

Housing and Health: Time Again for Public Health Action

James Krieger, MD, MPH, and Donna L. Higgins, PhD

Poor housing conditions are associated with a wide range of health conditions, including respiratory infections, asthma, lead poisoning, injuries, and mental health. Addressing housing issues offers public health practitioners an opportunity to address an important social determinant of health. Public health has long been involved in housing issues. In the 19th century, health officials targeted poor sanitation, crowding, and inadequate ventilation to reduce infectious diseases as well as fire hazards to decrease injuries. Today, public health departments can employ multiple strategies to improve housing, such as developing and enforcing housing guidelines and codes, implementing “Healthy Homes” programs to improve indoor environmental quality, assessing housing conditions, and advocating for healthy, affordable housing. Now is the time for public health to create healthier homes by confronting substandard housing. (*Am J Public Health*. 2002;92:758–768)

Housing is an important determinant of health, and substandard housing is a major public health issue.¹ Each year in the United States, 13.5 million nonfatal injuries occur in and around the home,² 2900 people die in house fires,³ and 2 million people make emergency room visits for asthma.⁴ One million young children in the United States have blood lead levels high enough to adversely affect their intelligence, behavior, and development.⁵ Two million Americans occupy homes with severe physical problems, and an additional 4.8 million live in homes with moderate problems.⁶

The public health community has grown increasingly aware of the importance of social determinants of health (including housing) in recent years,⁷ yet defining the role of public health practitioners in influencing housing conditions has been challenging. Responsibility for social determinants of health is seen as lying primarily outside the scope of public health.

The quality and accessibility of housing is, however, a particularly appropriate area for public health involvement. An evolving body of scientific evidence demonstrates solid relations between housing and health. The public health community is developing, testing, and implementing effective interventions that yield health benefits through improved housing quality. Public health agencies have valuable expertise and resources to contribute to a multisectoral approach to housing concerns. Public health has a long (albeit intermittent)

history of involvement in the housing arena, and this involvement is generally accepted by other housing stakeholders (e.g., building departments, community housing advocates). Housing-related health concerns such as lead exposure and asthma are highly visible.

The public is also concerned about the quality and accessibility of housing as affordable housing becomes scarcer.⁸ Elected officials and communities alike recognize that substandard housing is an important social justice issue that adversely influences health.

In this article, we describe some of the evidence linking housing conditions to health, place public health’s role in addressing housing issues in an historical context, provide examples of contemporary local public health activities in the housing arena, and conclude with suggestions for public health action in the next decade.

HOUSING AS A DETERMINANT OF HEALTH

An increasing body of evidence has associated housing quality with morbidity from infectious diseases, chronic illnesses, injuries, poor nutrition, and mental disorders. We present some of this evidence in the following section.

Infectious Diseases

Features of substandard housing, including lack of safe drinking water, absence of hot water for washing, ineffective waste disposal,

intrusion by disease vectors (e.g., insects and rats) and inadequate food storage have long been identified as contributing to the spread of infectious diseases.^{9–11} Crowding is associated with transmission of tuberculosis¹² and respiratory infections.^{13–16} Lack of housing and the overcrowding found in temporary housing for the homeless also contribute to morbidity from respiratory infections and activation of tuberculosis.^{17–20}

Chronic Diseases

In more recent years, epidemiological studies have linked substandard housing with an increased risk of chronic illness. Damp, cold, and moldy housing is associated with asthma and other chronic respiratory symptoms, even after potentially confounding factors such as income, social class, smoking, crowding, and unemployment are controlled for.^{21–31} Water intrusion is a major contributor to problems with dampness. In 1999, eleven million occupied homes in America had interior leaks and 14 million had exterior leaks.⁶ Overcrowding and inadequate ventilation also increase interior moisture.³² Damp houses provide a nurturing environment for mites, roaches, respiratory viruses, and molds, all of which play a role in respiratory disease pathogenesis.^{33–39} Cross-sectional epidemiological studies have also established associations between damp and moldy housing and recurrent headaches, fever, nausea and vomiting, and sore throats.^{37,40}

Old, dirty carpeting, often found in substandard housing, is an important reservoir for dust, allergens, and toxic chemicals.^{41,42} Exposure to these agents can result in allergic, respiratory, neurological, and hematologic illnesses.

Pest infestations, through their association with asthma, provide another linkage between substandard housing and chronic illness. Cockroaches can cause allergic sensitization and have emerged as an important asthma trigger in inner-city neighborhoods. Children with asthma who are sensitized and exposed to cockroaches are at elevated risk for hospitalization.⁴³ Mouse allergen also acts as a clini-

cally important cause of allergy and asthma morbidity.⁴⁴ Structural defects permit entry of cockroaches and rodents; leaking pipes and other sources of water provide them with water to drink. Inadequate food storage and disposal facilities provide them with opportunities for obtaining food. Dead spaces in walls harbor pests and permit circulation among apartments in multiunit dwellings.¹¹

Deviation of indoor temperature beyond a relatively narrow range has been associated with increased risk of cardiovascular disease.⁴⁵ Living in cold housing has been associated with lower general health status and increased use of health services.⁴⁶ These health concerns have contributed to the development of standards for thermal comfort.⁴⁷

Exposure to toxic substances found in homes can result in chronic health problems. The association of passive exposure to indoor tobacco smoke with respiratory disease is well documented.^{48–50} Poor ventilation may increase exposure to smoke.³⁷ Indoor exposure to nitrogen dioxide (from inadequately vented or poorly functioning combustion appliances) has been associated with asthma symptoms.³⁷ Exposure to volatile organic compounds (emitted by particle board and floor coverings) may be associated with asthma and sick building syndrome.³⁷ Moderately elevated levels of carbon monoxide (from poorly functioning heating systems) cause headache, whereas higher levels result in acute intoxication.⁵¹ The relation between lead exposure (from leaded paints) and neurodevelopmental abnormalities is clearly established,^{52,53} and additional evidence suggests an association with hypertension.⁵⁴ Asbestos exposure (from deteriorating insulation) can cause mesothelioma and lung cancer.⁵⁵ Polyvinyl chloride flooring and textile wall materials have been associated with bronchial obstruction during the first 2 years of life.⁵⁶ Residential exposure to radon, which is increased by structural defects in basements, can cause lung cancer.⁵⁷ Old carpeting can contain pesticide residues and other compounds such as polycyclic aromatic hydrocarbons.^{58,59}

Injuries

The importance of designing homes to prevent injuries has received long-standing attention,⁶⁰ especially with regard to reducing

burns and falls.⁶¹ Attributes of substandard housing that increase the risk of injury include exposed heating sources, unprotected upper-story windows and low sill heights,⁶² slippery surfaces,⁶³ breakable window glass in sites with a high likelihood of contact, and poorly designed stairs with inadequate lighting.⁶⁴ Building design and materials influence the risk of injury from fires. These hazards are frequently present in temporary accommodations provided to homeless women and young children.²⁰

Childhood Development and Nutrition

Recent analyses of longitudinal cohorts of children have examined the influence of childhood housing conditions on the subsequent development of chronic diseases. A study conducted in Britain demonstrated modest associations of inadequate ventilation with overall mortality (respiratory mortality was not specifically examined) and type of water supply with coronary heart disease mortality, independent of other measures of deprivation.⁶⁵ Another cohort study suggested that recurrent periods of housing deprivation during the participants' first 33 years of life were associated with disability or severe ill health.²⁷

Lack of affordable housing has been linked to inadequate nutrition, especially among children. Relatively expensive housing may force low-income tenants to use more of their resources to obtain shelter, leaving less for other necessities such as food.⁶⁶ Children from low-income families receiving housing subsidies showed increased growth compared with children whose families were on a subsidy waiting list, an observation consistent with the idea that subsidies provide a protective effect against childhood undernutrition.⁶⁷ Temporary housing for homeless children often lacks cooking facilities, leading to poor nutrition.²⁰

