Chapter 7
Community-Based Interventions in Asthma

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Abstract Community and public health interventions provide potentially powerful means of decreasing morbidity, hospitalizations, emergency room visits, and mortality from asthma. This chapter thus provides an overview of community-based interventions, which have been demonstrated to be effective—and/or ineffective—in reducing the burden of disease, including development of asthma coalitions, interventions for both provider and patient education, environmental controls to reduce exposure to asthma triggers, and institutional policy and systems change. Perhaps most important is the demonstrated effect of integrated, comprehensive approaches to asthma management and control. A multidisciplinary approach spanning T1 through T4 translational research, coupled with public health activities is promising and has already demonstrated success in reducing the burden of disease.

Keywords Community asthma interventions • Asthma coalitions • Provider and patient education • Environmental control of asthma triggers • Integrated approaches to asthma control

7.1 T1 to T4 Research: From Bench to Curbside

An integrated approach to asthma management and control is increasingly important, given the increase in prevalence of asthma nationally and globally over the past decades. Basic science provides us with a better understanding of mechanisms, which in turn is leading to development of new and innovative pharmaceutical

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interventions to enable better control and management of the disease. Research reveals, however, that community and public health interventions also provide potentially powerful means of decreasing morbidity, hospitalizations, emergency room visits, and mortality. It is important to note that many large organizations are primarily focused on achieving improved outcomes for asthma. Among these are the American Lung Association; the American Thoracic Society; the American College of Allergy, Asthma, and Immunology; the Asthma and Allergy Foundation of America, as well as charitable organizations including the Robert Wood Johnson and Kaiser Family foundations. However, these groups are likely to approach interventions from different perspectives, with disease-based organizations more likely to address provider and patient education and community-based coalitions more likely to focus on environmental, public health, and policy interventions (Keirns 2009). This chapter thus provides an overview of both types of community-based interventions, which have been demonstrated to be effective—and/or limited in effectiveness—in documenting reduced burden of disease, including the development of multidisciplinary coalitions, interventions for both provider and patient education, environmental controls to reduce exposure to asthma triggers, and institutional policy and systems change. Perhaps most important is understanding and appreciating the collective impact of integrated, comprehensive approaches to asthma management and control.

7.2 Public Health Interventions for Asthma

7.2.1 Role of Community Coalitions

One of the earlier and arguably among the strongest community-based initiatives in combating asthma was a national program funded by the Robert Wood Johnson Foundation, Allies Against Asthma Initiative (Allies). The Allies program, directed by the University of Michigan School of Public Health from 2000 to 2006, supported the development of seven community-based coalitions in an effort to improve health care and coordination of efforts while also developing programs and resources that were site specific but could be adopted or adapted as best practices by other communities. An important contribution was the use of standardized tools to evaluate the coalitions as they evolved and their functionality (Clark et al. 2006).

The overarching goals of the coalitions were to improve access to health care as well as the quality of care received, consistent with The National Asthma Education and Prevention Program (NAEPP) guidelines, as well as to provide patient, family and provider education and support. They also sought to address environmental issues associated with asthma and to support development of evidence-based policies and systems change. These combined efforts were designed to reduce hospitalizations and emergent care visits for treatment of asthma and consequent missed school days as well as to improve quality of life in children with asthma and to

develop strategies for managing asthma through sustainable community initiatives. The seven coalitions funded included both established and new initiatives including both professional and grassroots partners:

- Alianza Contra el Asthma Pediátrica en Puerto Rico (ALIANZA)
- Consortium for Infant & Child Health (CINCH)
- Fight Asthma Milwaukee Allies (FAM Allies)
- The King County Asthma Forum (KCAF)
- Long Beach Alliance for Children with Asthma (LBACA)
- National Capital Asthma Coalition (NCAC)
- Philadelphia Allies Against Asthma (PAAA)

The Controlling Asthma in American Cities Project (CAACP), funded by the National Asthma Program of the National Center for Environmental Health within the Centers for Disease Control and Prevention, was initiated in 2001. A complex and ambitious undertaking, also involving coalitions, the CAAAP was largely based upon the experience of the Allies program. The CAAP initiatives required integrating and coordinating multiple interventions at multiple levels. Based upon program theory, the CAAAP sought to establish community asthma coalitions that would include both professionals and community members, nurtured by external funding and access to expertise and resources including paid staff and technical assistance. Following a period of capacity-building, coalitions were expected to complete community needs assessments from multiple sources with a goal of developing community-specific asthma action plans involving coordinated efforts among community, change leaders, policy makers, and healthcare payers. Outcomes of interventions were to be rigorously monitored and evaluated for both process and efficacy, with plan revisions made accordingly. Each coalition was to target children with asthma and their families as well as healthcare providers, community-based organizations, healthcare systems and payers, and policy makers in order to effect environmental and psychosocial improvements (Herman 2011).

