Point of Care Spirometry Assessment for Pediatric Asthma Prevalence in a Family Homeless Shelter in Omaha, Nebraska

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Abstract

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Methods: We obtained a voluntary parent-child assessment of the child’s respiratory history and an Asthma Control Test (ACT) between ages 4-18 for children residing at the family-homeless shelter. We obtained a pre-albuterol and post-albuterol mobile spirometer assessment using the Global Initiative for Asthma (GINA) guidelines. If spirometry failed, peak-flow measurements were obtained per Global Initiative for Asthma (GINA) guidelines.

Results: Nine of 25 children had active reversible airways (36%, Confidence Intervals 22-66%). One-third had a previous asthma diagnosis, 20% post-peak-flow reversibility. Six of seven follow-up appointments did not show up.

Conclusion: Pediatric asthma in an Omaha homeless shelter mirrors shelters in other major US cities like New York City and Minneapolis. This study may suggest that using the Asthma Control Test with pre-albuterol and post-albuterol peak flow measurements is an acceptable screening method for pediatric asthma in family-homeless shelters.

Abbreviations: Open Door Mission (ODM), Asthma Control Test (ACT), Global Initiative for Asthma (GINA), United States (US), pulmonary function tests (PFT), New York City (NYC), peak expiratory flow (PEF).

Keywords
asthma, pediatric, homeless, shelter, spirometry, peak flow meter, GINA

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Point of Care Spirometry Assessment for Pediatric Asthma Prevalence in a Family Homeless Shelter in Omaha, Nebraska
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Abstract

Introduction: The few studies on pediatric asthma in U.S. homeless shelters describe a 27.9 – 39.8% prevalence, and historically Omaha has had a high incidence of fatal pediatric asthma. Thereby, Clarkson Family Medicine (CFM) residency began a pediatric asthma outreach to a local family-homeless shelter to assess the prevalence of pediatric asthma and follow-up appointment attendance.

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Results: Nine of 25 children had active reversible airways (36%, Confidence Intervals 22-66%). One-third had a previous asthma diagnosis, >25% had asthma medications, only one teenager provided reliable spirometer results. Seven provided peak-flows only, with five >20% post-peak-flow reversibility. Six of seven follow-up appointments did not show up.

Conclusion: Pediatric asthma in an Omaha homeless shelter mirrors shelters in other major U.S. cities like New York City and Minneapolis. This study may suggest that using the Asthma Control Test with pre-albuterol and post-albuterol peak flow measurements is an acceptable screening method for pediatric asthma in family-homeless shelters.

Introduction

In the U.S., asthma prevalence among children age 17 years old and younger is 6.1 million cases.1 Asthma is the most common chronic disease of youth living below the poverty line.2 Disease burden and mortality due to asthma are higher in patients with low socioeconomic status than counterparts with a high socioeconomic index.3 Children from families without insurance, low education levels, and lower median income were more likely to access emergency medical services for asthma exacerbations.4 Homeownership was associated with a lower number of emergency department visits.5 Low housing quality was associated with increased asthma morbidity.6

Studies performed in various parts of the world have shown an increased prevalence of pediatric asthma among homeless shelter guests compared to reference populations. Investigators in Paris, France, surveyed asthma-like symptoms in homeless children. They found that 19.6% of those children had asthma-like symptoms, and poor sanitation was directly associated with those symptoms.4 Pediatric asthma prevalence was three times the national average in a Minneapolis shelter.7 These children were more likely to be hospitalized for asthma exacerbation.8 In New York City, between 1998 and 1999, 39.8% of homeless children were found to likely have asthma.8

The purpose of our study was to identify the prevalence of pediatric asthma at a transitional-emergency (homeless) shelter in Omaha, Nebr. Prior studies have not used in-shelter spirometry assessments to determine if a child has asthma. This study used a mobile spirometer and peak flow meters to assess airway reversibility.

Methods

The Clarkson Family Medicine residency program obtained Institutional Review Board approval through the University of Nebraska Medical Center. A faculty member oversaw the assessments by residents and medical students. The study took place at the Open Door Mission, a homeless shelter in Omaha, Nebraska. Twenty-five children living at the Open Door Mission between the ages of 4 and 18 enrolled in the study. Consent was obtained by the child’s guardian. Data collection started on 12/15/2018 and ended on 12/02/2019. The study was stopped due to the COVID-19 pandemic.

Asthma screening clinics occurred biweekly throughout the study. All children were recruited on a walk-in basis. The asthma screening clinic was promoted by making calls over an intercom and hanging flyers in common spaces within the shelter. No appointments were made before the clinic.

