

Reducing the Prevalence of Asthma in Boston Public Housing

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Introduction

Asthma is a chronic lung disease that inflames and narrows the airways, characterized by periodic episodes of coughing, wheezing, respiratory distress, and reversible bronchospasm. It is the most common chronic disease in children, and it disproportionately affects minority children, those of lower socioeconomic status, and those in urban areas (Nelson & Zorc, 2013). An example of an urban area that is greatly affected is Boston, Massachusetts. People in Boston public housing are of particular concern due to their increased environmental exposure to asthma allergens such as mold growth, pest infestation, dust mites, and inadequate ventilation (Hynes et al., 2003). Many cases of asthma in Boston are easily avoidable, which is why it is imperative to address disparities that may lead to higher prevalence of Asthma in certain locations.

Medical Causes and Epidemiology

During an asthma attack, the sides of the airways in the lungs swell, causing the airways to shrink. This induces coughing, wheezing, chest tightness, and difficulty breathing (CDC, 2012). The exact biological causes of asthma are unknown, but many environmental, social, and economic factors have been linked to asthma exacerbation. It is predicted to be triggered by factors such as air pollution, allergies, family history, and smoking/exposure to second-hand smoke (Nelson & Zorc, 2013). Asthma in the U.S. has been steadily increasing since 1980. It currently affects an estimated eight percent (18.7 million) of adults and nine percent (7 million) of children (CDC, 2012). Estimated asthma incidence from 2006-2008 among at-risk adults was 3.8/1000, whereas that among at-risk children was 12.5/1000 (Winer et al., 2012). Asthma is often discounted as an important health issue because of the diseases that are more prevalent or life

threatening; however, the health detriments of Asthma should not be overlooked. Each year, over 3000 people die from asthma, and over 7000 people experience asthma as a “contributing factor” to their death (AAFA, 2013). Since 1980, asthma death rates have increased over 50% for all ages, genders, and ethnic groups, and the death rate for children under the age of 19 has increased by almost 80% (AAFA, 2013). This increase in prevalence is due to a variety of factors, such as increased exposure to toxic allergens and an increase in smoking, especially in urban areas. These two exposures will be elaborated upon later in this paper. Asthma is not usually fatal, but many people still suffer from the disease even though it is very easily preventable.

Economic Burden

Another important factor to consider when looking at Asthma in public housing is the unnecessary costs that the disease yields. For example, asthma accounts for 1.9 million emergency room visits and 196,000 pediatric hospital admission per year (Clougherty et al. , 2006). The total cost of asthma per person is estimated at around \$3,259 per year, and prescription medication expenses per person are estimated to cost an additional \$1,680 a year (Barnett & Nurmagambetov, 2011). Reducing asthma prevalence in inner-city children would result in fewer medical costs for both the individuals in the community and the primary care providers responsible for their medicine and treatment.

Risk Factors

There are many risk factors associated with Asthma, such as family history, obesity, and smoking. Asthma is believed to be genetic, and obesity seems to be a predisposing factor for the development of asthma; however, its exact influences are still

uncertain (NCBI, 2013). Smoking is a risk factor that is extremely harmful to respiratory health, yet it is preventable; it will be discussed later in more detail. The most important risk factor, however, is exposure to toxic allergens (CDC, 2012). Asthma is often triggered by allergens that irritate the throat, such as tobacco smoke, dust mites, air pollution, cockroach allergens, pets, and mold (Hynes et al., 2003). A study done by Call et al. showed that sixty-nine percent of the children with asthma that they studied had antibodies to dust mite, cockroach, or cat in their immune systems (Call et al., 1992). In highly populated urban areas like Boston, these allergens are often found in mass quantities due to overpopulation, an abundance of industrial buildings, and a high concentration of people who smoke (Call et al., 1992). As a result, inner-city children have the highest prevalence and mortality rates for asthma in the United States (Call et al., 1992).

