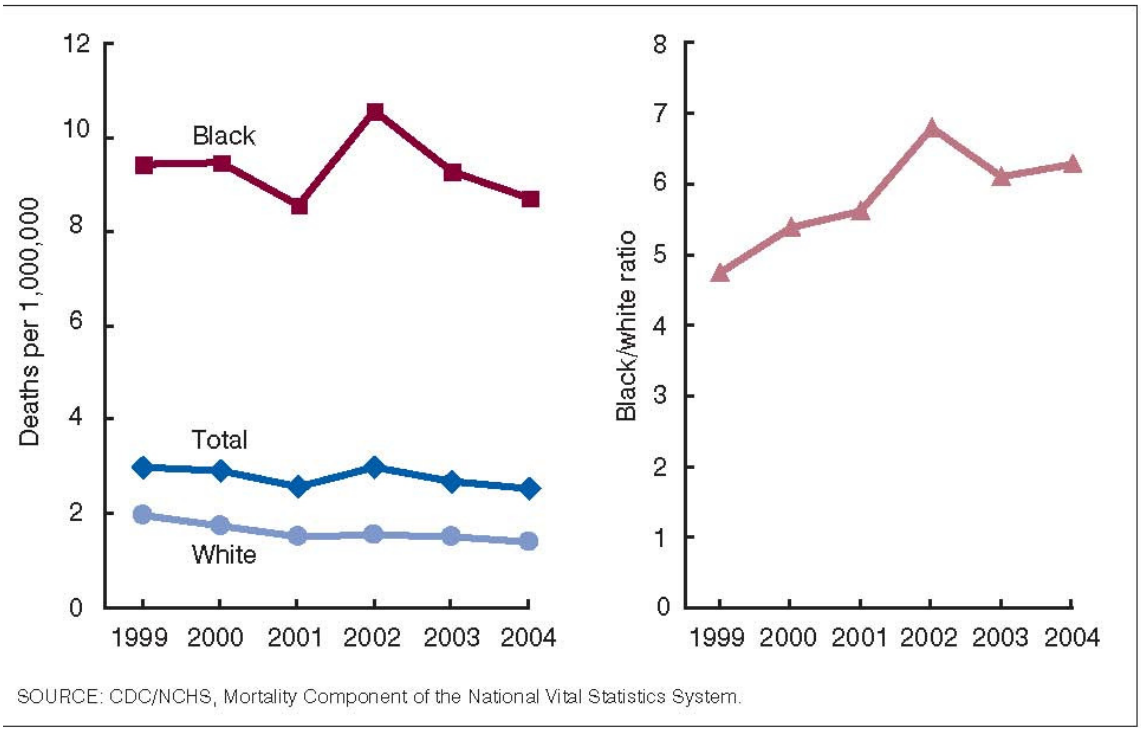
Indoor Environment Workgroup Report on Asthma Disparities

Attachment to March 31, 2011 CHPAC Letter to the EPA Administrator

The Centers for Disease Control and Prevention have reported that Black children are 2-3 times more likely to be hospitalized and 5 times more likely to die from asthma (see Figure 1). Although access to care may be a contributing factor, the environmental exposures for children who live in substandard housing also play an important role. Substandard housing, overcrowding, and deteriorating conditions in indoor environments daily impact the lives of children with asthma in the Living (home, shelters) and Learning (schools, childcare, preschool, Head Start) Environments.

Figure 1. Number of deaths due to asthma per 1,000,000 children 0 to 17 years of age by race, United State, 1999 to 2004 and ratio of black to white asthma death rates, children 0 to 17 years of age, United States, 1999 to 2004. (Akinbami, 2006)