Due to the broad-based and ambitious nature of the program, there were both successes and failures in achieving goals. Multiple sites reported difficulties in reaching children with uncontrolled asthma as well as engaging healthcare providers in interventions to improve the quality of care for children with asthma. Nonetheless, they also reported improvements in asthma outcomes related to innovative interventions. Davis et al. (2011) documented improvements in asthma medication prescription and use in targeted Chicago neighborhoods by analyzing a large pharmacy database. Findley et al. (2011) reported dramatic improvements in asthma management for preschool children through a multifaceted educational program targeting early childhood centers, parents, and children as well as healthcare providers. The Oakland, CA coalition also reported significant achievements in asthma control in adolescents in a 4-week educational curriculum designed to improve asthma self-management (Davis et al. 2008). While many of the coalitions used or adapted existing educational programs developed by NIH or professional organizations such as the American Lung Association, several created innovative new programs that are now available for use. Among these are the *Asthma Basics for*

Children handbook for parents and early childhood teachers (available from the Asthma and Allergy Foundation of America) and Oakland's *Kickin' Asthma* educational curriculum, which was designated by ALA as a best practice program (Herman et al. 2011)

While these examples are representative of effective community coalitions, it should be noted that many other community-based, multisite efforts have been implemented. Among these are seven Centers for Children's Environmental Health and Disease Prevention Research, jointly funded by the NIEHS and EPA, which have carried out diverse studies of children with asthma and environmental exposures and generated a large body of scientific literature that have, in turn, informed the development of multiple intervention efforts which have commonalities across sites, while taking into consideration local and site-specific circumstances (Eggleston et al. 2005).

A different type of networked initiative emerged from the Merck Childhood Asthma Network (MCAN), which was funded by the Merck Company Foundation and developed to provide evidence-based interventions in three, widely ranging settings, including schools, clinics, and communities in five program sites. This ambitious program employed multidisciplinary teams utilizing a translational approach to the interventions. While MCAN shared many similarities with other such coordinated efforts, an important distinction was its emphasis on rigorous evaluation not only of outcomes but also of the processes and infrastructure required for and barriers imposed by implementing clinical or research intervention protocols in the real world setting. Perhaps more importantly, lessons learned are being used to guide funding initiatives for future intervention research (Viswanathan et al. 2011; Ohadike et al. 2011).

7.2.2 Patient and Provider Education

Numerous patient and provider education curricula have been developed that are consistent with NAEPP guidelines. Among these is the Physician Asthma Care Education (PACE) program, which is an interactive educational seminar that employs a multimedia approach. PACE has been highly effective in increasing physicians' efficacy in dealing with patients with asthma and in reducing morbidity from the disease in terms of symptom-free days and reduced emergent visits for treatment (PACE 2012). The National Asthma Control Initiative, initiated by the NHLBI in conjunction with CDC, offers numerous patient and provider education resources, as do the AAFA and the ALA, including *Open Airways for Schools* (ALA 2012), as well as *You Can Control Asthma*, and *Wee Wheezers* (AAFA 2012).

Other innovative provider education programs have demonstrated success. Morrow et al. developed an innovative, educational program that combines clinical vignettes with interactive discussions, allowing providers to synthesize the educational components with their own experience and knowledge, i.e., utilizing a problem-based learning approach, yielding significant changes in healthcare

providers' decisions about care of patients with asthma (Morrow et al. 2007). Kattan et al. (2006) demonstrated the efficacy of a program geared toward education of both providers and parents of childhood asthma patients to prompt appropriate prescription and use of asthma medications, reduced asthma symptoms, and healthcare utilization. This novel program involved bimonthly telephone calls to caretakers of enrolled children to collect information about the child's symptoms and asthma control. Following the call, a computer-generated letter was sent to providers summarizing the child's symptoms as well as healthcare usage based upon the discussion with the caretaker, with recommendations for provider action to improve patient outcomes. A second telephone-based intervention involved coaching of parents of children with asthma to provide education and support, resulting in significantly improved quality of life for enrolled parents (Garbutt et al. 2010). Another "hybrid" intervention focused on both provider and patient education also achieved remarkable results. Lob et al. (2011) illustrated significant improvement in patient outcomes via a program, which provided healthcare practitioners with training on the NAEPP diagnostic and treatment guidelines while concomitantly increasing clinic-based patient education through a team-based effort involving the practitioner as the "clinician asthma champion," an asthma coordinator, and nonclinical staff. This continuous quality improvement intervention not only resulted in improved patient outcomes but also documented improved care processes in the clinics and quality of life for study participants.