Mental Health

Substandard housing may also adversely affect mental health, although the evidence is more tentative. Excessive indoor temperature has been linked with irritability and social intolerance.^{68,69} Damp, moldy, and cold indoor conditions may be associated with anxiety and depression.⁷⁰ A study in Glasgow demonstrated that dampness was significantly and independently associated with poorer mental

health.⁷¹ Crowding was associated with psychological distress among women aged 25 to 45 in London.⁷² Homelessness and living in substandard, temporary housing has been related to behavioral problems among children.⁷³ Substandard housing conditions may lead to social isolation because occupants are reluctant to invite guests into their homes. High-rise buildings may inhibit social interaction because they lack common spaces.⁷⁴

In summary, substandard housing affects multiple dimensions of health. There is evidence that, in part, poor housing conditions contribute to increasing exposure to biological (e.g., allergens), chemical (e.g., lead) and physical (e.g., thermal stress) hazards, which directly affect physiological and biochemical processes. In addition, concerns about substandard housing and fear of homelessness are psychosocial stressors that can lead to mental health problems. Preliminary research has suggested that residents' perceptions of their homes (e.g., pride in and satisfaction with their dwelling and concerns about indoor air quality) are associated with self-rated health status.⁷⁵ Stress induced by substandard housing may also play a pervasive role in undermining health by increasing the allostatic load⁷⁶ on the body; this hypothesis merits further investigation. For example, excessive noise (common in poorly insulated housing units) has been associated with sleep deprivation that leads to psychological stress and activation of the hypothalamic–pituitary–adrenal axis and sympathetic nervous system. These factors are major contributors to allostatic load (the wear and tear accumulated by an organism as a result of physiological responses to environmental stressors).^{77,78}

Neighborhood Effects

Beyond the condition of the housing unit itself, the site of the home may be a determinant of health. Neighborhood-level effects on health have been documented; these include elevated rates of intentional injury,^{79,80} poor birth outcomes,⁸¹ cardiovascular disease,⁸² HIV,⁸³ gonorrhea,⁸⁴ tuberculosis,⁸⁵ depression,⁸⁶ physical inactivity,^{87,88} and all-cause mortality^{89–91} in neighborhoods of low socioeconomic status, independent of individual-level risk factors. Several features of these neighborhoods may contribute to poor

health. Air quality may be poor because of their proximity to sources of vehicle exhaust emissions such as major roads, bus depots, airports, and trucking routes.⁹² These sources also create substantial noise exposure, which may be associated with a range of adverse health effects.⁹³ Sites of improper waste disposal can harbor pests, which can then infest homes. Yet it is possible to design neighborhoods to promote health by considering sidewalk and street design, the presence of green spaces and recreational sites, and the location of schools, work, and shopping within walking distance of homes.^{94,95}

Social dimensions of neighborhoods also affect health. Sampson and colleagues examined the relation between collective efficacy (a combination of trust, social cohesion, and informal social control) and violence in Chicago neighborhoods and concluded that rates of neighborhood violence were lower in areas with high collective efficacy.⁷⁹ In addition, physical insecurity and violence can cause people to stay in their homes,⁹⁶ thus limiting physical activity.

Disparities in Housing, Disparities in Health

Exposure to substandard housing is not evenly distributed across populations. People of color and people with low income are disproportionately affected. For example, Blacks and low-income people are 1.7 times and 2.2 times more likely, respectively, to occupy homes with severe physical problems compared with the general population.⁶ People with low income are more likely to live in overcrowded homes. Disparities in asthma morbidity may be attributable, in part, to disproportionate exposure to indoor environmental asthma triggers associated with living in substandard housing.^{97,98} Injuries occur more commonly in low-income households because of substandard conditions and a lack of resources to repair them. Clutter stemming from lack of storage space and hazardous cooking facilities also contribute to increased risk of injury from fire.⁹⁹ Homes of people with low income are more likely to be too warm or too cool because they are less well insulated, often have relatively expensive forms of heating such as electric baseboards, and frequently lack air conditioning.^{100,101} Ad-

NEIGHBOR'S SMOKING COMBINES WITH A STRUCTURAL DEFECT

When 5-year-old Jose and his 3-year-old sister Maria suddenly developed breathing problems, their doctor was puzzled. The usual medical treatments didn't work, and the symptoms persisted even after their mother followed instructions to rid the apartment of rugs, dust, and cockroaches. The pediatrician initially disregarded the mother's frustration with her neighbor's smoking—until she realized that the smoke flowed right into Jose and Maria's apartment through a large hole in the living room wall.^{1(p8)}

ditionally, occupants often cannot afford to pay for the energy needed to make their homes comfortable. As housing and energy prices continue to climb, low- and moderate-income households make tradeoffs between having enough food, staying warm, and living in adequate housing, with resultant adverse effects on health.

PUBLIC HEALTH AND HOUSING: A LONG-STANDING RELATIONSHIP

The notion of housing as a public health issue is not new. In the middle of the 19th century, pathologist Rudolf Virchow advised city leaders that poorly maintained, crowded housing was associated with higher rates of infectious disease transmission.¹⁰² Engels, in his study of the working class in England, noted that "There is ample proof that the dwellings of the workers who live in the slums, combined with other adverse factors, give rise to many illnesses."¹⁰³ "Slum clearance" and improving the quality of housing and sanitation were important components of 19th- and early-20th-century campaigns to control typhus, tuberculosis, and other infectious diseases.^{104–106}

Interest in housing as a determinant of health has fluctuated in response to housing-related infectious disease outbreaks (e.g., cholera in New York City in the 1830s), social unrest and class conflict, industrialist interest in

maintaining a healthier workforce, and economic downturns leading to crises in housing availability and quality.¹⁰⁷ Thus, interest in housing and health increased in the early 19th century because of concerns regarding infectious diseases. Later in the century, the sanitary reform movement was spurred by urban industrialization and growing class conflict. The depression and social unrest of the 1930s brought renewed public health attention to housing. During the post-World War II period, a lack of affordable housing, exacerbated by the return of veterans and migration from the rural South, increased the prominence of the housing issue. In the 1960s through the 1980s, activists addressed racial disparities in housing, the civil rights movement resulted in legislation prohibiting discrimination in housing, and indoor lead exposure became a major public health concern. Although a comprehensive history of public health involvement in housing is beyond the scope of this article, we next provide several illustrative examples.

In the early 1800s, the relation between housing conditions and health was recognized among public health practitioners in the United States^{108–112} and Europe^{113–115} and led to the rise of the sanitary reform movement. Industrialization caused a rapid growth in urban populations that was not matched by a sufficient increase in adequate housing. Builders, eager to capitalize on the need for housing, built inferior housing in congested areas of cities. In 1844, Engels observed, "in a word, we must confess that in the workingmen's dwelling of Manchester [England], no cleanliness, no convenience, and consequently no comfortable family life is possible; that in such dwellings only [beings] robbed of all humanity, degraded, reduced morally and physically to bestiality, could feel comfortable and at home."¹⁰³ Common characteristics of the housing of the working poor throughout the 19th century and into the early 20th century included insufficient light and air, few toilet and bathing facilities, and overcrowding. In New York City, windows in many tenement rooms opened into an air shaft instead of directly to fresh air and hallways were reported to be "pitch-black."¹¹⁶ It was reported that entire families lived in single rooms and that as many as 30 people occupied single rooms in

lodging houses.¹¹⁷ These conditions were graphically documented by Edwin Chadwick¹¹⁸ in England and by John Griscom¹¹⁹ and Jacob Riis¹²⁰ in New York City.

The response to this situation established the basis of public health action at the local and national levels and clearly established the link between public health and housing. In the United States, the sanitary reform movement was carried out by boards of health and in some cases by voluntary health associations consisting of physicians, public officials, and other civic-minded citizens. They educated the public on hygiene, lobbied for policy reform, and sought to eliminate “crowded, poorly ventilated, and filthy [housing], impure water supplies, inadequate sewerage, and unwholesome food.”¹⁰² In New York City, the Council of Hygiene’s report on the sanitary conditions of the city resulted in the first health and housing laws in the nation (the New York Metropolitan Health Act of 1866 and the New York Tenement House Law of 1867). Multiple reports followed, as did legislation requiring windows that opened to outside air in place of air shafts, separate “water closets” for each apartment, functional fire escapes, adequate lighting in hallways, proper sewage connections, and regular waste removal. These reforms succeeded in controlling the epidemics of infectious diseases.