Boston Public Housing

Many poverty-stricken families in Boston live in public housing. The average household income for Boston public housing residents is \$11,250, 17% of Boston's median household income (Hynes et al., 2003). Although its original goal was to provide a stable environment, both physically and socially, for the urban poor, public housing now entails poor physical conditions and social tribulations that arise in a poverty-stricken setting (Hynes et al., 2000). It has been proven that minority individuals who live in urban environments experience higher asthma morbidity and mortality than Caucasian children who live at a stable income level (Bryant-Stephens, 2009). For example, African American individuals who live in urban areas are more likely to have asthma and are 2.5 times more likely to experience asthma-related emergency department visits and

hospitalizations than white individuals with a stable income, and blacks are five times more likely to die from asthma than whites (CDC 2012). This is due to a variety of factors, one of which being the fact that low-income individuals tend to live in urban areas, such as public houses. The Boston Housing Authority houses approximately 26,000 people in public housing developments and supports approximately 25,000 people with rental assistance vouchers (Digenis-Bury et al., 2008). The high concentration of people who inhabit Boston public housing yields an environment for low-income minorities that is detrimental to their respiratory health.

Social Determinants

The main determinants of respiratory health in Boston public housing are the physical environment and the social habits associated with the housing community (Hynes et al., 2000). The physical environment that the housing provides is a key aspect of why asthma is prevalent in public housing. Many public houses are infested with termites, cockroaches, and dust mites, all of which cause allergies. Due to a lack of cleanliness and maintenance, the foundations of the houses are often damp, moldy, and rotted, leading to deterioration of the infrastructure over time (Hynes et al., 2000). Studies have shown that coughing, wheezing, bronchitis and other chest illnesses in children are associated with damp housing regardless of whether mold is visible (Hynes et al., 2000). Public Housing infrastructure is often built with cheaper materials, which are more susceptible to mold and rotting (Hynes et al., 2000). One such material is particle board, a board made of very small pieces of wood bonded together (Merriam-Webster). A study by Daugbjerg et al. in 1989 showed that children who lived in homes with an abundance of particle board had more headaches, throat irritation, and the need

for asthma medication than those with low or no particle board (Hynes et al. 2000). Most houses also lack proper ventilation to release toxins. This deficiency of fresh-air exchange results in particles and chemical vapors, which harm the respiratory system and lungs, being trapped inside houses (Hynes et al., 2000). There is great potential for interventions to improve the physical conditions of Boston's public housing, and fixing these minor problems can greatly improve respiratory health issues such as asthma.

Another aspect of the physical environment that can be detrimental to respiratory health is the fact that cities tend to have a high number of industrial plants and factories. For example, two power plants in Massachusetts, Mystic Station in Everett and Fore River in Weymouth, pumped nearly 8.7 million metric tons of carbon dioxide and other greenhouse gases into the air per year (Struck, 2011). Outdoor air pollution levels have been associated with many of the health effects in individuals with asthma, such as increased bronchial hyper-responsiveness, pulmonary function decrements, and inflammation (Koenig, 1999). Air pollutants can come from nature, such as O₃ and sulfate, or as pollutants emitted directly out of exhaust pipes and stacks, such as the pollutants NO_x, SO₂, and soot (Trasande & Thurston, 2005). There is nothing that can be done about natural pollutants, but there are many ways to reduce pollutants from factories and industrial plants in cities at the policy level, such as enacting laws to regulate factories that produce harmful byproducts.

In addition to physical environment, public housing in Boston provides a social environment that facilitates poor respiratory health. For example, there is a high prevalence of smoking in urban areas (Bryant-Stephens, 2009). The National Cooperative Inner-City Asthma Study found that over 59% of children in urban areas

