**DIRECT FROM HUD**

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# HUD's Healthy Homes Program: Progress and Future Directions

**Editor's Note: The home environment is important to all of us. We spend a great amount of time in our homes and it's important for our homes to be free from hazards that may be detrimental to health. Environmental health plays an important role in the healthy homes approach—a coordinated, comprehensive, and holistic approach to preventing diseases and injuries that result from housing-related hazards and deficiencies.**

**In pursuit of providing relevant information on this topic, NEHA is pleased to feature a new column from the U.S. Department of Housing and Urban Development's (HUD's) Office of Lead Hazard Control and Healthy Homes (OLHCHH). The mission of OLHCHH is to help ensure that all Americans, but especially low-income households and other vulnerable population, live in homes that are free of significant health and safety hazards. OLHCHH does this by awarding grants to create lead-safe healthy housing, supporting healthy housing research, enforcing federal regulations, conducting outreach and education, and promoting healthy homes issues such as smoke-free housing and the use of integrated pest management.**

**The conclusions in this column are those of the author(s) and do not necessarily represent the views of HUD.**

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What conditions in a home pose the most significant health risk to residents? How are these potentially hazardous conditions/risk factors distributed among both the U.S. housing stock and the U.S. population? What are cost-effective protocols for identifying and mitigating these hazards? These are questions that the U.S. Department of Housing and Urban Development's (HUD's) Office of Lead Hazard Control and Healthy Homes (OLHCHH) has grappled with since the inception of the Healthy Homes Initiative (now Program) in 1999. The Healthy Homes (HH) Initiative was a supplement to the Office's Lead Hazard Control Program, which was created in 1993 with the mission of reducing the risk of childhood lead poisoning by providing grants to state and local governments to create lead-safe housing for low-income families with young children.

In establishing the HH Initiative, HUD was directed by Congress to obtain the advice of experts in order to "develop and implement a program of research and demonstration projects that would address multiple housing-related problems affecting the health of children." The health effects of mold exposure were of particular interest to some members of Congress at the time, and a portion of HUD's initial appropriation for HH activities was to fund research and demonstration projects on residential mold. The HH movement was initiated by residential hazard control professionals who became aware of the fact that homes with lead hazards often had other hazardous conditions as well (e.g., mold, pests).

The experts who were engaged by HUD identified a list of priority issues that included lead, allergens, mold and moisture, pests and pesticides, radon, asbestos, indoor air quality (IAQ), injury and fire hazards, and drinking water contamination (U.S. Department of Housing and Urban Development [HUD], 1999). The panel further identified the following cross-cutting interventions that, when implemented, could each address multiple hazards: moisture control, dust control, IAQ improvements, and resident education. For example, reducing excess moisture can prevent paint failure (a lead hazard), reduce the likelihood of mold growth, and prevent the amplification of allergens such as dust mite and cockroach. Dust control can reduce exposure to lead, allergens, and toxins (e.g., pesticides) that can be tracked into the home from the outside. In this way, the HH model promotes the movement away from single-issue programs (e.g., radon, lead hazard control) towards a more integrated model that includes a thorough

home assessment followed by interventions to address multiple priority hazards. As identified by the expert panel, resident education is a key program component because of the important influence residents have on indoor environmental quality (e.g., food storage, cleaning habits, smoking behavior).

An increased focus on the issue of health disparities (i.e., the fact that lower socioeconomic status populations have a disproportionately high burden of disease) in recent years has also helped to focus attention on the home environment as an important "social determinant of health." Childhood lead poisoning is a clear example of how substandard housing can adversely affect the health of disadvantaged populations. Since national level data have been available, children in poor households have been at the highest risk of lead exposure, with African-American children being at greatest risk among this group. Childhood lead exposure also represents an example of a public health success story resulting from the efforts of sustained and coordinated actions by federal, state, and local governments and nongovernmental organizations (NGOs). Through the concerted efforts of government to remove lead from house paint, gasoline, food containers, and consumer products, and support for blood lead surveillance in children and targeted interventions to create lead-safe housing, the geometric mean blood lead level in children fell from 15 μg/dL in 1976–1980 to 1.3 μg/dL in 2007–2010 (Centers for Disease Control and Prevention [CDC], 2013). This also resulted in a reduction in the disparities of childhood lead exposure by race and income and saved billions in averted costs in areas such as health care and special education and preventing the productivity losses attributable to lead-induced IQ reductions.

