

# ***Improving Asthma-Related Outcomes Among Children Participating in the Head-Off Environmental Asthma in Louisiana (HEAL), Phase II Study***

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**Purpose.** Pediatric asthma disproportionately affects low-income and minority children. The HEAL (Head-Off Environmental Asthma in Louisiana), Phase II Project was a collaborative effort with a primary focus to improve pediatric asthma management in New Orleans, Louisiana. The purpose of this article is to report clinical outcomes captured at baseline and 12-month follow-up. **Method.** HEAL (Head-off Environmental Asthma in Louisiana), Phase II was a pre-post intervention study that enrolled children ages 2 to 18 years of age with a diagnosis of asthma to receive asthma education within the clinic setting. Enrollees received an asthma education intervention, an environmental evaluation, and a 12-month follow-up session. Endpoints included symptom days, level of asthma control, asthma exacerbations, emergency room visits, hospitalizations, and missed school days. **Results.** The majority of participants were aged 5 years and older, male, Black, and persistent asthmatics. Emergency room visits decreased from 41% to 20% ( $p < .001$ ). Improvements in coughing (83% to 62%,  $p < .001$ ), wheezing (50% to 26%,  $p < .001$ ), and chest tightness (29% to 18%,  $p < .001$ ) were also seen. **Conclusion.** The novel intervention was associated with improved asthma outcomes among pediatric

patients receiving care at the clinical sites in the Greater New Orleans area.

**Keywords:** asthma; chronic disease; health disparities; patient education

## ► INTRODUCTION

Asthma is a serious, sometimes life-threatening, chronic respiratory disease that affects approximately 25 million Americans, including almost 7 million children (Moorman et al., 2012). Asthma has a significant impact on health care cost and can affect the physical, emotional, and social well-being of individuals living with the disorder (Simon & Akinbami, 2016). This is particularly the case when symptoms are not adequately controlled (Kodjebacheva, Sabo, & Parker, 2016). Pediatric asthma can account for considerable absences from

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school and reduced participation in family life (Wilson, Rapp, Jack, Hayes, & Malveaux, 2015). Though asthma is an incurable disorder, it can be controlled through management of environmental triggers, medical treatment, and supportive self-care behaviors (Cave et al., 2016). The purpose of this article is to describe how findings from previously published research was used to translate evidence into organizational policy to implement effective system changes to improve asthma related care to low-income pediatric patients in real-world clinical settings in New Orleans. Specifically, this article describes the development and implementation of an evidenced-based multicomponent pediatric asthma management project and reports findings on clinical outcomes captured at baseline and 12-month follow-up.

## ► BACKGROUND

Examining the latest data available regarding pediatric asthma in Louisiana, in 2007, approximately 97,000 children in Louisiana had asthma (Centers for Disease Control and Prevention [CDC], 2011). One in 10 Louisiana households with children have at least one child with asthma (CDC, 2011, 2014a, 2014b). The most recent results from the Louisiana Youth Tobacco Survey (2008) revealed that 11.2% of high school students currently have asthma, while 13% of middle school students also have the disorder. African American children were more likely to report currently having asthma compared to white children (Eaton et al., 2012). Approximately 5.1% of youth missed school because of asthma one or more days during the past 12 months (Louisiana Department of Health and Hospitals, Bureau of Primary Health Care and Rural Health, & Louisiana Asthma Management and Prevention Program, 2010).

Information is currently scarce about how to prevent the onset of asthma in children at risk. Therefore, results from the Head-off Environmental Asthma in Louisiana (HEAL), Phase II Project demonstrate how asthma care, delivered using a multicomponent approach, could be instrumental in improving clinical outcomes among pediatric patients.

The HEAL, Phase II Project was a collaboration between Xavier University's Center for Minority Health and Health Disparities Research and Education, the Merck Childhood Asthma Network, Inc., Daughters of Charity Services of New Orleans, and the Children's Health Fund–Tulane Health Sciences Center Department of Pediatrics Mobile Clinic. The initiative was designed and implemented to evaluate a multicomponent intervention to help document and address factors contributing to asthma symptoms and management among children between the ages of 2 to 18 living in New Orleans, Louisiana (Jack, Hayes, & Post, 2013; Rapp

et al., 2013). Those factors include issues with taking medications (e.g., concern about side effects, mechanical problems using delivery device, or remembering to take medications), symptoms experienced in the past 4 weeks (including coughing, wheezing, tightness in the chest, difficulty breathing, and feeling out of breath), and other clinical outcomes (e.g., exposure to tobacco smoke, use of a short acting beta-2 agonist, asthma attacks, emergency department visits, and hospitalizations).

