is associated with ongoing acute exacerbations but factors associated with VPC are understudied.

**OBJECTIVE:** To examine the risk factors associated with VPC asthma in urban minority children.

**METHODS:** This descriptive study examined asthma control levels (well-controlled [WC], not well-controlled [NWC], and VPC) at baseline and 6 months in children participating in an ongoing randomized controlled trial of an emergency department/home environmental control intervention. Data collection occurred during the index emergency department visit and included allergen-specific IgE and salivary cotinine testing and caregiver interview of sociodemographic and child health

characteristics. Follow-up data were collected at 6 months. Unadjusted analyses examined the association of sociodemographic and health characteristics by level of asthma control. Multivariate analysis tested significant factors associated with VPC asthma at 6 months.

**RESULTS:** At baseline most children were categorized with VPC asthma (WC, 0%; NWC, 47%; VPC, 53%) and rates of VPC minimally improved at 6 months (WC, 13%; NWC, 41%; VPC, 46%). Risk for VPC asthma was twice as likely in children with allergic rhinitis (odds ratio [OR], 2.42), having 2 or more primary care provider asthma visits within the past 3 months (OR, 2.77), or caregiver worry about medication side effects (OR, 2.13) and 3 to 4 times more likely when asthma control

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**Abbreviations used**

AR- Allergic rhinitis

ED- Emergency department

ICU- Intensive care unit

NAEPP- National Asthma Education and Prevention Program

NWC- Not well-controlled

OR- Odds ratio

PCP- Primary care provider

SHS- Second-hand smoke

VPC- Very poorly controlled

WC- Well-controlled

was assessed during the fall or spring season (OR: fall, 3.32; spring, 4.14).

**CONCLUSIONS: Improving asthma control in low-income, high-risk children with VPC asthma requires treatment of comorbidities, attention to caregiver medication beliefs, and adept use of stepwise therapy.** © 2017 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2017; ■:■-■)

**Key words:** Asthma control; Very poorly controlled asthma; Stepwise therapy; Children

Among the 8 million US children with asthma, approximately 50% experience an acute asthma exacerbation each year<sup>1</sup> representing uncontrolled asthma.<sup>2</sup> Not only is uncontrolled asthma associated with increased emergency department (ED) visits<sup>3</sup> and unscheduled medical visits,<sup>4</sup> but it also places a considerable burden on the child and family.<sup>5</sup> The primary goal of asthma management is to achieve well-controlled (WC) asthma. The National Asthma Education and Prevention Program (NAEPP) guidelines present recommendations to achieve WC asthma based on frequency of symptoms and short-acting  $\beta_2$  agonist use, child activity limitation, and the number of ED visits and hospitalizations.<sup>2</sup> Despite these guidelines, approximately 50% of adult and pediatric patients with asthma remain not well controlled or poorly controlled.<sup>6</sup>

The heterogeneity of childhood asthma manifests with varied symptom profiles including age at onset, atopy, comorbidities, and response to therapy, creating specific asthma phenotypes.<sup>7</sup> Recognizing these phenotypes can inform the specifics of treatment decisions such as stepwise therapy (altering the dosage of medication and/or adding other medications) to achieve WC asthma. A “very poorly controlled asthma (VPC) phenotype” has been described<sup>8</sup>; however, the risk factors associated with this phenotype and the characteristics of children more susceptible to VPC asthma are not well understood.<sup>9</sup>

Risk factors that may be related to VPC or not well-controlled (NWC) asthma include exposure to indoor allergens, respiratory infections and second-hand smoke (SHS),<sup>10</sup> comorbid allergic rhinitis (AR)<sup>11</sup> or eczema,<sup>12</sup> improper medication delivery device technique, poor adherence to medication, parental misperception of their child’s level of asthma control,<sup>13</sup> and parental beliefs about asthma medications. In particular, SHS is associated with a dose-related increase in cysteinyl leukotriene production that triggers contractile and inflammatory airway responses.<sup>14</sup> Nasal secretions occurring with AR expose the lower respiratory tract to allergic and/or infectious secretions that release systemic mediators leading to airway inflammation.<sup>15,16</sup> Poor adherence to or

improper delivery of controller medication can lead to insufficient medication delivered to the airways.<sup>17,18</sup> Caregiver stressors, that is, poverty, violence exposure, poor housing, and low caregiver quality of life, are associated with poor asthma control.<sup>4,5,19,20</sup>

However, specific sociodemographic and clinical risk factors for children with VPC asthma are often not recognized by clinicians treating children with asthma.<sup>3</sup> The goals of this descriptive study were (1) to examine change in asthma control levels (WC, NWC, or VPC asthma) over 6 months and (2) to explore factors associated with VPC asthma in urban minority children with persistent asthma and frequent asthma ED visits.

## METHODS

### Design and study setting

This descriptive study was a subanalysis of data obtained from an ongoing randomized controlled trial testing the efficacy of an ED/home-based environmental control intervention in young inner-city children who had frequent ED visits for asthma.<sup>21</sup> Families of children aged 3 to 12 years were recruited and enrolled during an asthma ED visit from August 2013 through February 2016. Inclusion criteria were physician-diagnosed persistent and uncontrolled (NWC or VPC) asthma based on current national asthma guidelines,<sup>2</sup> having 2 or more ED asthma visits or 1 or more hospitalization over the past 12 months, and residing in the Baltimore metropolitan area. Children were excluded if they had significant other nonasthma respiratory conditions, that is, cystic fibrosis. The study is registered with ClinicalTrials.gov (NCT01981564) and was approved by The Johns Hopkins Medical Institutional and the University of Maryland institutional review boards. Written informed consent was obtained from each child’s primary caregiver/legal guardian and all children older than 8 years provided verbal assent to participate. Out of the 554 child/caregivers screened for study enrollment (Figure 1), 215 caregivers declined to participate and another 117 children were ineligible for enrollment, resulting in the enrollment of 222 children into the study. Study attrition was minimal, with 95% of participants retained at 6 months. During the index ED visit, all children received serum allergen-specific IgE serologic tests measured by fluorescent enzyme immunoassay to identify allergen sensitization to common environmental allergens and salivary cotinine measurement to screen for exposure to SHS. Baseline and 6-month surveys were administered by a trained research assistant using the REDCap web-based application. Families received \$30.00 for completing each survey.

### Description of interventions

Children assigned to the ED/home-based environmental control intervention received (1) a medical follow-up visit in the ED and within 7 days of asthma index ED visit, (2) 2 home nurse visits for targeted environmental control education based on positive IgE results, (3) a brief motivational interview for caregivers of children with positive cotinine levels (>1.0 ng/mL) to implement a total home smoking ban, and (4) assistance scheduling follow-up asthma care with the child’s primary care provider (PCP). The control group children and their caregivers received 3 home nurse visits to provide asthma education regarding guideline-based medication use (rescue vs controller medication), standard environmental trigger avoidance information, and assistance in scheduling a follow-up asthma visit with the child’s PCP.

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