The recognition of lead-based paint as a health hazard is another important chapter in the history of public health involvement in housing. As early as 1914, the health consequences of lead exposure were discussed in the medical literature. By the mid-1920s, there was strong evidence that lead poisoned those exposed to it and was especially harmful to children.^{121,122} In the early 1930s, the Baltimore Health Department responded to this threat by educating its constituents. It continued an aggressive campaign throughout the 20th century, providing free diagnostic tests for lead poisoning, inspecting houses, requiring the removal of lead by landlords, and mandating the inclusion of warning labels for lead-based paint.¹²² Unfortunately, it was not until the 1940s and early 1950s that other state and local health departments began warning their constituents about the dangers of lead paint; this delay was due in part to the obstructionist actions of the Lead Industries

Association.¹²¹ Gradually, local bans were implemented across the United States. Ultimately, the Consumer Product Safety Commission prohibited the use of all lead paint after 1978.

The American Public Health Association (APHA) began its involvement in housing issues in 1937 with the formation of its Committee on Hygiene of Housing. In 1941, C. E. A. Winslow (president of APHA, editor of the *Journal*, and chair of the Hygiene and Public Health Committee) invigorated APHA’s commitment. He observed,

Thirty years ago, our major emphasis was transferred from the physical environment to the individual. Today, we must shift our gaze from the individual back to the environment, but in a broader sense...to the whole social and economic environment in which the individual lives and moves and has his being.¹²³

He therefore led the Hygiene and Public Health Committee in an examination of the components of healthy housing in terms of physical, physiological, and psychological needs. The committee prepared a report called the “Basic Principles of Healthful Housing” and developed an evaluation procedure to “appraise existing housing in objective quantitative terms.”¹²⁴ This assessment tool was used in many American cities to examine housing stock and was incorporated into urban planning efforts at the urging of the US Public Health Service. APHA has periodically updated these guidelines on healthy housing.^{125–127} The last version was published in 1986.¹²⁸ In 1999 and 2000, APHA released policy statements concerning public health’s role in codes regulating the design, construction, and use of buildings.^{129,130}

PUTTING HEALTH INTO HOUSING—WHAT IS PUBLIC HEALTH DOING ABOUT IT TODAY?

Current public health efforts to improve housing conditions include a continuation of these historical activities as well as new strategies based on emerging issues such as indoor environmental quality. We now describe some of the activities of Public Health—Seattle & King County (PHSKC) and of sister agencies in larger American cities.

Guidelines, Codes, and Enforcement

The development and enforcement of most housing codes are the responsibility of housing and construction departments. Our health department, like most others, issues and enforces housing codes that address a limited set of concerns (e.g., plumbing, sanitation, occupancy). Local codes are based on national uniform codes that set minimal standards for new housing construction, fire safety, plumbing, and mechanical systems. However, these codes consider only a subset of the conditions that affect housing quality. For the most part, they do not address the maintenance or remediation of substandard conditions in existing buildings. Many jurisdictions have promulgated general health and nuisance codes that allow public health to intervene in situations in which an immediate threat to health exists, although such codes are applied infrequently to substandard housing conditions. A major limitation on the usefulness of codes is the difficulty in implementing them. Resources for inspection and enforcement are spread across multiple agencies that lack adequate staff and do not coordinate efforts. Another constraint is the current political climate, which favors market-based solutions and individual legal action rather than public sector regulation and enforcement.

In 2000, members of APHA’s Joint Housing and Health Committee met with officials from the International Code Council and NFPA International (formerly the National Fire Protection Association) to emphasize the need for more involvement from public health professionals in the development of national building standards and codes. As a result, APHA is now represented on several key NFPA International committees.¹³¹

At the local level, recent guideline development has been directed at indoor mold contamination. The New York City Department of Health has issued Guidelines on Assessment and Remediation of Fungi in Indoor Environments.¹³² The California legislature passed the Toxic Mold Protection Act of 2001, which calls for setting standards for permissible levels of mold exposure and requires disclosure of mold contamination in real estate transactions. Some jurisdictions are using the more general health codes to address substantial mold contamination.

Healthy Homes

The emergence of asthma as a major public health issue has led to renewed interest in improving indoor environmental quality and in integrating these newer efforts with ongoing work addressing other indoor health hazards such as lead and injury risk factors. Our department and many other local health jurisdictions (e.g., Boston, Cambridge, Cleveland, Detroit, New York, Philadelphia, San Diego, San Francisco) have developed “Healthy Homes” initiatives as a response. These projects provide education and resources to support household members in taking actions to improve the quality and safety of their home environments. The Seattle–King County Healthy Homes Project^{133,134} employs community health workers who use a home environmental checklist to assess exposures, knowledge, and actions related to indoor asthma triggers and indoor chemical hazards. The checklist guides the development of a specific, computer-generated home environmental action plan for each household. The community health worker makes 5 visits over 1 year in which she works with clients to carry out the action plan by offering education and social support, encouraging changes in habits (e.g., household cleaning, tobacco use), providing materials to reduce exposures (e.g., bedding covers, vacuum cleaners, doormats, cleaning kits, integrated pest management supplies), helping repair minor deficiencies (e.g., small holes that allow pests to enter, minor leaks), assisting tenants in working with their landlords or relocating if needed, and providing counseling and referral for other household concerns. The project’s scope is being expanded to include injury hazards, and Healthy Homes projects in jurisdictions with higher prevalences of lead exposure have also integrated lead assessment and abatement.

In addition to community health workers, other public health workers promote Healthy Homes principles. For example, the PHSKC Home Health Hazards Project trained public health nurses to conduct in-home environmental assessments and education to address fall hazards, infant and toddler safety issues, and indoor air quality.

Limited resources have restricted the scope of most Healthy Homes projects to ed-

OVERCROWDING, LEAKS, AND MOLD LEAD TO ASTHMA

I have a 6-year-old patient who presented with severe asthma (no previous history; no previous symptoms recognized by mom) after moving into a large multifamily dwelling. Public Health nurse described mold on walls, dripping faucets, one small window in the whole place, roach infestation, mom and 3 kids slept in one room on a mattress on the floor.^{1(p4)}

ucating household members, asking them to take individual actions, and assisting them with minor repairs. However, more substantial structural remediation is often necessary to reduce sources of exposure. For example, we found structural deficits permitting water intrusion in over 20% of the low-income homes included in our Healthy Homes project. Remediation is often not completed given the lack of landlord interest or of resources to make the improvements (e.g., installation of ventilation systems, removal of water-damaged carpet or wallboard, replacement of windows).

Several Healthy Homes projects, with support from the Department of Housing and Urban Development (HUD), federal home loan programs, energy assistance grants, and other sources, are assessing the benefits of more aggressive structural remediation interventions. For example, with HUD support, PHSKC is remediating 70 homes at an average cost of \$8000 each over the next 3 years. Examples of remediation activities include removing and replacing extensive mold- or water-damaged material, installing continuously operating whole-house exhaust ventilation systems, repairing plumbing leaks, and removing carpeting. We have considered landlord–tenant issues in the development of this project. Owners agree that rent will not be increased as a result of remediation and that tenants will be guaranteed the right to remain for at least 24 months after remediation, unless they violate the terms of the initial rental agreement. Boston and Cleveland are completing similar projects.

Additional support for lead control has come from the federal government. Congress enacted the Residential Lead-Based Paint Hazard Reduction Act of 1992 with the goal of eliminating lead-based paint hazard in all housing as expeditiously as possible and preventing further childhood lead poisoning. Federal funds are now provided to state and local health departments to determine the extent of childhood lead poisoning, screen children for elevated blood lead levels, help ensure that lead-poisoned infants and children receive medical and environmental follow-up, develop neighborhood-based efforts to prevent childhood lead poisoning, and safely remove lead from houses.^{135,136}

Exposure Assessment and Consultation for Individuals

Local health departments offer indoor environmental quality assessment of homes through visual inspection and, in some cases, through quantitative measurement of exposure to biological contaminants and toxic substances such as pesticides and heavy metals. They also provide education on reducing exposure.