## ► THEORETICAL FRAMEWORK

Asthma is a complex chronic disease shaped by several factors to include the physical environment, patient awareness and self-management behavior, provider awareness and training, health care tracking and monitoring system, and access to affordable medication (Bravata et al., 2009; Delate, Jenkins, & Lowe, 2017; Gamble, Stevenson, Heaney, 2011; Guner & Celebioglu, 2014). As such, a framework that offers an integrated approach to simultaneously address multiple factors is necessary. The framework that forms the basis for the multicomponent HEAL, Phase II project was modeled after the chronic care model. The chronic care model incorporates six elements: (1) health system, (2) delivery system design and decision support, (3) clinical information systems, (4) self-management support, and (5) community.

## ► INTERVENTION APPLICATION: PLANNING AND IMPLEMENTATION

The HEAL, Phase II project framework has been previously published elsewhere (Jack et al., 2013), but a brief description of how the framework's components were used to plan and implement the intervention is worth mentioning.

### *Health System*

The HEAL, Phase II team met with key clinic personnel weekly to discuss ways to implement a meaningful intervention to both the site and the project. Clinic personnel included a pediatrician, nurse manager, electronic medical record expert, and a member of clinic administration. All involved in the planning process were important to developing enhancements that could be sustainable within the organization.

### *Delivery System Design and Decision Support*

To address this issue, the HEAL, Phase II intervention implemented a health care provider training component. Health care providers, including physicians,

nurses, and medical assistants, at all participating clinical sites received provider education based on the latest National Asthma Education Prevention Program guidelines (National Heart, Lung, and Blood Institute, 2007). Three educational sessions were led by a pediatric allergist and focused on classification of asthma severity, classification of asthma control, and the step-wise approach to asthma management.

### ***Clinical Information Systems***

Clinical partners made changes to their electronic health record system used across all clinical sites and the mobile unit to include documentation of the patients' asthma severity, asthma control, and asthma control test score (Rapp et al., 2013). These changes allowed clinic personnel to access and enter important asthma information easily in the electronic health record. The adopted changes aligned with the asthma guidelines and helped ensure that all patients, regardless of socioeconomic status, race and ethnicity, and age received similar monitoring and pediatric asthma care (Rapp et al., 2013).

### ***Self-Management Support***

Certified asthma educators were incorporated as members of asthma management care teams within clinics to provide tailored asthma education to children and their caregivers. Asthma educators were certified via the National Asthma Educator Certification Board (2017). Participants of the HEAL, Phase II Project had at least two visits with certified asthma educators—at baseline and 12-month follow-up. During the baseline visit, certified asthma educators used the Childhood Asthma Risk Assessment Tool (CARAT), a survey completed by caregivers to assist in determining level of asthma control and developing an asthma risk profile for children (CARAT, 2011). Certified asthma educators used results from the CARAT survey to tailor the asthma education provided to the child and their caregiver (Wilson et al., 2014).

### ***Community***

In the HEAL Phase II Project, patients qualified for home visits if referred by their provider or classified as having *not well controlled* or *very poorly controlled* asthma. During home visits, trained community health workers completed an environmental scan and made recommendations for environmental remediation. The environmental assessment allowed caregivers and patients to recognize features of the home that may contribute to asthma symptoms. Community health workers were able to recommend to parents and children ways to remediate asthma triggers in the home, ideally leading to less frequent asthma symptoms and attacks.

## **► DATA COLLECTION**

The HEAL, Phase II Project protocol was reviewed and approved by the institutional review board at Xavier University of Louisiana. The HEAL, Phase II Project used a cross-sectional study design to examine improvement between baseline and follow-up data collections. Pediatric patients participating in this study received pediatric asthma care at one of three Daughters of Charity Health Clinics or on the New Orleans Children's Health Fund–Tulane Mobile Clinic. The study included pediatric patients with intermittent and persistent asthma based on diagnosis consistent with National Asthma Education Prevention Program guidelines.

Clinical outcomes were documented in this cohort of children diagnosed with asthma. Clinical outcomes were collected using surveys administered by certified asthma educators to assess study participants' experience with managing asthma. As mentioned previously, information collected through surveys were used to tailor asthma education to meet specific needs of study participants. Clinical asthma outcomes were captured at baseline and 12-month follow-up to examine improvements in quality of life among pediatric patients participating in the study. Outcome measures collected included issues with taking medications, symptoms experienced in past 4 weeks, exposure to tobacco smoke, short-acting beta agonist use in past 2 weeks, occurrence of asthma attacks, emergency department visits, and hospitalizations.