have at least one smoker in their homes, 39% have a primary caretaker who smokes, and greater than 48% have increased urinary cotinine levels compatible with heavy exposure to smoke (Bryant-Stephens, 2009). This could be associated with the fact that the urban poor who live in housing projects are mostly made up of ethnic and racial minorities such as African Americans and Latinos, and that smoking prevalence in these groups is found to be higher than that of the majority population (Bryant-Stephens, 2009). This is harmful to inner-city children of public housing in two ways: first, they have a great exposure to secondhand smoke, which is not in their control (Bryant-Stephens, 2009); second, being around people who smoke often encourages them to start smoking, ultimately leading to the destruction of their lungs and an overall increase in respiratory problems (Bryant-Stephens, 2009). This leads to an on-going cycle of poor respiratory health because these children will grow up with habits they witnessed as a child, and their future smoking will ultimately harm the next generation of urban children (Bryant-Stephens, 2009). The abundance of smoke in public housing is not only detrimental to the overall health of its inhabitants, but it greatly increases asthma prevalence. For example, in her study Bryant-Stephens found that blacks are more likely to have asthma and are 2.5 times more likely to experience asthma-related emergency room visits and hospitalizations than whites (Bryant-Stephens, 2009). Because African Americans make up a great deal of the minority individuals that live in urban areas, and more specifically inhabit public housing, there is a great need for intervention. Even a small reduction of smoke in urban areas through policies regarding public housing could lead to a great decline in asthma in the youth of Boston.

Minority groups of low-socioeconomic status are constantly exposed to harmful

allergens that aggravate asthmatic symptoms. These exposures are commonly due to factors such as the physical environment and behavior of the community's inhabitants. Although genetics is out of our control, many of the other asthma triggers such as environmental allergens and unhealthy practices can be easily eliminated from Boston public housing with simple health interventions, and doing so would greatly reduce the prevalence and incidence of asthma in the future. Asthma is a fixable health concern that contributes to detrimental problems caused by more serious health concerns. The current solution to asthma is medication; however, medical treatment for asthma only suppresses the problem. A more rational approach is the use of community health interventions to prevent respiratory health issues and substantially reduce the prevalence of asthma in urban areas. This paper will introduce three possible interventions, each at a different level of the socioecologic model, which all have the potential to greatly reduce asthma prevalence in Boston Public Housing.

Interpersonal Intervention

One possible intervention at the interpersonal level is an at-home environmental remediation program with the objective of creating an allergen-free home. This prevention strategy would be a two-part approach: part one would be an allergen-extermination process, and part two would consist of education for asthma treatment and prevention strategies. First, public housing residents would be given basic tools such as allergen-proof mattress and pillow covers, cockroach and mouse extermination services, and air purifiers to remove asthma allergens. One type of air filter that has proven to be quite successful for the prevention of asthma symptoms is the high-efficiency particulate absorption (HEPA) purifier, which removes 99.97% of particles that have a size of 0.3

micrometers or larger from the air that pass through it (Swartz et al., 2004). These products are relatively inexpensive, user-friendly, and easily replaceable. Soon after asthmatic public housing residents are encouraged to utilize these basic allergen-preventing materials, they will see a drastic change in the frequency of their symptoms. Also, people suffering from asthma and caretakers of children with asthma would be provided access to an asthma education program designed to give them the knowledge and skills necessary to maintain an environmentally healthy home. Parents of children with asthma would have the option of enrolling their children in an afterschool program taught by a public health professional. This program would teach children to recognize asthma symptoms, understand triggers, to understand methods to stop attacks, and to seek help from their parents and other adults. Parents would receive information packets that correspond with the lessons presented to their children so they can monitor their children's progress at home. In addition, public health professionals would provide at-home visits to further educate asthma-affected families at an interpersonal level.

Since the causes of asthma are still unknown, there are no primary prevention strategies that can be used to completely prevent the disease from occurring. As a result, the best way to reduce the prevalence of asthma is by using secondary prevention strategies. The aim of the study is to reduce or even eradicate the symptoms of people who are currently affected by asthma, which is why this intervention strategy is a form of secondary prevention. The intervention is designed to take place at the interpersonal level of the socioecologic model, and the interactions between community health professionals and the asthma patients and families being targeted are crucial for the success of the intervention.

The basis for this intervention is the social learning theory, which states that people, especially children, learn best within a social context. It is centered upon learning through observation and modeling (Rosenstock et al., 1988). Many individuals, especially children, are kinesthetic learners, which means they learn through active physical engagement. This intervention strategy would send public health professionals straight to the homes of families of asthma patients who live in public housing. These professionals would provide an education on exactly how to utilize the tools provided (HEPA filter, dust mite-proof mattress covers, etc.) as well as teach general home cleanliness practices with the hope of ameliorating the environments of these public housing establishments. The idea is that patients will be able to see firsthand exactly how to maintain an allergen-free home, and then they can put these strategies into practice. For the first few months of their efforts to reduce allergens, the public housing residents will receive phone calls from public health workers so they can voice any concerns and receive feedback on their progress.