Community Assessment

One barrier to developing effective housing policy is the lack of information on housing quality at the community level. Although the US Census Bureau’s American Housing Survey collects housing quality data for larger metropolitan areas every 6 years, smaller-area data for most municipalities and neighborhoods are not available. A few municipal housing departments collect supplemental local data (e.g., the New York City Department of Housing Preservation and Development). We are unaware of any American local health jurisdictions that systematically collect and analyze local data related to housing and health, although some have in the past.¹⁰ British local health districts are more involved in housing assessment. More than one-half of their annual health reports include a discussion of housing issues.¹³⁷ The City of Glasgow conducted a comprehensive survey of housing conditions in the mid-1980s.¹⁰⁰ It revealed substantial proportions of homes with dampness and mold, deteriorated external structural envelopes, and inadequate heating systems.

Services for Homeless People

Public health agencies frequently offer clinical assessment and management services to homeless shelter clients. Some of these agencies are responsible for operating shelters. Efforts to return the homeless to stable housing or to prevent eviction in the first place are less common. For example, the San Francisco Department of Public Health purchases buildings and renovates them for supportive housing for homeless or near-homeless people with substance abuse, mental health, or other chronic health conditions. This activity requires the patching together of multiple funding sources from the state and local levels. The program has decreased the use of hospital-based acute care health services.

Collaboration

Typically public health agencies do not build, maintain, or own housing stock; nor do they design housing developments or issue building permits. To promote healthy housing, they must collaborate with other entities who are more directly involved in the housing sector. Our Healthy Homes Project works with the local public housing authority to increase its awareness of the impact of housing conditions on asthma. The housing authority moved Healthy Homes clients to the top of its waiting list and offered housing that met Healthy Homes criteria. For clients already living in public housing units, the agency immediately repaired unhealthy conditions, gave priority to eradication of roaches, and moved the tenant to a more suitable unit (e.g., a second-floor unit with less dampness) if necessary. The project also refers clients to local weatherization programs that have resources to improve ventilation and energy efficiency. The New York City Department of Health is partnering with the housing authority to implement a pilot integrated pest management project to reduce exposure to pesticides and cockroach antigens. The Boston Healthy Homes Project works with a community development corporation to arrange grants to low-income home owners for remediation of conditions with adverse health effects. It is developing a decision-making tool to assist housing rehabilitators in incorporating affordable modifications

that improve respiratory health. The health authority in Cornwall, England used National Health Service funds to install central heating in homes that were damp and inhabited by children with asthma. An uncontrolled evaluation demonstrated significant reduction in dampness in children's bedrooms and in asthma morbidity.¹³⁸

Advocacy

Public health workers support individuals and communities seeking better housing. For example, when public health staff assisted Healthy Homes participants in asking their landlords to make repairs, the tenants' requests were often more adequately addressed than when tenants tried on their own. Home visitors from the New York City Department of Health assist tenants by encouraging landlords to correct hazardous conditions before enforcement action is initiated. Some local health departments have successfully advocated with local elected officials and agencies on behalf of increasing the availability of affordable, healthy housing. Public health workers have supported the efforts of community organizations fighting for improved housing conditions.¹³⁹

Public health advocates can point to evidence demonstrating that residents of substandard housing who move to improved living environments enjoy better health outcomes. Low-income seniors who moved from deteriorated, single-room, roach-infested apartments with inadequate kitchen and bath facilities into a new, well-designed senior apartment building with a senior center had lower mortality and improved self-reported health status after 8 years than a comparison group who were eligible to live in the new building but did not move.¹⁴⁰ Low-income families who moved from substandard housing to newly constructed public housing made fewer outpatient medical visits than did a similar group who did not move.¹⁴¹ A small Danish study showed that lung function, symptoms, and medication use improved among asthmatic, dust-mite-allergic patients who moved to homes with effective ventilation systems compared with others who did not move.¹⁴² However, a recent review of the health effects of housing interventions found that "because of the method-

ological limitations of the studies, it is impossible to specify the nature and size of the health gain," even though most studies did report benefits.¹⁴³ Preliminary findings from a study in Boston (not included in the aforementioned review) indicate that families that received a housing subsidy experienced increased safety, fewer behavioral problems among boys, and improved health among heads of households.¹⁴⁴

Public Education and Awareness

Public health agencies provide information to the public regarding ways to make homes healthier and safer. They participate in distribution of smoke detectors,¹⁴⁵ offer educational resources in print and on Web sites regarding indoor environmental quality, and help with efforts to eliminate hazardous wastes and toxins from homes.

WHAT NEXT?

Public health workers continue to build on a long tradition of engagement with housing and health issues. Many of the efforts we have described are yielding benefits, although most are small in scale relative to the need. Expansion of capacity is an important priority and is dependent on securing adequate resources. We conclude by suggesting what this expanded capacity might look like and what it might accomplish.

Making Housing Codes Healthier

Refinement of housing codes to reflect current knowledge of healthful housing is urgently needed.¹⁴⁶ Enhanced national uniform codes or guidelines that address factors affecting health such as ventilation,^{147,148} moisture, carpeting, molds, injury hazards,⁹⁹ exposure to toxic substances, privacy, noise, lighting and other factors that are applicable to both new and existing housing stock would be a valuable asset for local public health agencies seeking to upgrade local housing codes.⁹ As noted above, APHA's Joint Housing and Health Committee has established a public health "foothold" in national standards and code development. Continued and expanded efforts by the committee will help to include public health practitioners in such national endeavors. It may also be useful for national

organizations, expert panels, and local health departments to develop guidelines (rather than codes).

Revised codes and enhanced guidelines can lay the groundwork for an expanded public health role in housing quality consultation, education, and enforcement. Local public health agencies need guidelines in order to respond to concerns about housing quality brought to them by the public, community organizations (e.g., tenant unions and housing advocacy groups), and other service providers. These agencies must have the capacity to assess whether units meet standards, to educate property owners and builders about how to implement guidelines, and to impose sanctions if standards are not met. Some owners of substandard property, especially landlords who own only a few units, lack the resources to improve their properties. Public health can take the lead in advocating for policies and resources to assist them.

Sustaining and Expanding Healthy Homes Programs

Evidence is accumulating that Healthy Homes programs yield measurable health benefits. These programs are popular with the public and current capacity cannot meet demand. Options for expansion include increasing program staffing and incorporating Healthy Homes activities into the regular duties of other home visitors (e.g., public health nurses, environmental health professionals, and community health workers). Advocating for payment by health insurers for some of these activities (in the context of health assessment and education for patients with asthma) may help fund this expansion.

Assessment

Many state and local health departments produce community health assessment reports, yet few include measures of housing quality and resident satisfaction with housing. Special reports that describe housing status in more detail, using qualitative as well as quantitative methods and incorporating visual documentation of housing conditions, could be powerful tools to focus attention on housing issues. Such assessment data could be invaluable for housing advocates attempting to improve housing in their communities.

FAMILY IN SHELTER TO AVOID LEAD EXPOSURE

I just witnessed the reunification of a young mother with her 3 children in a homeless shelter. The family had previously lived together in an overcrowded apartment with other extended family members. When the 3 children (ages 2, 5, and 6) all tested high for lead, the mother voluntarily signed the children over to custody of the Department of Social Services so they could be placed in a lead-free home. The mother then tried and failed to find safe and affordable apartment for her family; moving to a shelter became her only chance to live with her children in safety. She is now homeless, searching for affordable housing, with little hope for securing a unit. At least her children have their mother back. (Boston Medical Center Web site. Available at <http://www.bmc.org/program/doc4kids/append.htm>. Accessed March 1, 2002.)

For example, the documentation in prose and photos by Jacob Riis of tenement conditions in New York City in the late 1800s helped intensify the tenement reform movement.¹²⁰

Collaboration and Cross-Sectoral Planning

At the Milbank Memorial Fund meeting on housing and health in 1950, a participant noted that “the knitting together of various local [city] departments in an attempt to solve a problem of mutual concern [housing] is an important and long overdue step forward in public administration.”¹²⁴ This still holds true in 2002. A single public health agency cannot achieve the goal of ensuring access to healthy housing and building healthy neighborhoods. For example, the revision of housing codes and development of guidelines discussed above will require collaboration with other government agencies that regulate housing construction, tenants, community housing advocacy groups, nonprofit housing organizations, community development corporations, builders, home owners, landlords, architects, and urban planners.