## **► STATISTICAL ANALYSES**

A total of 174 children were needed to generate a necessary sample size to detect statistical significance. This sample size of 174 reflected a power of 80% and a two-sided significance level of .05. Descriptive statistics were used to describe demographics and clinical health outcomes. Two sample tests of equal proportions were used to compare pre- and postintervention occurrences of qualitative clinical health outcomes. For all inferential statistical procedures, the alpha level was set at  $p < .05$ . All data extractions, manipulations, and statistical analyses were conducted using Stata 12 software.

## **► RESULTS**

### ***Baseline Characteristics***

From December 1, 2011 to April 30, 2014, the study enrolled and followed 222 pediatric patients living with asthma, between the ages of 2 to 18 years. However, 35 of those enrolled were lost to follow-up. Lost to follow-up was due to patients not attending

**TABLE 1**  
**Baseline Demographic Characteristics (n = 187)**

| <i>Demographic</i>  | <i>n</i> | <i>%</i> |
|---------------------|----------|----------|
| Age category, years |          |          |
| 2-4                 | 45       | 24.1     |
| 5-11                | 91       | 48.7     |
| 12-18               | 51       | 27.3     |
| Gender              |          |          |
| Female              | 82       | 43.9     |
| Male                | 105      | 56.2     |
| Race                |          |          |
| Black               | 165      | 88.2     |
| White               | 13       | 7.0      |
| Unreported/Other    | 9        | 4.8      |
| Ethnicity           |          |          |
| Hispanic            | 14       | 7.5      |
| Non-Hispanic        | 169      | 90.4     |
| Unreported          | 4        | 2.1      |
| Preferred language  |          |          |
| English             | 179      | 95.7     |
| Spanish             | 8        | 4.3      |
| Primary insurance   |          |          |
| Medicaid            | 150      | 80.2     |
| Private             | 16       | 8.6      |
| Self-pay            | 21       | 11.2     |
| Asthma severity     |          |          |
| Intermittent        | 77       | 41.2     |
| Mild persistent     | 55       | 29.4     |
| Moderate persistent | 40       | 21.4     |
| Severe persistent   | 12       | 6.4      |
| Undocumented        | 3        | 1.6      |

follow-up clinical visits or having unreliable contact information. Table 1 outlines the demographic characteristics for 187 participants completing both baseline and 12-month follow-up sessions. A majority of study participants were 5 years of age and older, male, Non-Hispanic, Black, English speaking, Medicaid recipients, and diagnosed as mild or moderate persistent asthmatics.

### ***Clinical Outcomes***

Table 2 reports asthma outcomes at baseline and 12-month follow-up. Significant improvements can be seen in outcomes including issues with taking medications, asthma symptoms, asthma attacks, and emergency department visits. Significant improvements were seen in issues with taking medications. There was a decrease

from 8% to 2% ( $p < .01$ ) in concerns about side effects of taking medication. Reporting of mechanical problems using medication delivery devices decreased from 28% to 14% ( $p < .001$ ). The percentage of pediatric patients reporting remembering to take medication as an issue decreased from 20% to 10% ( $p < .01$ ). Among reported symptoms in the past 4 weeks, there was an improvement in experiencing coughing (83% to 62%,  $p < .001$ ), wheezing (50% to 26%,  $p < .001$ ), chest tightness (29% to 18%,  $p < .01$ ), difficulty breathing (41% to 18%,  $p < .001$ ), and feeling out of breath (66% to 36%,  $p < .001$ ). The reporting of asthma attacks increased from 41% at baseline to 64% at 12-month follow-up ( $p < .001$ ). In contrast, the reporting of emergency department visits decreased from 41% to 22% ( $p < .001$ ).

When specific asthma outcomes are viewed by classification of asthma severity, significant differences are noted between severity groups (see Table 3). The reporting of asthma attacks, emergency department visits, and hospitalizations were significantly different among asthma severity groups. The same can be said for the reporting of these outcomes at the 12-month follow-up. As expected, the baseline reporting of asthma attacks and emergency department visits increased with asthma severity. However, reporting of asthma attacks at the 12-month follow-up increased for all severity levels while the reporting of emergency department visits decreased for each severity level. The baseline reporting of hospitalizations was consistent among intermittent (8%), mild persistent (8%), and moderate persistent asthmatics (8%), but severe persistent asthmatics reported a significantly higher occurrence of hospitalizations (42%). At the 12-month follow-up, all severity groups except moderate persistent experienced some decrease in their reporting of hospitalizations.