The diagnosis of asthma was made by screening for symptoms with the Asthma Control Test, then testing for reversibility. Age and language-appropriate versions of the Asthma Control Test (ACT) were administered. If the child scored a 19 or lower on the ACT, we proceeded with pre-albuterol and post-albuterol pulmonary function tests (PFT) with a portable spirometer. The portable spirometer used was Easy One Air spirometer made by New Diagnostic Design. A $500 grant provided disposable supplies such as spirometer mouthpieces and nebulizer tubing.

PFTs with equal to or greater than 12% or 200mL reversibility in the post-albuterol study were considered significant to make a diagnosis of asthma, following which the child was referred for asthma treatment. If the patient could not provide an adequate effort to meet the manufacturer’s minimum study quality, we conducted a pre-albuterol and post-albuterol peak expiratory flow (PEF) measurement per the Global Initiative Asthma’s (GINA) recommendations in low resource environments.9 Reversibility of 20% of the best of three peak flow measurements was considered significant to make a diagnosis of asthma, and the child was referred for treatment of asthma.

If a child is diagnosed with asthma, the patient was offered a follow-up appointment with Clarkson Family Medicine within a month of diagnosis. The purpose of this appointment was to perform formal spirometry testing and to start on appropriate medications. Follow-
up was coordinated with the medical director of the Open Door Mission and staff from Clarkson Family Medicine. Follow-up was assessed by whether or not the child attended the follow-up appointment.

Results

Twenty-five children, aged 4 to 14 years old, living at the Open Door Mission were enrolled. The average age of the children was 7.28 years. There were 13 males and 12 females. Thirty-two percent of children were Hispanic/Latino, 44% were Black/African American, and 24% were White/Caucasian.

Twelve of 25 children had symptoms on the ACT or history screening worksheet and underwent point of care pre and post albuterol spirometry and peak-flow testing. Nine out of the 25 children screened had asthma or a PFT profile suggestive of asthma. Three children had known asthma. Three children (all older than 11 years) provided an acceptable effort or understanding of hand-held spirometry. One of the three children with an acceptable PFT showed >12% reversibility in FEV1. Seven children that could not adequately perform spirometry had the peak-flow assessments. All seven children successfully performed the peak flow assessment. Five children showed >20% reversibility, diagnostic for asthma per GINA guidelines. Seven follow-up appointments were made, but six children did not show up for their appointment.

Discussion

We found a total point of care assessment and care provision to be low-cost and essential due to the high no-show rate for follow-up appointments and the identification of active, uncontrolled asthma. We quickly transitioned from being “assessment only” to providing education, spacers, peak-flow plans to the parents, and delivering medications to the shelter. We also engaged in social work for assistance. There is a dire need for point-of-care asthma treatment due to homeless youths being 31 times more likely to be hospitalized for asthma than non-homeless youth.13

The 36% asthma prevalence we found in this study is similar to New York City and Minneapolis shelters. A strength of our research is that we identified asthma through direct evaluation. In comparison, other studies used chart reviews. This study also describes the challenge of achieving good follow-up for this population of children. No other study to our knowledge has longitudinal outcome information.

A limitation of this study is that we only tested children that scored high on the ACT. Due to our limited resources, screening methods were necessary to isolate children with a high likelihood of having asthma. However, we likely missed children with reversible lung obstruction that did not report asthma symptoms. Therefore, the prevalence of asthma in the Omaha homeless shelter may be higher than the numbers we reported. The results of this study are influenced by volunteer bias as only subjects that walked into the clinic were screened. Further research should aim to screen all children upon intake into the shelter. Lastly, our study ended early as the COVID-19 pandemic made aerosol-generating procedures, such as spirometry, dangerous to perform. This unexpected stoppage explains our relatively low subject number.

Uncontrolled homeless pediatric asthma appears to be concerning in Omaha despite being a smaller metro area. Ongoing screening and point of care provision of care appear beneficial. Portable spirometry and peak-flow meter assessments are inexpensive and easy to perform in a resource-constrained setting. Further studies are needed to understand the extent of uncontrolled pediatric asthma in homeless shelters.

Conclusion

The prevalence of asthma in an Omaha homeless shelter is similar to shelters in large metropolitan areas. Due to the lack of resources available for asthma screening in homeless shelters, it is essential to find other methods than spirometry to diagnose asthma accurately. Mobile spirometry by inexperienced technicians may not be an effective screening tool in pediatric homeless shelter guests. This study may suggest that using the Asthma Control Test with pre-albuterol and post-albuterol peak flow measurements is an acceptable screening method for pediatric asthma in family-homeless shelters.

References