Public health representatives can participate in local planning processes and offer consultation to housing agencies and developers. They can encourage the use of Health Impact Assessment^{149,150} methods to consider the health implications of new construction and zoning decisions. They can encourage development of policies and actions that incorporate the principles of healthy housing into housing construction and maintenance. They can advocate for the design of healthy communities that offer opportunities for physical activity, social interaction, and community building activities.

Public health workers can collaborate with community housing advocates by providing them with assessment data, offering technical assistance (e.g., with program planning, evaluation, and fundraising), and endorsing their efforts. Working closely with advocates and residents, public health workers can also develop culturally appropriate educational materials that explain healthy housing guidelines.

Closer collaboration with public housing agencies will protect the health of the most vulnerable populations. Partnering to make public housing units safe and healthy, supporting health promotion and community building activities, and developing mechanisms to identify children whose health is adversely affected by housing conditions and to rehouse them promptly are only some of the possibilities.

Advocacy

Public health workers should take the lead in advocating for housing policies that ensure access to affordable, healthy housing units and the elimination or remediation of unhealthy housing stock. Burridge and Ormandy note:

The deficiencies in the housing stock will not be remedied by the waving of some legislative wand. At best, legal intervention can provide some normative standards for fiscal or coercive action, and a framework for intervention. Deeper solutions lie in the political arena. There is a pressing need for a public housing policy which embraces the perspectives of public health and the maintenance of a healthy national housing stock.¹⁵¹

Other arenas for advocacy include providing energy assistance for people with low income, expanding medical insurance coverage

for items that make homes healthier (e.g., allergy-control bedding encasements, radiator covers, window guards, home assessments), and providing subsidies in the form of rental vouchers for use in the private housing market.

The extent to which these efforts will actually occur is dependent on the resources and organizational capacity of public health agencies. Staff already working on housing-related issues (e.g., in environmental health and health assessment units) can form a multidisciplinary team to initiate housing and health activities. This team can develop a strategic plan to address housing issues in collaboration with other public health staff and external partners. Resources to implement local public health housing activities will come from a combination of local sources, federal agencies, and national foundations. An important challenge is to develop sustainable and increased funding. Public health housing advocates may be able to interest the Centers for Disease Control and Prevention, other federal agencies, local housing developers, and health care payers in supporting their efforts.

Political factors also influence the ability of public health to respond to housing issues. Substandard housing is an environmental justice issue. The inequitable socioeconomic distribution of substandard housing reflects underlying disparities in income, assets, and power. Tenants are often powerless to improve their housing conditions in the context of the low vacancy rates, high rental costs, weak tenant protection laws, and politically influential landlord associations commonly found in American cities. Public health assets can help remedy this imbalance in power. Yet these circumstances also constrain public health practitioners, many of whom are reluctant to antagonize powerful local political interests and the elected officials who support them. The absence of organized community advocacy groups that can effectively balance landlords' influence further inhibits public health action. The current political climate is not supportive of a proactive, regulatory approach to addressing housing issues. Moving beyond an advisory, incentive-based approach will require courageous public health officials who can ally themselves with supportive community organizations and local elected officials.

Today, several issues drive the housing and health agenda: increased asthma morbidity,^{152,153} unaffordable urban housing, urban sprawl, and a renewed interest in social determinants of health. This new era of unaffordable housing and the health and social disintegration that accompanies it will demand further public health attention. Sprawl that began almost 50 years ago with "White flight" from urban areas is also beginning to have deleterious effects on health¹⁵⁴ and will likely result in an increased public health interest in housing, housing environments, and health. These issues, along with the growing interest in the return of public health to its roots in addressing social factors affecting health, are converging to establish housing as a priority public health issue.

We have learned much in the past decade about how to make homes healthier places in which to live. Public health has a long history of promoting healthy housing. In recent years, we have been less engaged. It is time for us to build on this groundwork and do our share in ensuring that everyone has a safe and healthy home. ■

About the Authors

James Krieger is with Public Health—Seattle & King County and the Schools of Medicine and Public Health, University of Washington, Seattle. Donna L. Higgins is with the Centers for Disease Control and Prevention, Atlanta, Ga.

Requests for reprints should be sent to James Krieger, MD, MPH, Public Health—Seattle & King County—EPE, 999 Third Ave, 12th Floor, Seattle, WA 98104-4039.

This article was accepted January 28, 2002.

Contributors

J. Krieger developed the initial concept for this manuscript. Both authors developed the final concept, reviewed relevant literature, and wrote the manuscript.

Acknowledgments

We thank the following colleagues for their thoughtful comments on drafts of this manuscript and for providing information about their valuable efforts in addressing housing and health issues in their communities: Daniel Moran and David Williams (Public Health—Seattle & King County), Rajiv Bhatia (San Francisco Department of Public Health), Andrew Goodman and Jennifer Leighton (New York City Department of Health), Margaret Reid (Boston Public Health Commission), Elizabeth Fee (National Library of Medicine), Theodore M. Brown (University of Rochester), and Carolyn Beeker (Centers for Disease Control and Prevention).

References

1. Sharfstein J, Sandel M, eds. *Not Safe at Home: How America's Housing Crisis Threatens the Health of Its Chil-*

dren. Boston, Mass: Boston University Medical Center; 1998.

2. Warner M, Barnes PM, Fingerhut LA. Injury and poisoning episodes and conditions. National Health Interview Survey, 1997. *Vital Health Stat* 10. 2000; No. 202.

3. Karter MJ. *Fire Loss in the United States During 1999*. Quincy, Mass: National Fire Protection Association; 2000.

4. *National Hospital Ambulatory Medical Care Survey: 1998 Emergency Department Summary. Advance Data* 313. Hyattsville, Md: National Center for Health Statistics; 2000. Publication PHS 2000-1250.

5. National Center for Environmental Health, Centers for Disease Control and Prevention Web site. Available at: <http://www.cdc.gov/nceh/lead/about/about.htm>. Accessed December 6, 2001.

6. US Census Bureau. American Housing Survey 1999. Available at: <http://www.census.gov/hhes/www/ahs.html>. Accessed February 19, 2002.

7. Marmot M, Wilkinson R. *Social Determinants of Health*. New York, NY: Oxford University Press, 1999.

8. *Rental Housing Assistance—The Worsening Crisis: A Report to Congress on Worst Case Housing Needs*. Washington, DC: US Dept of Housing and Urban Development; 1997.

9. Mood EW. Fundamentals of healthful housing: their application in the 21st century. In: Burrige R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:303–337.

10. Marsh BT. Housing and health: the role of the environmental health practitioner. *J Environ Health*. 1982; 45:123–128.

11. Howard M. The effects on human health of pest infestations in houses. In: Burrige R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:256–282.

12. Stein L. A study of respiratory tuberculosis in relation to housing conditions in Edinburgh; the pre-war period. *Br J Soc Med*. 1950;4:143–169.

13. Fonseca W, Kirkwood BR, Victora CG, Fuchs SR, Flores JA, Misago C. Risk factors for childhood pneumonia among the urban poor in Fortaleza, Brazil: a case-control study. *Bull World Health Organ*. 1996;74: 199–208.

14. Denny FW Jr. The clinical impact of human respiratory virus infections. *Am J Respir Crit Care Med*. 1995;152(4 Pt 2):S4–S12.

15. Murtagh P, Cerqueiro C, Halac A, Avila M, Salomon H, Weissenbacher M. Acute lower respiratory infection in Argentinian children: a 40 month clinical and epidemiological study. *Pediatr Pulmonol*. 1993;16:1–8.

16. Graham NM. The epidemiology of acute respiratory infections in children and adults: a global perspective. *Epidemiol Rev*. 1990;12:149–178.

17. Wood DL, Valdez RB, Hayashi T, Shen A. Health of homeless children and housed, poor children. *Pediatrics*. 1990;86:858–866.