## **► DISCUSSION**

Studies have shown that health care providers do not routinely follow asthma guideline recommendations (Jack, Hayes, & Post, 2013; Wisnivesky et al., 2008), resulting in below standard care and negative health outcomes (Akinbami, Moorman, Garbe, & Sondik, 2009; Bracha, Brottman, & Carlson, 2011; Jack et al., 2013). Health care administration makes care improvement, an important priority and communicates goals and policies to improve the quality of care within the organization (Wagner, 2001). In order to address the many factors that influence the ability of a health care systems to deliver optimal asthma care to pediatric patients and their caretakers, this study relied on a multicomponent framework that simultaneously addressed health system changes, enhanced delivery system design and decision support, modified clinical information systems, promoted effective self-management

**TABLE 2**  
**Proportions of Asthma Characteristics and Health Outcomes of Participants Completing the 12-Month Follow-up (n = 187)**

| <i>Asthma Outcomes</i>                    | <i>Baseline (%)</i> | <i>12-Month Follow-up (%)</i> | <i>p *</i> |
|-------------------------------------------|---------------------|-------------------------------|------------|
| Issues with taking medications            |                     |                               |            |
| Concern about side effects                | 8                   | 2                             | .0096*     |
| Mechanical problems using delivery device | 28                  | 14                            | .0006*     |
| Remembering to take medication            | 20                  | 10                            | .0091*     |
| Symptoms experienced in past 4 weeks      |                     |                               |            |
| Coughing                                  | 83                  | 62                            | .0000*     |
| Wheezing                                  | 50                  | 26                            | .0000*     |
| Tightness in the chest                    | 29                  | 18                            | .0073*     |
| Difficulty breathing                      | 41                  | 18                            | .0000*     |
| Feeling out of breath                     | 66                  | 36                            | .0000*     |
| Other outcomes                            |                     |                               |            |
| Child exposed to tobacco smoke            | 37                  | 40                            | .5957      |
| Short acting beta-2 agonist use           | 55                  | 45                            | .0627      |
| Asthma attacks                            | 41                  | 64                            | .0000*     |
| Emergency department visits               | 41                  | 22                            | .0002*     |
| Hospitalizations                          | 10                  | 5                             | .1160      |

<sup>a</sup>Two-sample test of equal proportions.

\**p* < .05.

**TABLE 3**  
**Proportions of Adverse Asthma Health Outcomes Among Severity Level Groups**

| <i>Asthma Health Outcomes</i>           | <i>% of Levels of Asthma Severity</i> |                                     |                                         |                                       | <i>p *</i> |
|-----------------------------------------|---------------------------------------|-------------------------------------|-----------------------------------------|---------------------------------------|------------|
|                                         | <i>Intermittent<br/>(n = 77)</i>      | <i>Mild Persistent<br/>(n = 55)</i> | <i>Moderate Persistent<br/>(n = 40)</i> | <i>Severe Persistent<br/>(n = 12)</i> |            |
| Asthma attack in past year              |                                       |                                     |                                         |                                       |            |
| Baseline                                | 27                                    | 56                                  | 57                                      | 82                                    | .000, .000 |
| 12-month follow-up                      | 49                                    | 72                                  | 83                                      | 100                                   | .000, .000 |
| Emergency department visit in past year |                                       |                                     |                                         |                                       |            |
| Baseline                                | 30                                    | 44                                  | 53                                      | 67                                    | .026, .025 |
| 12-month follow-up                      | 11                                    | 19                                  | 38                                      | 58                                    | .000, .000 |
| Hospitalization in past year            |                                       |                                     |                                         |                                       |            |
| Baseline                                | 8                                     | 8                                   | 8                                       | 42                                    | .002, .014 |
| 12-month follow-up                      | 0                                     | 6                                   | 8                                       | 33                                    | .000, .000 |

\**p* < .05 ( $\chi^2$  and Fisher's exact tests for association).

support, and mediated community and environmental trigger.

Findings from this study demonstrate that a multicomponent intervention can have a positive impact on asthma outcomes among children living with asthma. The first year of the project was a deliberate planning process to

help ensure successful implementation of the project at the clinical sites (Jack et al., 2013). This intervention contributed to observed improvements associated with a decrease among caretakers reporting children having an issue taking medications, experiencing asthma symptoms, and visits to the emergency department visits.