Many studies show similar interventions that have been quite successful. One example is the Inner-City Asthma Study (ICAS), which used environmental counselors to help families reduce asthma exposures (Morgan et al., 2004). The study focused on six modules: dust mites, roaches, smoking, pets, rodents, and mold. Their goal was to create an environmentally safe sleeping zone, as well as to educate caretakers of asthma patients. For this study, children ages 5-11 from major cities including Boston, New York, and Chicago who had been diagnosed with asthma were randomly assigned to either the control group or the intervention group. The families of children in the intervention group were taught various environmental remediation strategies, such as pest

removal and cleaning methods by the environmental counselors, and were then asked to perform the tasks while the counselors provided feedback and encouragement. The counselors returned to homes for five mandatory and two optional home visits to monitor progress. The results of this experiment showed that patients in the intervention group had significantly fewer asthma symptoms during both the intervention year and the following year. They also had fewer asthma-related emergency room visits than did the control group. Also, levels of dust mite, cat, and cockroach allergens in bedrooms greatly decreased in the intervention group. As a result, there was a decrease in number of days with asthmatic symptoms, number of hospitalizations, and number of unscheduled asthma-related visits for both years of the study. These results exemplify that asthma-inducing allergens can be greatly reduced in the homes of inner-city children, and that this reduction is associated with a decrease in asthma-related morbidity (Morgan et al., 2004).

Another study that proves the success of such an intervention is a study conducted by Seymour G. Williams et al. in Atlanta, Georgia. In this study, children ages 5-12 and their primary caregivers were educated by community health workers on the importance of maintaining a clean home to eliminate asthma-inducing allergens (Williams et al., 2006). First, the families in the intervention group were given a one-time professional cleaning of their residences. They were then given dust mite-impermeable covers for mattresses and pillows and instructions for washing and drying sheets, blankets, carpets, furniture, and curtains. They were also instructed on proper food-handling practices to reduce the attraction of cockroaches. In addition, they were given brochures from the community health workers that reinforced the lessons they were taught at the home visits.

The results of this study showed that after eight months, the intervention group had substantially fewer dust mite and cockroach allergens than at baseline, and the control had an increased quantity of dust mite and cockroach allergens. This suggests that community health workers effectively delivered environmental interventions which lowered the levels of harmful levels in the residences of asthma-affected children (Williams et al., 2006).

An interpersonal-level environmental remediation and education intervention has the potential to greatly reduce asthma symptoms not just because it is practical and easy to follow, but also because the practices instilled in the asthma patients by the community health workers can be passed along by the public housing residents that learn them. Residents can teach each other how to maintain healthy and clean living facilities, and by doing so these habits can become ingrained in the public housing community.

Community Intervention

An intervention at the community level that could greatly reduce the prevalence of asthma in Boston public housing communities is a smoking cessation intervention. This intervention would encourage public housing residents who smoke to visit with physicians at community health clinics to discuss the respiratory health risks associated with smoking, and would provide them with supplementary reading materials emphasizing the detrimental effects of smoking on both the individual and the community. In addition, community health professionals would make telephone calls to everyone in the community to monitor the progress of the individuals who smoke and assess the effects of the intervention on the community as a whole. The visits with physicians would allow physicians to communicate with individuals in the community

and voice their concerns and advice on the importance of quitting smoking. Pamphlets would then be sent to everyone in the community highlighting the reasons why smoking is harmful to respiratory health, especially in regard to asthma. The aim of this intervention would be to greatly reduce smoking within the entire public housing community.

Just like the environmental remediation intervention, this intervention is another example of a secondary prevention program with the goal of reducing and even eradicating asthmatic symptoms in people who already show signs of asthma. It is targeted at the community level, with the hope that smoking can be greatly reduced in public housing areas, which would in turn lead to decreased asthma prevalence in public housing residents.

