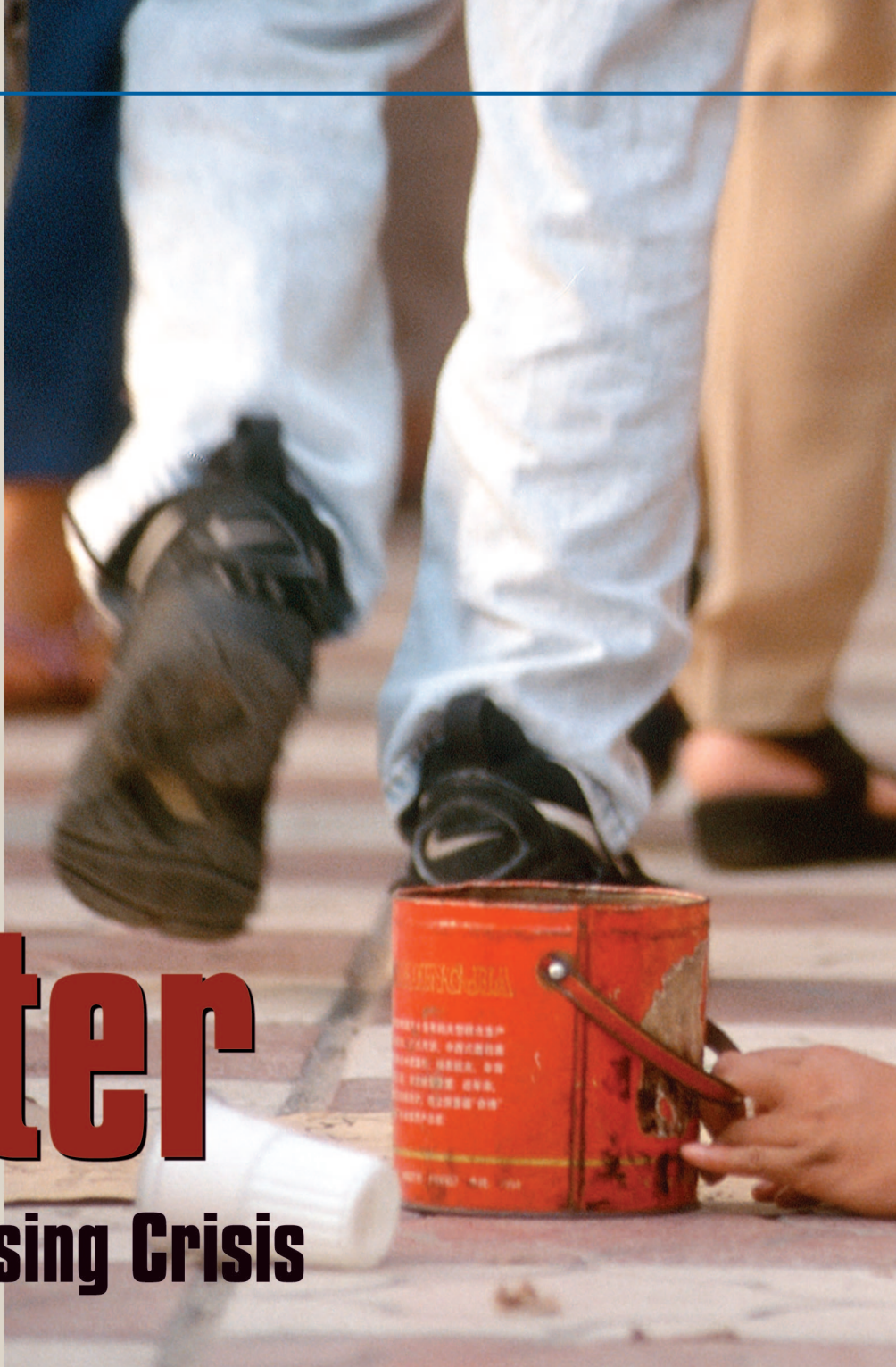


Give Me Shelter

The Global Housing Crisis



The problem of inadequate or nonexistent housing has reached crisis proportions globally. The world population passed 6.1 billion in 2001 and is expected to reach 7.9–10.9 billion by 2050, according to the United Nations (UN) Population Fund. This sheer volume alone exerts enormous pressure to improve existing housing and create new homes. As the global population grows, rural areas around the world

Mark Henley/Photos



are emptying and megacities springing up, usually as unregulated districts circling an older, more organized core. According to the Washington, D.C.–based advocacy group Population Action International, as of 1996 (the latest figures available), approximately 52% of the total housing in Caracas, Venezuela, consisted of squatter settlements; in Dar es Salaam, Tanzania, the figure was 49%, and in Karachi, Pakistan, 40%.