A Centers for Disease Control and Prevention analysis of data from the American Housing Survey (AHS) also identified disparities in the distribution of homes with moderate or severe physical problems (e.g., deficiencies in plumbing, heating, electrical systems) (CDC, 2011). In the 2009 survey, approximately 5.7 million homes (5.2% of housing) were considered inadequate because of the presence of moderate or severe physical problems. A significantly higher risk for housing inadequacy was identified by race/ethnicity (higher among Hispanic and African-American, non-Hispanic households), lower educational attainment, and lower income. A similar, although less pronounced, pattern was reported for survey variables grouped to create an "unhealthy housing" index (i.e., observation of rodents, water leaks, peeling paint, lack of a working smoke alarm). The OLHCHH organized the inclusion of additional questions on residential health hazards in the 2011 AHS. Initial data analysis identified a higher frequency of risk factors such as mold, fall and fire hazards, and cockroach infestation in households the lowest income quartile (Ashley, Cox, Kaufman, & Pinzer, 2014).

Annual funding for HUD's HH Program has ranged from approximately $8 million to $20 million, with a fiscal year 2015 budget of $15 million. The program has been implemented through competitively awarded demonstration, research, and production grants; interagency agreements (i.e., formal contractual agreements between federal agencies); and contracts. The grants have been instrumental in developing local capacity and knowledge, demonstrating and evaluating different program models, and supporting key research in areas such as integrated pest management, IAQ, and home interventions to improve the health of children with poorly controlled asthma. One of the first program grants supported a randomized controlled trial that targeted children with asthma living in homes with mold and moisture problems. Medical care was optimized for children in both control and intervention groups and both received education; however, only the intervention group received mold mitigation. The remediation group had a significant reduction in symptom days and in the need for acute asthma care (Kerscmar et al., 2006). Other grant-supported research has demonstrated elevated concentrations of nitrogen dioxide and carbon monoxide in homes with unvented gas fireplaces and the efficacy of integrated pest management in controlling cockroaches in multi-unit housing (Francisco, Gordon, & Rose, 2010; Wang & Bennett, 2009).

In 2009, HUD published an HH strategic plan that incorporated the experience gained over the previous decade and identified goals and strategies for the program to pursue (HUD, 2009). The plan identified four broad goal areas: improving partnerships among federal agencies and with NGOs, supporting key research activities, strategically incorporating HH principles into existing programs and movements, and developing local capacity to create and sustain HH programs. Actions taken by OLHCHH to implement this plan include the creation of a federal Healthy Homes Work Group to foster partnership and coordination among federal agencies.

The HH movement was given a boost by the publication of the *Surgeon General's Call to Action to Promote Healthy Homes* in 2009 (U.S. Department of Health and Human Services, 2009). The document identifies priority residential hazards and actions to mitigate the hazards, summarizes key research needs, and identifies actions that can be taken by individuals, housing providers, governmental agencies, and NGOs for "ensuring healthy, safe, affordable, and accessible homes." In the area of research, the document cites the need for developing new methods for housing intervention research (i.e., acknowledging the ethical and design challenges of conducting housing intervention research using randomized controlled trials), developing better cost-benefit data on HH interventions, and improving our understanding in areas such as the impact of the residential environment on mental health, noise and health, and the health effects from exposure to chemicals in the home.