This intervention is based on the Stages of Change theory, which states that individuals go through a series of stages when they attempt to change a particular health behavior (Croyle, 2005). The action of changing a behavior can be broken down into five stages: pre-contemplation, contemplation, preparation, action, and maintenance. Each aspect of the proposed intervention is aimed to target one of these stages. For example, appointments with physicians at community health clinics are designed to instill the idea of quitting smoking into the patients' mind (pre-contemplation stage), and then give them the information needed to understand the process of quitting smoking (contemplation stage). Then, after the patients decide to attempt to quit smoking, community health professionals will provide pamphlets and other literature about effective ways to quit smoking (preparation stage). As the patients begin the arduous task of quitting smoking, community health professionals will call them periodically answer possible questions and

to insure that the patients are making progress (action stage). Finally, the physicians as well as the community health workers will make themselves available for follow-up appointments to make sure the patients stay non-smokers after they've quit (maintenance stage). (Croyle, 2005).

In 1999, Manfredi et al. created a community-based smoking cessation intervention that was proven to be quite effective. It was called the "IT'S TIME" Program, and it was conducted in twelve public health clinics in and around Chicago, Illinois (Manfredi et al., 1999). It consisted of clinical and supplementary after-clinic components, as well as program support components. The clinic-based strategies included video segments and posters in the waiting rooms of the public health clinics, advice from physicians to quit smoking, a motivational self-help booklet, and a provider agreement form which gave the patient the option to receive periodic phone calls to monitor progress. Adjuncts to the clinic visit included a letter that reminded the patient of the advice to quit smoking and a 15-minute phone call interview (assuming they signed the previously-mentioned agreement form) in which patients could ask questions and express concerns. The results of this study were that smokers exposed to the intervention were more likely to have quit or take actions toward quitting than smokers that were not exposed to the intervention (14.5% vs. 7.7%). Intervention participants were also found to have had higher mean action, stage of readiness, and motivation to quit scores. These criteria were established by the researchers based on statistical data collected at the end of the study to show different areas in which participants were successful, and they show that the intervention was effective (Manfredi et al., 1999).

Another innovative experiment that showed the potential for smoking cessation

interventions was a study conducted by Lipkus et al. (1999) in Durham, North Carolina. This study focused on three strategies- healthcare provider-prompting interventions, tailored print communications, and tailored telephone counseling- and how one or a combination of these strategies could be used to effectively reduce smoking (Lipkus et al., 1999). The healthcare provider-prompting intervention consisted of a computerized health maintenance tracking system that doctors used to assess the patients, and from this they could generate advice on a plan for action. The tailored print communications were designed to appeal to patients and make them see the positive effects of quitting smoking. Birthday cards with the “Healthy Birthdays Newsletter” were sent to patients with friendly reminders and smoking cessation tips. The tailored counseling was based on personalized messages depending on the person’s reasons for quitting, whether he was addicted, and his previous quitting attempts. The results of this experiment showed a 32.7% quit rate among patients who received both the provider prompting intervention with tailored print materials. These patients were more likely to have quit than smokers who received the provider intervention alone (32.7% vs. 13.2%) (Lipkus et al., 1999). The tactics used in this experiment are especially interesting because they proposed a multi-faceted approach that not only provided factual information to the members of the community, but also appealed to their emotional sides through the use of personalized messages. This provides a promising combination of strategies for future smoking cessation interventions.

The high prevalence of smoking in public housing communities is extremely detrimental to respiratory health, and personal interventions have been proven effective in instilling change in the community. If public health professionals can get enough people

in the community to quit smoking, these people can hopefully encourage others to follow in their footsteps. Interventions that address the health effects of smoking while also targeting the emotions of smokers have been proven to be successful in creating social change at the community level, which is why these interventions have the potential to be quite effective in the reduction of smoking, and in turn the reduction of asthma prevalence in Boston public housing.