18. Zolopa AR, Hahn JA, Gorter R, et al. HIV and tuberculosis infection in San Francisco's homeless adults. Prevalence and risk factors in a representative sample. *JAMA*. 1994;272:455–461.

19. Kermod M, Crofts N, Speed B, Miller P, Streeton

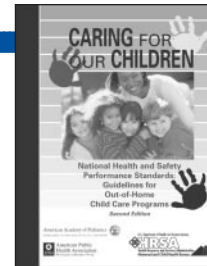
- J. Tuberculosis infection and homelessness in Melbourne, Australia, 1995–1996. *Int J Tuberc Lung Dis*. 1999;3:901–907.
20. Conway J. Ill-health and homelessness: the effects of living in bed-and-breakfast accommodation. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:283–300.
21. Bornehag CG, Blomquist G, Gyntelberg F, et al. Dampness in buildings and health. Nordic interdisciplinary review of the scientific evidence on associations between exposure to “dampness” in buildings and health effects (NORDDAMP). *Indoor Air*. 2001;11:72–86.
22. Peat JK, Dickerson J, Li J. Effects of damp and mould in the home on respiratory health: a review of the literature. *Allergy*. 1998;53:120–128.
23. Hyndman S. Making connections between housing and health. In: Kearns R, Gesler W, eds. *Putting Health Into Place: Making Connections in Geographical Research*. Syracuse, NY: Syracuse University Press; 1998:191–207.
24. Robinson T, Russell P. Healthy indoor environments for energy efficient housing. In: *Health and Ecological Effects: Proceedings of the 9th World Clean Air Congress, August 30–September 4, 1992, Montreal, Quebec, Canada*. Pittsburgh, Pa: Air & Waste Management Associates; 1992.
25. Hunt S. Damp and mouldy housing: a holistic approach. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:67–93.
26. Strachan DP. Dampness, mould growth and respiratory disease in children. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:94–116.
27. Marsh A, Gordon D, Pantazis C, Heslop P. *Home Sweet Home? The Impact of Poor Housing on Health*. Bristol, England: The Policy Press; 1999.
28. Platt SD, Martin CJ, Hunt SM, Lewis CW. Damp housing, mould growth, and symptomatic health state. *BMJ*. 1989;298:1673–1678.
29. Dales RE, Zwanenburg H, Burnett R, Franklin CA. Respiratory health effects of home dampness and molds among Canadian children. *Am J Epidemiol*. 1991;134:196–203.
30. Brunekreef B, Dockery DW, Speizer FE, Ware JH, Spengler JD, Ferris BG. Home dampness and respiratory morbidity in children. *Am Rev Respir Dis*. 1989;140:1363–1367.
31. Williamson IJ, Martin CJ, McGill G, Monie RD, Fennerty AG. Damp housing and asthma: a case–control study. *Thorax*. 1997;52:229–234.
32. Markus TA. Cold, condensation and housing poverty. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:141–167.
33. Bierman CW. Environmental control of asthma. *Immunol Allergy Clin North Am*. 1996;16:753–765.
34. Billings CG, Howard P. Damp housing and asthma. *Monaldi Arch Chest Dis*. 1998;53:43–49.
35. Verhoeff AP, van Strien RT, van Wijnen JH, Brunekreef B. Damp housing and childhood respiratory symptoms: the role of sensitization to dust mites and molds. *Am J Epidemiol*. 1995;141:103–110.
36. Karim YG, Ijaz MK, Sattar SA, Johnson-Lussenburg CM. Effect of relative humidity on the airborne survival of rhinovirus-14. *Can J Microbiol*. 1985;31:1058–1061.
37. Institute of Medicine. *Clearing the Air: Asthma and Indoor Air Exposures*. Washington, DC: National Academy Press; 2000.
38. Oie L, Nafstad P, Botten G, Magnus P, Jaakkola JK. Ventilation in homes and bronchial obstruction in young children. *Epidemiology*. 1999;10:294–299.
39. Eggleston PA, Arruda LK. Ecology and elimination of cockroaches and allergens in the home. *J Allergy Clin Immunol*. 2001;107(suppl 3):S422–S429.
40. Platt SD, Martin CJ, Hunt SM, Lewis CW. Damp housing, mould growth, and symptomatic health state. *BMJ*. 1989;298:1673–1678.
41. Vaughan JW, Platts-Mills TA. New approaches to environmental control. *Clin Rev Allergy Immunol*. 2000;18:325–339.
42. Roberts JW, Dickey P. Exposure of children to pollutants in house dust and indoor air. *Rev Environ Contam Toxicol*. 1995;143:59–78.
43. Rosenstreich DL, Eggleston P, Kattan M, et al. The role of cockroach allergy and exposure to cockroach allergen in causing morbidity among inner-city children with asthma. *N Engl J Med*. 1997;336:1356–1363.
44. Phipatanakul W, Eggleston PA, Wright EC, Wood RA. Mouse allergen, II: the relationship of mouse allergen exposure to mouse sensitization and asthma morbidity in inner-city children with asthma. *J Allergy Clin Immunol*. 2000;106:1075–1080.
45. Collins KJ. Low indoor temperatures and morbidity in the elderly. *Age Ageing*. 1986;15:212–220.
46. Evans J, Hyndman S, Stewart-Brown S, Smith D, Petersen S. An epidemiological study of the relative importance of damp housing in relation to adult health. *J Epidemiol Community Health*. 2000;54:677–686.
47. *Thermal Environmental Conditions for Human Occupancy*. Atlanta, Ga: American Society of Heating, Refrigerating, and Air-Conditioning Engineers; 1981. ASHRAE Standard ANSI/ASHRAE 55-1981.
48. *Respiratory Health Effects of Passive Smoking*. Washington, DC: Environmental Protection Agency; 1992. Publication EPA/600/6-90/006F.
49. Weitzman M, Gortmaker S, Walker DK, Sobol A. Maternal smoking and childhood asthma. *Pediatrics*. 1990;85:505–511.
50. Cook DG, Strachan DP. Health effects of passive smoking, III: parental smoking and prevalence of respiratory symptoms and asthma in school age children. *Thorax*. 1997;52:1081–1094.
51. Walker E, Hay A. Carbon monoxide poisoning. *BMJ*. 1999;319:1082–1083.
52. Rosen JF. Adverse health effects of lead at low exposure levels: trends in the management of childhood lead poisoning. *Toxicology*. 1995;97:11–17.
53. Needleman HL, Schell A, Bellinger D, Leviton A, Allred EN. The long-term effects of exposure to low doses of lead in childhood: an 11-year follow-up report. *N Engl J Med*. 1990;322:83–88.
54. Schwartz J. The relationship between blood lead and blood pressure in the NHANES II survey. *Environ Health Perspect*. 1988;78:15–22.
55. Landrigan PJ. Asbestos—still a carcinogen. *N Engl J Med*. 1998;338:1618–1619.
56. Jaakkola JJ, Oie L, Nafstad P, Botten G, Samuelsen SO, Magnus P. Interior surface materials in the home and the development of bronchial obstruction in young children in Oslo, Norway. *Am J Public Health*. 1999;89:188–192.
57. Lubin JH, Boice JD Jr. Lung cancer risk from residential radon: meta-analysis of eight epidemiological studies. *J Natl Cancer Inst*. 1997;89:49–57.
58. Lewis RG, Fortmann RC, Camann DE. Evaluation of methods for monitoring the potential exposure of small children to pesticides in the residential environment. *Arch Environ Contam Toxicol*. 1994;26:37–46.
59. Lewis RG, Fortune CR, Willis RD, Camann DE, Antley JT. Distribution of pesticides and polycyclic aromatic hydrocarbons in house dust as a function of particle size. *Environ Health Perspect*. 1999;107:721–726.
60. Ranson R. *Healthy Housing: A Practical Guide*. London, England: Spon Press and the World Health Organization Regional Office for Europe; 1991.
61. Home radiator burns among inner-city children: Chicago. *MMWR Morb Mortal Wkly Rep*. 1996;45:814–815.
62. American Academy of Pediatrics. Falls from heights: windows, roofs, and balconies. *Pediatrics*. 2001;107:1188–1191.
63. Nuffield Institute for Health and NHS Centre for Reviews and Dissemination. Preventing falls and subsequent injury in older people. *Eff Health Care*. 1996;2:1–16.
64. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med*. 1988;319:1701–1707.
65. Dedman DJ, Gunnell D, Davey Smith G, Frankel S. Childhood housing conditions and later mortality in the Boyd Orr cohort. *J Epidemiol Community Health*. 2001;55:10–15.
66. Ellaway A, Macintyre S, Fairley A. Mums on Prozac, kids on inhalers: the need for research on the potential for improving health through housing interventions. *Health Bull*. 2000;54:336–339.
67. Meyers A, Frank DA, Roos N, et al. Housing subsidies and pediatric undernutrition. *Arch Pediatr Adolesc Med*. 1995;149:1079–1084.
68. Collins KJ. Cold and heat-related illnesses in the indoor environment. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:117–140.
69. Heat-related deaths—Los Angeles County, California, 1999–2000, and United States, 1979–1998. *MMWR Morb Mortal Wkly Rep*. 2001;50:623–625.
70. Hyndman SJ. Housing dampness and health amongst British Bengalis in east London. *Soc Sci Med*. 1990;30:131–141.
71. Hopton JL, Hunt SM. Housing conditions and mental health in a disadvantaged area in Scotland. *J Epidemiol Community Health*. 1996;50:56–61.
72. Gabe J, Williams P. Women, crowding and mental health. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:191–208.
73. Zima BT, Wells KB, Freeman, HE. Emotional and