Multifaceted, clinic-based programs geared toward increasing patient self-efficacy through counseling, ongoing education, and development of personalized asthma action plans have also been effective in adults with moderate-to-severe asthma (Cote et al. 2000) as well as in high-risk, primarily African American patients of low socioeconomic status with poorly controlled disease (Martin et al. 2009). While a pilot effort, there is some indication that efforts to improve parental health literacy and provide education in the emergency department setting are also effective, even among parents with low health literacy (Macy et al. 2011). Other successful initiatives include school-based education (Mansour et al. 2008).

7.3 Asthma, the Environment, and Respiratory Health

The disparate foci of communities and researchers often lend itself to a Community-Based Participatory Research (CBPR) approach. Environmental interventions at community-levels have become increasingly common, and to varying degrees, highly successful. Community Action Against Asthma (CAAA) utilized a CBPR approach in a series of community-based asthma environmental interventions. Originally established in 1998, the initial project had two primary objectives, to carry out home-based intervention studies to reduce asthma triggers, and to conduct an epidemiologic assessment of exposure to ambient air and concomitant health effects. The group utilized Community Health Workers to carry out the household interventions, achieving increases in some measures of lung function and reducing

morbidity for children with asthma in the form of reduced emergent care visits, reduction of asthma triggers in the home, and increasing appropriate use of asthma medications. An important part of these community-based interventions, however, was building and evaluating community capacity to effect change (Edgren et al. 2005; Parker et al. 2003, 2008, 2010).

A predecessor to the work of CAAA was the "Healthy Homes" approach to identify and control environmental indoor asthma triggers that was developed in the late 1990s and approved for use by the NIEHS, the Department of Housing and Urban Development, and the EPA, which heavily funded such efforts. Krieger et al. utilized such an approach to conduct a randomized control trial using community health workers to provide a series of in-home environmental assessments over a 1-year period, during which they also provided support and resources for asthma education (Krieger et al. 2005). As with the CAAA initiative, investigators documented reduced asthma morbidity and symptom days as well as reductions in emergent visits for asthma treatments. Also, like the CAAA program, they revealed self-reported improvements in caregiver quality of life. Similar results were observed for a study which focused on environmental improvements through better insulating homes and improving heat sources. This study was significant in that the authors cited such interventions as more effective than individual behavioral intervention alone (Howden-Chapman et al. 2011).

Our own work has focused on both indoor and outdoor air quality, the study of which has been prompted by community inquiries regarding respiratory health and safety. In 2002, in response to concerns of the local Galveston/Houston community over poor air quality, researchers from the University of Texas Medical Branch (UTMB) initiated the Gulf Coast Study of Urban Air Pollution and Respiratory Function (GC-SURF) as a pilot study with the Galveston County Beach Patrol, hypothesizing that exposure to pollutants would adversely affect the lung function of healthy, athletic young adults working as beach lifeguards (Petronella et al. 2004; Thaller et al. 2008). Deleterious effects of particulate matter and ozone appeared to be transient, but occurring at pollutant levels far below national standards, suggesting that even low levels of exposure may have small but significant effects on healthy individuals. This study was an outgrowth of previous studies in which environmental research initiatives were developed in response to community concerns that further developed into educational and policy interventions to benefit community health, as well as engendering additional, more mechanistic research (Thaller et al. 2005).

Significantly for the Galveston community, and for the three million annual visitors to its beaches, these efforts have evolved into a model that uses the results of these scientific studies to inform public health education and policies. Since 2006, Galveston beaches have included in the public notification flag system an orange "environmental alert" flag, deployed on the city's 26 lifeguard towers and seven freestanding system stations, as well as at strategic locations along the seven-mile Galveston seawall and the entrances to the community "pocket" parks. At each of these locations, information is posted detailing the specific environmental condition of concern, along with guidelines for practical steps to ensure health. In this study,

the community served as partners in the research and used findings to implement intervention/education measures to protect public health.

A second community-based project was developed based upon the GC-SURF study, this time focusing on development of a notification system for parents of children with asthma to apprise them when air quality at local levels had been determined to be unhealthy. The overall goals of the Breathe Easy: Air Quality Index Notification System (BEAQINS) project are to reduce children's health risks from exposures to ozone and other outdoor air pollutants and to evaluate the use of an educational and early warning system in impacting participants' knowledge and subsequent behavior to effect risk reductions. By implementing a daily indicator of air quality at area schools along with appropriate educational programming, we hope to reduce student exposures to unhealthy air, to inform regional school districts and the Texas Interscholastic League of the need to limit prolonged outdoor exertion and the benefits of providing alternative indoor activities, and to increase public awareness of the Air Quality Index (AQI) and its prescribed behaviors appropriate to vulnerable populations. The flags, colored green, yellow, orange and red, correspond to the colors of the AQI and advise parents, students, and school staff of the air quality forecast for the day. The flag's color thus acts as a parent and school advisory and could help to determine choices for outdoor activities. In the event that air quality decreases during the day, the Texas Commission on Environmental Quality's automatic email warning system will advise schools, allowing them to post a warning flag during the day.