Policy Intervention

One of the most effective ways that community health professionals can carry out successful interventions is by doing so at the policy level. One possible policy-level intervention that can be enacted by community health workers is a program designed to enforce housing codes and increase access to legal services when needed. This intervention would be a multidisciplinary approach between healthcare, legal, and public health professionals. Low-income tenants of public housing are not always aware of their rights, and interventions to provide them with the policy and legal services necessary to live in a healthy home would greatly reduce asthma prevalence in Boston public housing. The goals of this intervention would be achieved by providing patients with free legal assistance to address environmental hazards in public housing. Also, policy would be enacted to allow healthcare professionals provide housing inspections to asthma patients if poor housing conditions could be responsible for their asthma symptoms.

Just like the two previously proposed intervention strategies, this intervention is a form of secondary prevention. It strives to improve housing conditions for residents who already have asthma with the hope of reducing their symptoms. A policy-level intervention such as this one can greatly revolutionize the practices of landlords of public

housing. In some cases, the legal threat alone may be enough encourage the landlord to better maintain the building infrastructure; in other cases, the law may have to be enforced in order to evoke change. Either way, the policy has great potential to reduce asthma in Boston public housing.

A study done by Murphy et al. in 2011 highlights two models that successfully reduce housing-related threats and improve asthma symptoms: the Medical Legal Partnership model and the Breathe Easy at Home program in Boston. These two programs aim to improve communication between public housing for children with asthma and agencies able to enforce housing codes (Murphy et al., 2011). Many landlords avoid their responsibilities until they are threatened with legal action. Since most residents of public housing are unaware of their rights as tenants, they do not call their landlords out on unfair housing conditions. The Medical Legal Partnership model (MLP) seeks to change this by giving patients free legal assistance to address environmental hazards that are harmful to children with asthma. It strives to identify potential legal barriers to health with the goal of reducing, if not eliminating these barriers. In this model, attorneys and paralegals train healthcare providers to recognize the connections between unmet legal needs and health to develop screening questions for patients. Then, clinicians write legal form letters asking landlords to change conditions. In the Breathe Easy at Home (BEAH) program, Boston agencies, such as the Inspectional Services Department Housing Inspection Division, Boston Medical Center, and local community health centers collaborate to aid asthma patients by upholding their legal right to safe housing conditions. This web-based referral system, which was launched in 2006, allows doctors, nurses, and other health professionals to refer asthma patients for a home

inspection, conducted by the Boston Inspectional Services Department if they feel that poor housing conditions are responsible for aggravated symptoms. Both the MLP and the BEAH were so successful in Massachusetts that they were launched in many other states (Murphy et al., 2011).

Due to many factors, including low income and lack of education, many public housing residents are unaware of their rights when it comes to the maintenance of their living spaces. This is why it is crucial for policy makers to step in and address this issue. Lawmakers not only have the power to scare landlords, but they have the power to correct social injustice in Boston public housing by creating laws and policies that protect residents from asthma-inducing living conditions.

Intervention Recommendation

As seen through the literature cited in this paper, there are many possible intervention strategies that can be implemented to reduce the prevalence of asthma in Boston public housing. Asthmatic symptoms are aggravated mainly by harmful allergens present in public housing such as dust mites, mold and cockroaches. Many residents of public housing are unaware of these allergens and how easy it is to get rid of them. Very simple fixes around the house have the potential relieve suffering due to asthma symptoms, and it is for this reason that I believe the most effective intervention strategy is a combined environmental remediation service and education program on how to maintain a healthy, allergen-free home. As I previously mentioned, this strategy utilizes social learning theory to teach asthmatic children and their caretakers through observation and modeling in a kinesthetic learning style. The practices learned through interventions of this style can be passed down through residents who live in public

housing until everyone employs these techniques as part of their natural routines. This will hopefully lead to public housing facilities that are constantly maintained to insure allergen-free environments. This could allow residents to live in public housing while experiencing very few or even no asthma symptoms. This intervention strategy has been proven to be successful by studies including those of Morgan et al. and Williams et al., and with the hard work of public health professionals, it can be implemented at an interpersonal level to facilitate knowledge throughout the residents of Boston public housing to reduce asthma prevalence and to insure that this reduction is permanent.

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