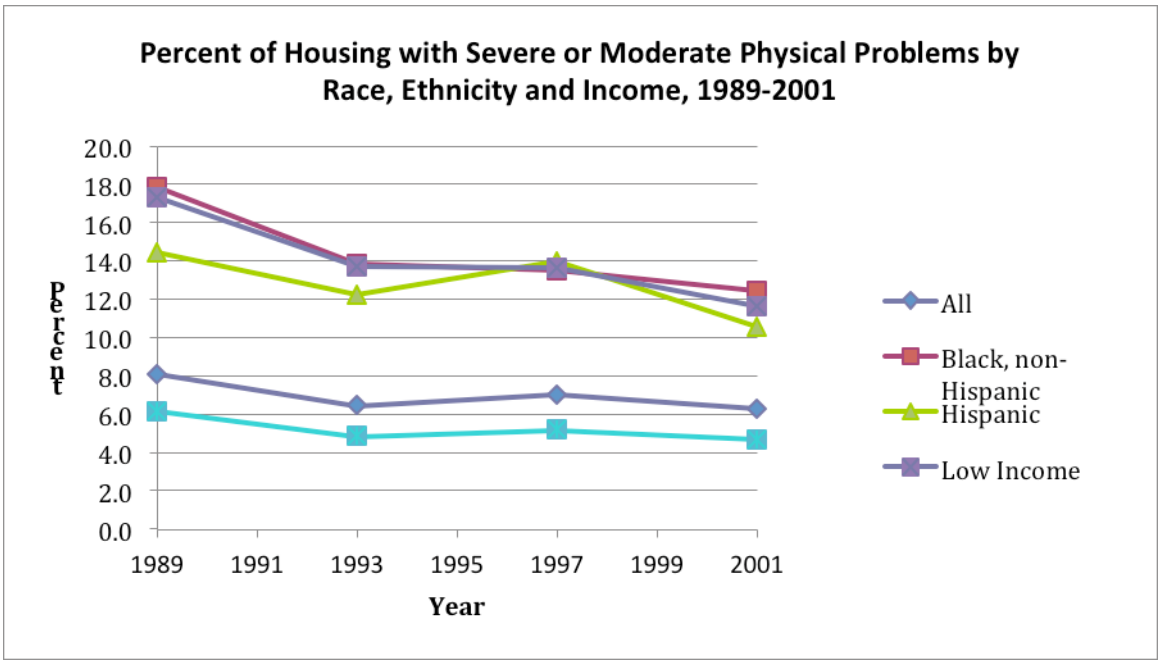


Indoor biologic and chemical agents figure prominently among environmental factors implicated in asthma morbidity, including allergens from cockroaches, rodents, dust mites, and fungi, in addition to respiratory irritants such as fungal cell wall components, formaldehyde, oxides of nitrogen, tobacco smoke and volatile organic compounds. **Children with asthma are exposed to many of these agents in the Living and Learning Environments**.

Living Environments

Housing stock in disadvantaged communities is often old and poorly maintained. The deteriorated state of the housing stock results in increased exposures to many asthma triggers and toxins associated with asthma symptoms. Exposure to moisture/mold from common sources of water and moisture include structural membrane leaks, condensation, damp foundations and crawl spaces, inadequate ventilation, activities such as bathing and cooking, and unattended plumbing problems. Structural and plumbing deficiencies in a home provide entry points for pests, which are attracted by hidden food spills and garbage. Inadequately maintained heating and ventilation systems can disburse allergen-containing dust throughout the indoor environment. Repeated hospitalizations for childhood asthma have been correlated with children residing in the census tracts with the highest proportion of crowded housing conditions, highest racial minorities, and highest neighborhood level poverty. Furthermore, the American Housing Survey shows that there has been little progress in eliminating the disparities in housing quality by race and income since at least the 1980s (see Figure 2). Housing with severe and moderate physical problems is associated with asthma and high allergen levels.

Figure 2. Housing data from the US Census Bureau American Housing Survey: 2005



Graph courtesy of David Jacobs, National Center for Healthy Housing, Washington, DC

Excess moisture supports the growth of mold and provides an environment favorable to dust mites, cockroaches, and rodents. A recent federal survey found that more than 80 percent of homes in the United States have detectable levels of house dust mite allergen in the bedroom, 46 percent have levels above 2 µg/mg, and 24 percent have

levels above 10 μg/mg, which are often used as clinically important thresholds. However, these thresholds have not been updated in over a decade. Levels in minority and low-income households are even higher. Dust mite allergens are the only class of inhalant allergens for which the National Academy of Sciences found sufficient evidence for a causal association between exposure and the development of asthma. Yet other airborne allergens including cat, cockroach, and environmental tobacco smoke have been found by the Institute of Medicine to directly cause exacerbations disproportionately in poor and minority communities leading to more hospitalizations and deaths in this population.

One of the most common allergens in the inner city, cockroach allergen has been directly associated with asthma exacerbations resulting in increased emergency room visits and hospitalizations. Heavy infestations in homes may create reservoirs of allergen in carpets, rugs, beds, and in areas that are difficult to reach behind appliances and furniture. A detectable level of cockroach allergen is found in 63 percent of dwellings in the United States, and 10.2 percent of all dwellings have cockroach allergen levels above the asthma morbidity cut-point.

In addition, mouse allergen has emerged as an important allergen in low-income, inner-city dwellings. For example, the National Cooperative Inner-City Asthma Study (NCICAS) found that 95 percent of all homes assessed had detectable mouse allergen in at least one room, suggesting that mouse allergens are widely distributed in inner-city homes. Epidemiologic and laboratory evidence also links the presence of mold and moisture to poor health outcomes, such as cough, wheeze, and other asthma symptoms. Mold is associated with exacerbation of allergic rhinitis and allergic asthma in those people who are sensitized to mold and often found in deteriorating housing stock.

Perhaps the most common asthma indoor trigger, environmental tobacco smoke (ETS), has a strong association with asthma symptoms and morbidity whether it is of primary or secondary exposure. Evidence for causal relationship between ETS and exists for prenatal, perinatal and postnasal exposure. NCICAS found that 59 percent of children with asthma were exposed to ETS in their homes and similar findings have been reported in other studies. In addition, more patients reporting ETS exposure also report exposure to cockroach allergen and mold than those not reporting ETS exposure. Tobacco exposure has a strong association with asthma symptoms and morbidity, regardless of the type of exposure (primary, secondhand, thirdhand). The December 2010 US Surgeon General report on tobacco smoke found that even brief exposures to tobacco smoke cause immediate cellular and DNA injury, and there is no risk-free level of exposure.