Because of the importance of residential exposures in exacerbating asthma (and possibly contributing to its development), program-supported activities have frequently focused on this issue. The National Survey of Lead and Allergens in Housing (1999–2000), sponsored by HUD and the National Institute of Environmental Health Sciences, included the collection of settled dust samples for allergen analysis and the assessment of homes for the presence of one or more lead-based paint hazards. The presence of multiple allergens was common; 51.5% of homes had at least six detectable allergens and 45.8% had at least three allergens at elevated concentrations (Salo et al., 2008). Among asthmatic residents with a doctor-diagnosed allergy (77%), the odds of having recent asthma symptoms were 81% greater in homes with high allergen burdens. The classification of households as white was one of the strongest predictors of high allergen burden (driven by higher concentrations of *Alternaria*, dust mite, cat, and dog allergens). Elevated levels of cockroach and mouse allergen were significantly higher in non-white and

poor households, which suggests that exposure to these allergens is likely a contributing factor to the disproportionately high burden of asthma among African-American children and children from poor households (President's Task Force on Environmental Health Risks and Safety Risks to Children, 2012).

A similar national survey (the American Healthy Homes Survey) was conducted by HUD (teaming with the U.S. Environmental Protection Agency [U.S. EPA]) in 2006 (HUD, 2011). A unique aspect of this survey was an analysis of mold in dust samples using a polymerase chain reaction–based method developed by U.S. EPA researchers in a previous HUD-sponsored study (Vesper et al., 2004). This resulted in a national distribution of dust samples based on the environmental relative moldiness index (ERMI), an index that is based on 36 mold species, representing both common background molds and molds that are indicative of wet or damp conditions (Vesper et al., 2007). More recent HUD-sponsored research included ERMI analysis of dust samples from a longitudinal study of asthma development, and found that mold exposures during the first year of life predicted the presence of asthma in the children at age seven (Reponen et al., 2011).

Grant-funded demonstration projects and studies have illustrated the value of using community health workers (i.e., trained members of the target community), nurses, environmental specialists, and others to conduct in-home interventions, with some also reporting a positive return on investment from the interventions (Polivka, Chaudry, Crawford, Bouton, & Sweet, 2011). For example, the Multnomah County (Oregon) Health Department used two demonstration grants to assess the benefits of in-home interventions for children with asthma and reported a reduction in emergency department visits and hospitalizations following interventions, resulting in significant medical cost savings (Harris-Tierney, 2014). The program leveraged these findings to receive reimbursement for home asthma visits through the state's Medicaid program under the category of "targeted case management."

Although the examples of program-sponsored activities discussed above focused on specific research findings or health outcomes (i.e., asthma), it is important not to lose sight of the HH paradigm of reducing residential hazards (and the associated adverse health outcomes) through integrated interventions that address multiple hazards. This can only be accomplished through the coordinated efforts of federal agencies; work that is being guided by a strategy that was developed by the Federal Healthy Homes Work Group under the auspices of the President's Task Force on Environmental Health Risks and Safety Risks to Children (Federal Healthy Homes Work Group, 2013). One current example of interagency coordination is support for research on IAQ by a team of agencies including HUD, U.S. EPA, and the Department of Energy. The research, conducted by scientists at the Lawrence Berkeley National Laboratory, has resulted in publications on priority IAQ hazards, the potential health impacts from exposure to indoor air pollutants (IAPs), and the need for improvements in kitchen range exhaust hoods. Among the findings of this effort was that the cumulative modeled health impact of IAPs was driven by exposure to several common pollutants (e.g., $PM_{2.5}$, acrolein, and formaldehyde) and that the modeled health impact was similar or greater to the impacts from exposure to secondhand tobacco smoke and radon (Logue, Price, Sherman, & Singer, 2012).

Federal agencies can help establish the infrastructure, support research, and develop policies and tools to promote healthy housing in the U.S., but systems change will be needed to significantly increase the supply and equitable distribution of healthy housing. State and local governments and NGOs must recognize the value of healthy housing and strategically and creatively target resources to create sustainable supplies of quality, healthy housing. Increased public knowledge and awareness is needed to create the demand for green and healthy housing, in both the context of new construction and housing rehabilitation. Building and housing codes need to be modified to better protect the health of residents and the codes need to be widely adopted and effectively enforced. Finally, we are seeing changes in the health care sector that will facilitate coverage of the costs of some evidence-based in-home interventions (e.g., for poorly controlled asthma) by insurers when a clear return on investment is evident. The healthy homes movement is indeed gaining momentum and the American public will benefit through improvements in both health and quality of life.

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