Two previously published studies agree that children with more severe asthma benefit more from educational interventions than those with less severe disease (Auger, Kahn, Davis, Beck, & Simmons, 2013; Chung, Hathaway, & Lew, 2015). However, it was very important to participating clinical sites that all pediatric asthmatic patients have an opportunity to enroll in the project, regardless of level of asthma severity. The HEAL, Phase II project study participants, unlike many studies (Auger et al., 2013; Chung et al., 2015), experienced improvements.

In reviewing the change in proportions of asthma attacks reported in the past year, an unexpected observation was made. The reporting of asthma attacks increased from baseline to 12-month follow-up for all severity groups. This increase may be due to the fact that providing tailored asthma education to participants and caregivers contributed to greater awareness of signs and symptoms of asthma attacks. Other documented outcomes, such as asthma symptoms and emergency department visits, are reported as a result of an obvious occurrence. In contrast, reporting of an asthma attack involves an awareness of what an asthma attack entails—an awareness that increased after caregivers and children received tailored asthma education.

Outcomes related to emergency room visits are consistent with previous studies (Janevic et al., 2016; Mansfield et al., 2011). Improvements were noted in the reporting of emergency room visits in the past year from baseline to 12-month follow-up for all severity groups, including significant decreases in emergency room visits among patients with less severe asthma. In contrast to other studies (Auger et al., 2013; Chung et al., 2015), less severe asthmatics did benefit from the educational intervention.

It is worth noting that the improvements experienced by the severe persistent asthmatics in this study were markedly less than other severity groups. In taking a closer look at this group, several factors become apparent. First, this subset contains only 12 patients, which warrants caution in any statistical comparison. Second, most of the patients (8 of 12) had “very poorly controlled” asthma at baseline. The fact that the severe persistent patients reported hospitalizations in significantly greater proportions than other severity groups, at both baseline and 12-month follow-up, is a great indication of a lack of asthma control. Third, most of the patients (9 of 12) were also younger than 10 years.

Wilson et al. (2015) noted that younger children with persistent asthma were less likely to adhere to prescribed medication regimen for various reasons relative to caregiver support: running out of medicines, not having necessary medications on hand when asthma symptoms arise, facing problems in making sure medicines are obtained, and poor experiences with children taking medicines as prescribed. Lack of adherence would certainly contribute

to poorly controlled asthma and hinder chances of improvement during intervention. Hence, almost all the patients (11 of 12) reported experiencing difficulty breathing and feeling out of breath in the past 4 weeks at baseline. This particular group of patients contained confounding factors that may require a more intense intervention than the HEAL, Phase II project offered.

Asthma management is largely controlled outside of the clinical setting (Kintner et al., 2015; Rapp et al., 2013). Environmental triggers such as allergens, dust mites, cockroaches, and mold can worsen asthma (Belice & Becker, 2017). Exposures to these environmental triggers are exacerbated in certain living conditions (e.g., inappropriate housing, ventilation, inadequate pest control; Belice & Becker, 2017). Environmental triggers may have played a role in shaping outcomes among the severe persistent group. In post Katrina New Orleans, many children experienced environmental exposures that led to an increase in upper and lower respiratory symptoms (Rath et al., 2011). All children enrolled in the HEAL, Phase II study did not receive allergy testing; therefore, specific allergies and degree of exposure was unknown. It is possible that children classified as severe persistent had continued exposure to environmental triggers, which hindered movement toward asthma control. If this study were repeated, allergy testing for all children with persistent asthma may be beneficial.

## ► CONCLUSION

Most of the participants had less severe asthma. Greater impact of the multicomponent intervention may have best been exhibited if more study participants were diagnosed with severe asthma. Participants were recruited from only two sources in the city: Three Daughters of Charity clinics and one mobile health unit; this will limit the generalizability of the study results. Despite efforts to recruit and enroll patients with severe asthma, these efforts only yielded 12 patients. In addition, the study used a cross-sectional study design that limits the study's ability to establish causality due to confounding factors. Despite the study's limitations, it does make the case that a coordinated multicomponent asthma intervention can help improve clinical outcomes among low-income racial and ethnic populations. This study demonstrates that implementation of clinical management based on clinical guidelines involving the incorporation and active use of certified asthma educators in primary care settings shows promise for diffusion into similar settings serving at-risk children. This study also demonstrates that important systems changes based on a carefully developed theoretical approach, organizational buy-in, and multisite adoption of the same approach (e.g., adopting clinical guideline, electronic

medical records enhancement, screening surveys, tailored asthma education delivered by trained/certified asthma educators, and regularly schedule data reporting) can lead to better reporting of symptoms, proper use of medications, reduce missed school days, reduce emergency room use, and greater asthma management efficacy among children and their caregivers.

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