Learning Environments

In addition to the Living Environment, it is critical to consider the time that children spend in Learning Environments—schools, childcare, and Head Start—and how those

environments impact childhood asthma disparities. In the US, over the past decade, more than 50 million children are enrolled in schools, and more than half of the children ages 3–5 have attended center-based childcare programs. Children miss more than 14 million school days each year in part due to asthma exacerbated by unhealthy school environments. Since children spend most of their waking hours in the Learning Environment more than in any other environment, it is essential that their indoor environments be asthma trigger free. As found in US housing stock, Learning Environments, particularly those in disadvantaged communities, are old and often poorly maintained. Research has documented that school environmental health issues such as indoor air quality (IAQ), green cleaning, pest control, maintenance, school siting and school construction are correlated with childhood asthma symptoms among student populations .

Due to the poor quality of many Learning Environments, they become breeding grounds for asthma environmental triggers, such as allergens (dust mite, cockroach, rodent, pet), toxins and tobacco smoke. Physical (humidity, temperature), structural (age, type of building) and behavioral factors (occupant pet ownership, cleaning and maintenance practices) influence these exposures. Allergen levels exceeding sensitization thresholds associated with allergic sensitization and asthma morbidity have been found in Learning Environments. For example, cat, cockroach and mice allergens are commonly detected in schools at levels that are high enough to cause asthma symptoms. In Learning Environments that cater to disparate populations, the presence of these allergens may disrupt the child's ability to learn and to attend school. Additionally, allergen exposures in Learning Environments may compromise the impact of Living Environment allergen reduction measures on asthma symptoms. Given these findings it is important to study and to implement cost-effective approaches to reduce environmental triggers in the Learning Environment.

Schools that serve low-income and minority students suffer disproportionately from poor IAQ, which can cause or aggravate asthma. One in five schools in the United States report unsatisfactory IAQ; one in four has inadequate ventilation. Unsatisfactory IAQ in schools is generally due to lack of proper heating, ventilation, and air conditioning (HVAC) systems, poor maintenance and unaddressed water damage. The resulting dirt, dust, lead, asbestos fibers, chemical vapors, carbon monoxide and other gases, pesticides, bacteria, molds, and many other contaminants from equipment (such as photocopiers and computers) exacerbate the already negative health effects of diesel bus exhaust on children.

Other sources of indoor air pollution in schools include pesticides, mold, cockroach dander, radon, cleaning products, and chemicals in science classroom laboratories. Many schools use conventional cleaning products and some of these products contain chemicals suspected of being harmful especially to individuals prone to respiratory disease. Despite the fact that many safer alternatives are available, cleaning products used in some schools contain toxic chemicals and are asthma irritants. This type of

exposure in the school environment is of special concern because children are especially vulnerable to toxic exposure and the many of the chemicals contained in traditional cleaning products are known asthma triggers. Research shows that minorities, as a group, tend to have more exposure to toxic chemicals than their Caucasian counterparts, through exposure in their communities, homes and workplaces.

Evidence-Based Interventions

NCICAS used established sensitization levels for many of the indoor asthma allergens. These levels should be standardized and controlled for public and federal-assisted homes of children with asthma.

Environmental mitigation interventions that have proven to be important in addressing indoor environmental exposures for children with asthma are multi-component in both the Living and Learning Environments. Such methods include Integrated Pest Management (IPM), dust mitigation strategies, eliminating environmental tobacco smoke exposure and green cleaning. IPM is a safe, effective and scientific approach to controlling pests, including cockroaches and rodents, that focuses on prevention, comprehensive inspections, constant monitoring and the use of enclosed tamper-proof pesticide baits and traps to get rid of roaches while using the least-hazardous methods. Additionally, EPA has developed second hand smoke reduction tools which should be widely disseminated.

Green cleaning programs incorporate the use of less-toxic cleaning chemicals, equipment that reduces the need for cleaning solutions and cleaning procedures that focus on health, thus reducing exposure to toxins for the living and learning environments.

Summary

Since 1999 when the asthma report of the President's Task Force on Environmental Health and Safety Risks to Children was issued, new research has clearly demonstrated that in-home multi-faceted tailored asthma interventions are effective, but interventions that focus on a single factor are far less likely to work. We believe that it is essential for EPA to act on this new evidence, most of which did not exist in 1999. Additional action is needed in both the Living and Learning Environments, where together children spend most of their time. The CHPAC recommendations (see March 31, 2011, letter) are both for EPA to work within the agency and to reach out to key stakeholders.

In general, CHPAC believes that the indoor environment has not received the attention it deserves. For example, there are clear exposure limits and standardized environmental measurement protocols for outdoor air, but few exist for the indoor environment, where children spend most of their time and where exposures to

hazardous agents are often far higher. EPA has championed indoor guidance for radon and standards for residential lead-based paint hazards, and has conducted important research on mold (fungi) and many other toxins found in the indoor environment. It has also led the way in creating important asthma educational materials, such as “tools for schools.” However the vast majority of hazardous agents in the indoor environment remain largely unregulated and unrecognized, which places American children at unnecessary risk.

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