- behavioral problems and severe academic delays among sheltered homeless children in Los Angeles County. *Am J Public Health*. 1994;84:260–264.
74. Gilloran JL. Social problems associated with “high living.” *Med Officer*. 1968;120:117–118.
75. Dunn JR, Hayes MV. Social inequality, population health, and housing: a study of two Vancouver neighborhoods. *Soc Sci Med*. 2000;51:563–587.
76. McEwen BS, Seeman T. Protective and damaging effects of mediators of stress: elaborating and testing the concepts of allostasis and allostatic load [review]. *Ann N Y Acad Sci*. 1999;896:30–47.
77. Henkin RI, Knigge KM. Effects of sound on hypothalamic-pituitary-adrenal axis. *Am J Physiol*. 1963;204:701–704.
78. Van Cauter E, Spiegel K. Sleep as a mediator of the relationship between socioeconomic status and health: a hypothesis. *Ann N Y Acad Sci*. 1999;896:254–261.
79. Sampson RJ, Raudenbush SW, Earls F. Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science*. 1997;277:918–924.
80. Cubbin C, LeClere FB, Smith GS. Socioeconomic status and injury mortality: individual and neighbourhood determinants. *J Epidemiol Community Health*. 2000;54:517–524.
81. Pearl M, Braveman P, Abrams B. The relationship of neighborhood socioeconomic characteristics to birthweight among 5 ethnic groups in California. *Am J Public Health*. 2001;91:1808–1814.
82. Diez Roux AV, Merkin SS, Arnett D, et al. Neighborhood of residence and incidence of coronary heart disease. *N Engl J Med*. 2001;345:99–106.
83. Wallace R. Synergism of plagues: “planned shrinkage,” contagious housing destruction, and AIDS in the Bronx. *Environ Res*. 1988;47:1–33.
84. Cohen D, Spear S, Scribner R, Kissinger P, Mason K, Wildgen J. “Broken windows” and the risk of gonorrhoea. *Am J Public Health*. 2000;90:230–236.
85. Barr RG, Riez-Roux AV, Knirsch CA, Pablos-Mendez A. Neighborhood poverty and the resurgence of tuberculosis in New York City, 1984–1992. *Am J Public Health*. 2001;91:1487–1493.
86. Schulz A, William D, Israel B, et al. Unfair treatment, neighborhood effects, and mental health in the Detroit metropolitan area. *J Health Soc Behav*. 2000;41:314–332.
87. Centers for Disease Control and Prevention. Neighborhood safety and the prevalence of physical inactivity—selected states, 1996. *MMWR Morb Mortal Wkly Rep*. 1999;48:143–146.
88. Brownson RC, Baker EA, Housemann RA, Brennan LK, Bacak SJ. Environmental and policy determinants of physical activity in the United States. *Am J Public Health*. 2001;91:1995–2003.
89. Yen IH, Kaplan GA. Neighborhood social environment and risk of death: multilevel evidence from the Alameda County Study. *Am J Epidemiol*. 1999;149:898–907.
90. Bosma H, van de Mheen D, Borsboom GJJM, Mackenbach JP. Neighborhood socioeconomic status and all-cause mortality. *Am J Epidemiol*. 2001;153:363–371.
91. Haan M, Kaplan GA, Camacho T. Poverty and health: prospective evidence from the Alameda County Study. *Am J Epidemiol*. 1987;125:989–998.
92. Perlin SA, Wong D, Sexton K. Residential proximity to industrial sources of air pollution: interrelationships among race, poverty, and age. *J Air Waste Manage Assoc*. 2001;51:406–421.
93. Stansfeld S, Haines M, Brown B. Noise and health in the urban environment. *Rev Environ Health*. 2000;15:43–82.
94. Jackson RJ, Kochutsky C. *Creating a Healthy Environment: The Impact of the Built Environment on Public Health*. Washington, DC: Sprawl Watch Clearinghouse Monograph Series; 2001.
95. Frumkin H. Beyond toxicity, I: human health and the natural environment. *Am J Prev Med*. 2001;20:234–240.
96. Fullilove MT, Heon V, Jimenez W, Parsons C, Green LL, Fullilove RE. Injury and anomie: effects of violence on an inner-city community. *Am J Public Health*. 1998;88:924–927.
97. Huss K, Rand CS, Butz AM, et al. Home environmental risk factors in urban minority asthmatic children. *Ann Allergy*. 1994;72:173–177.
98. Kane MP, Jaen CR, Tumiel LM, Bearman GM, O’Shea RM. Unlimited opportunities for environmental interventions with inner-city asthmatics. *J Asthma*. 1999;36:371–379.
99. Ranson R. Accidents at home: the modern epidemic. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:223–255.
100. *The Glasgow House Condition Survey*. Glasgow, Scotland: City of Glasgow; 1985.
101. Boardman B. Prospects for affordable warmth. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:282–400.
102. Rosen G. *A History of Public Health*. New York, NY: MD Publications; 1958.
103. Engels F. *The Condition of the Working Class in England*. New York, NY: Panther Books; 1969.
104. Byrne D, Keithley J. Housing and the health of the community. In: Burridge R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:41–66.
105. Walker WF. Some relation between our health and our environment. *Am J Public Health*. 1923;13:897–914.
106. McKeown T. *The Role Of Medicine—Dream, Mirage or Nemesis*. London, England: Nuffield Provincial Hospitals Trust; 1976.
107. Jacobs M, Stevenson G. Health and housing: a historical examination of alternative perspectives. *Int J Health Serv*. 1981;1:105–122.
108. Rosner D, ed. *Hives of Sickness: Public Health and Epidemics in New York City*. New Brunswick, NJ: Rutgers University Press; 1995.
109. Veiller L. Housing as a factor in health progress in the past fifty years. In: Ravenel MP, ed. *A Half Century of Public Health*. New York, NY: American Public Health Association; 1921:323–334.
110. Duffy J. *A History of Public Health in New York City 1866–1966*. New York, NY: Russell Sage Foundation; 1974.
111. Galishoff S. *Newark: The Nation’s Unhealthiest City 1832–1895*. New Brunswick, NJ: Rutgers University Press; 1988.
112. Melosi MV. *The Sanitary City: Urban Infrastructure in America From Colonial Times to the Present*. Baltimore, Md: Johns Hopkins University Press; 2000.
113. Wohl AS. *Endangered Lives: Public Health in Victorian Britain*. Cambridge, Mass: Harvard University Press; 1983.
114. Coleman W. *Death Is a Social Disease: Public Health and Political Economy in Early Industrial France*. Madison: University of Wisconsin Press; 1982.
115. Evans RJ. *Death in Hamburg: Society and Politics in the Cholera Years 1830–1910*. Oxford, England: Clarendon Press; 1987.
116. DeForest RW, Veiller L. The tenement house problem. In: DeForest RW, Veiller L. *The Tenement House Problem*. Vol 1. New York, NY: MacMillan Co; 1903:18.
117. *Sanitary Conditions of the City, Report of the Council of Hygiene and Public Health of the Citizens’ Association of New York*. New York, NY: Council of Hygiene and Public Health of the Citizens’ Association of New York; 1865.
118. Chadwick E. *Report on the Sanitary Condition of the Labouring Population of Gt. Britain*, by Edwin Chadwick. 1842. Flinn MW, ed. Edinburgh, Scotland: University Press. 1965.
119. Griscom JC. *The Sanitary Condition of the Laboring Population of New York With Suggestions for Its Improvement*. New York, NY: Harper and Bros; 1845.
120. Riis JA. *How the Other Half Lives: Studies Among the Tenements of New York*. New York, NY: Charles Scribner’s Sons; 1890.
121. Markowitz G, Rosner D. “Cater to the children”: the role of the lead industry in a public health tragedy, 1900–1955. *Am J Public Health*. 2000;90:36–46.
122. Fee E. Public health in practice: an early confrontation with the “silent epidemic” of childhood lead paint poisoning. *J Hist Med Allied Sci*. 1990;45:570–606.
123. Winslow CEA. Health and housing. In: *Housing for Health*. Lancaster, Pa: Science Press Printing Company; 1941.
124. *Housing and Health: The Proceedings of a Round Table at the 27th Annual Conference of the Milbank Memorial Fund*. New York, NY: Milbank Memorial Fund; 1951:5.
125. *Basic Principles of Healthful Housing*. New York, NY: American Public Health Association; 1938.
126. *Basic Health Principles of Housing and Its Environment; APHA-PHS Recommended Housing Maintenance and Occupancy Ordinance*. Washington, DC: American Public Health Association; 1971.
127. APHA Program Area Committee on Housing and Health, 1968. Basic health principles of housing and its environment. *Am J Public Health*. 1969;59:841–851.
128. Mood EW. *APHA-CDC Recommended Minimum Housing Standards*. Washington, DC: American Public Health Association; 1986.