7.4 Systems Changes

While admittedly outcomes of the Allies Against Asthma programs varied across sites, the community-based coalition approach to asthma management was largely documented to be successful, especially related to changes in policy (89 documented across site) and systems changes in five key areas: clinical practice, coordination and/or standardization of care, improvement of environmental conditions, family management of asthma, and other improvements that ranged from inter and intrainstitutional changes to statewide legislation related to exposure to environmental tobacco smoke in public places, improvement of air quality in schools, and assurance of children's rights to carry and administer asthma medications in schools (Clark et al. 2010). Coalitions were encouraged to develop community-specific, innovative programs. One such effort in Philadelphia, "the Child Asthma Link Line" demonstrated that children enrolled in a telephone-based care coordination and system integration program were less likely to require hospitalization or ED visits for their asthma and more likely to see their outpatient provider for regular management of asthma symptoms (Coughey et al. 2010). Allies coalitions also documented improvement in children's asthma symptoms as well as parents' emotional control in management of their children's disease. Significantly, they found that the coalitions which affected the greatest number of policy and system changes had

more core and ongoing partners as compared to those with a greater number of peripheral or transient partners (Clark et al. 2010).

A comprehensive review of asthma policies developed to improve asthma outcomes at the community level was carried out by Lyon-Callo et al. (2007) to assess degree of policy implementation and effectiveness. The authors found many examples of successful policies, including, albeit not limited to, reductions in exposures to triggers in the workplace and schools, improvement in both indoor and outdoor air quality, and increasing funding for asthma coalitions to launch comprehensive approaches to asthma education, treatment, and management. Nonetheless, they cite numerous deficiencies including a sparcity of peer-reviewed interventions, few policies focused on educating school staff regarding childhood asthma, and large disparities across local, state, regional, and national initiatives. They suggest that to effectively assess systems changes and efficacy of asthma policies, it is imperative to establish comprehensive monitoring databases that include information on socioeconomic status, race, and ethnicity. However, to do so, federal dollars and guidance will be necessary to ensure uniform implementation and assessment (Lyon-Callo et al. 2007).

7.5 Challenges in Real World Assessment of Program Impacts

Prior to definitively stating that community-based asthma interventions are uniformly successful, it is essential to consider and comprehend the difficulties in establishing and documenting change in a real world setting. Spiegel et al. (2006), for example, describe moderate successes achieved by the Inner City Asthma Intervention, yet revealing that actual implementation was affected by variations across sites and a lack of a clear evaluation design and data collection strategy that was capable of rigorous statistical analysis to document outcomes (2004). An umbrella review of public health interventions for asthma (Labre et al. 2012) found a decided lack of conclusive evidence of efficacy in most, although not all, asthma programs. However, as the authors point out, the ability to determine effectiveness of programs is complicated by the lack of consistent study designs, the interventions carried out, the inclusion criteria for subjects, the outcomes measured, and the means by which outcomes were measured. Of thousands of peer-reviewed studies published, they could only manage to find 42 which lent themselves to comparison. Similar results were obtained by Crocker et al. (2011) as they attempted to assess the effectiveness of multifaceted environmental interventions in the home with a focus on reducing asthma morbidity. While the literature search found over 10,000 citations, only 23 studies met criteria for conclusion in the analysis. Both sets of authors suggest, and rightly so, that if we are to clearly document our successes and failures (and thus establish best practices) we must begin by standardizing definitions and endpoints and integrating practices across programs conducted by federal, academic, and nongovernmental agencies to ensure the possibility of determining best practices in public health asthma intervention.

7.6 Summary

Comprehensive, community-based efforts have been demonstrated to be effective in improving outcomes for patients with asthma and their families. As observed in the preceding pages, coordinated initiatives encompassing environmental controls to minimize exposure to allergens and irritants, appropriate pharmacologic therapy, patient and healthcare provider education, and a systems change approach can collectively reduce morbidity, mortality, and financial costs associated with asthma. That said, rigorous attempts must be made to integrate programs, adopt best practices, and carefully track outcomes if we are to realize their full potential.

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