129. APHA policy statements. 9916: public health role of codes regulating design, construction and use of buildings. Available at: <http://www.apha.org/legislative/policy/policypdf1.pdf>. Accessed February 19, 2002.
130. APHA policy statements. 200019: public health role of the National Fire Protection Association on setting codes and standards for the built environment. *Am J Public Health*. 2001;91:503–504.
131. Pauls J. APHA's growing involvement with international standards and codes development activity affecting the built environment. Injury Control and Emergency Health Services Section Newsletter, Fall 2000. Available at: <http://www.apha.org/sections/newsletters/injurycontrolfall2001.htm#anchor265782>. Accessed February 19, 2002.
132. Guidelines on assessment and remediation of fungi in indoor environments. Available at: <http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html>. Accessed March 1, 2002.
133. Krieger JW, Song L, Takaro TK, Stout J. Asthma and the home environment of low-income urban children: preliminary findings from the Seattle-King County healthy homes project. *J Urban Health*. 2000; 77:50–67.
134. Krieger J, Takaro T, Allen C, et al. The Seattle-King County Healthy Homes Project: implementation of a comprehensive approach to improving indoor environmental quality for low-income children with asthma. *Environ Health Perspect*. 2002;110(suppl 2): 311–322.
135. Centers for Disease Control and Prevention. About lead. Available at: <http://www.cdc.gov/nceh/lead/about/about.htm>. Accessed February 19, 2002.
136. Dept of Housing and Urban Development. HUD awards over \$67 million to protect children from dangerous lead and other environmental hazards. Available at: <http://www.hud.gov/news/release.cfm?content=pr01-108.cfm>. Accessed February 19, 2002.
137. Roderick P, Victor C, Connelly J. Is housing a public health issue? A survey of directors of public health. *BMJ*. 1991;302:157–160.
138. Somerville M, Mackenzie I, Owen P, Miles D. Housing and health: does installing heating in their homes improve the health of children with asthma? *Public Health*. 2000;114:434–439.
139. Freudenberg N. Community organization, housing, and health: a perspective for public health workers. *Bull N Y Acad Med*. 1990;66:451–462.
140. Carp FM. Impact of improved living environment on health and life expectancy. *Gerontologist*. 1977;17: 242–249.
141. Wambem DB, Piland NF. Effects of improved housing on health in South Dos Palos, Calif. *Health Serv Rep*. 1973;88:47–58.
142. Harving H, Korsgaard J, Dahl R. Clinical efficacy of reduction in house-dust mite exposure in specially designed, mechanically ventilated "healthy" homes. *Allergy*. 1994;49:866–870.
143. Thomson H, Petticrew M, Morrison D. Health effects of housing improvement: systematic review of intervention studies. *BMJ*. 2001;323:187–190.
144. Katz LF, King JR, Liebman JB. The early impact of moving to opportunity in Boston. October 2000.

Available at: http://www.wws.princeton.edu/~kling/mto/mto_boston_hudreport.pdf. Accessed November 10, 2001.

145. Douglas MR, Mallonee S, Istre GR. Comparison of community based smoke detector distribution methods in an urban community. *Inj Prev*. 1998;4:28–32.
146. Raw GJ, Prior J. The environmental assessment of new houses. In: Burrige R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:361–381.
147. Wargocki P, Sundell J, Bischoff W, et al. Ventilation and health in nonindustrial environments. Report from a European Multidisciplinary Scientific Consensus Meeting, Clima 2000/Napoli 2001 World Congress, Napoli (I), 15–18 September 2001. *Indoor Air*. 2002. In press.
148. *Standards for Ventilation Required for Minimum Acceptable Indoor Air Quality*. Atlanta, Ga: American Society of Heating, Refrigerating, and Air-Conditioning Engineers; 1981. ASHRAE Standard ANSI/ASHRAE 62-1981.
149. Douglas MJ, Conway L, Gorman D, Gavin S, Hanlon P. Developing principles for health impact assessment. *J Public Health Med*. 2001;23:148–154.
150. Lock K. Health impact assessment. *BMJ*. 2000; 320:1395–1398.
151. Burrige R, Ormandy D. The legal environment of housing conditions. In: Burrige R, Ormandy D, eds. *Unhealthy Housing: Research, Remedies and Reform*. New York, NY: Spon Press; 1993:420–423.
152. Mannino DM, Homa DM, Pertowski CA, et al. Surveillance for asthma—United States, 1960–1995. *Mor Mortal Wkly Rep CDC Surveill Summ*. 1998;47: 1–27.
153. Gergen PJ. The increasing problem of asthma in the United States. *Am Rev Respir Dis*. 1992;146: 823–824.
154. Pierce J, Orlando D, Hortman P, Risco, Powell KE, Division of Environmental Hazards and Health Effects, CDC. Corporate action to reduce air pollution—Atlanta, Georgia, 1998–1999. *MMWR Morb Mortal Wkly Rep*. 2000;49:153–156.



2nd Edition

NEW

Caring for Our Children: National Health and Safety Performance Standards for Out-of-Home Child Care

Caring for Our Children is the most comprehensive source of information available on the development and evaluation of health and safety aspects of day care and child care centers. The guidelines address the health and safety needs of infants to 12-year-olds. This field-reviewed book provides performance requirements for child care providers and parents, as well as for regulatory agencies seeking national guidelines to upgrade state and local child care licensing.

The second edition is extensively revised based on the consensus of ten technical panels each focused on a particular subject. The book includes eight chapters of 658 standards and a ninth chapter of 48 recommendations for licensing and community agencies and organizations.

ISBN 0-97156-820-0
2002 ■ 544 pages ■ Softcover
\$24.50 APHA Members
\$34.95 Nonmembers
plus shipping and handling

American Public Health Association



Publication Sales
Web: www.apha.org
E-mail: APHA@TASCO1.com
Tel: (301) 893-1894
FAX: (301) 843-0159

CAR02J1