Housing affects health in many different ways. Deficient housing can compromise the most basic needs of water, sanitation, and safe food preparation and storage, allowing the rapid spread of communicable and foodborne diseases. Other problems, such as poor temperature and humidity regulation, can lead to respiratory disease. Overcrowding brings both physical and psychological dangers. And living in nonresidential settings such as factory grounds often exposes people to toxic chemicals that can cause both acute and chronic health effects.

A Multifactorial Epidemic

The UN Human Settlements Programme (UN-HABITAT) estimates that 600 million urban residents and 1 billion rural dwellers in developing countries live in overcrowded housing with poor water quality, lack of sanitation, and no garbage collection. People live in old buses, shipping containers, cardboard boxes, and aluminum shacks, and under staircases and plastic sheeting, among other forms of inadequate housing. In both the developed and developing worlds, industrial sites have become attractive settlements for displaced populations, partly because settlers can sometimes appropriate



Taking simplicity to the edge. Sometimes squatting, whether on the fringe of a megacity or in the heart of a forest, is the best—or only—housing option available.



building materials and tap into water and electricity systems.

Inadequate housing can be considered a multifactorial epidemic—rapid urbanization, economic restructuring, natural disasters, and political events such as regime changes and wars all have contributed to the crisis. In China, where the economy is modernizing rapidly, increasing urbanization in the next few decades will create a need for more than 200 million new housing units, almost twice the total number of existing housing units in the United States, says John Spengler, a professor of environmental health at the Harvard School of Public Health. According to *A Report on Worst Case*

Housing Needs in 1999: New Opportunity Amid Continuing Challenges, published in January 2001 by the U.S. Department of Housing and Urban Development (HUD), more than 5 million American families live in housing that is substandard, yet barely affordable.

A 2000 report by the Special Rapporteur to the UN Commission on Human Rights, *The Realization of Economic, Social and Cultural Rights*, noted that regional housing crises are increasingly being triggered by forced evictions stemming from ethnic cleansing and civil wars. For example, as many as 1.5 million people may have been displaced in southeast Turkey during a civil conflict from 1984 to 1999 between the government and the Kurdish Workers' Party, according to *Displaced and Disregarded: Turkey's Failing Village Return Program*, an October 2002 report published by the nonprofit Human Rights Watch. This report also says many villagers are still waiting in cities for the chance to reclaim their lands. In the city of Van, one refugee reported his family living in stables, 13 to a room, with 100 people sharing one water tap and one toilet.

Consequences of the Crisis

Not surprisingly, such conditions of overcrowding have fostered physical health problems such as typhoid fever and bronchitis, as well as post-traumatic stress disorder and depression, according to the Human Rights Watch report. In developing countries, overcrowding and poor ventilation can encourage the growth of disease vectors such as mosquitoes, parasites, bacteria, and viruses. Noise and sheer physical safety, including vulnerability to violent crime, contribute to anxiety and depression in both developed and developing countries.



A global dilemma. The lack of adequate housing is a problem with no geographical boundaries. Regional factors contributing to homelessness vary, but even affluent nations have been unable to escape the epidemic.

Some of the worst environmental health problems associated with housing, especially in developing countries, are unsafe water supplies, lead exposure, and poor indoor air quality (along with related dust and moisture problems).

Unsafe water. The developing world suffers 98% of the deaths resulting from unsafe water, sanitation, and hygiene facilities, according to the World Health Organization's (WHO) *World Health Report 2002*. The report identifies infectious diarrhea as the largest single contributor to ill health associated with water, sanitation, and hygiene inadequacies. In some countries schistosomiasis, trachoma, and other parasitic diseases arise from contaminated water systems. Schistosomiasis is caused by a blood fluke and causes fever, diarrhea, and enlargement of the liver and spleen. Trachoma is caused by a *Chlamydia* parasite and causes inflamed eyelids, corneal abrasion, and eventually blindness. According to the WHO, 6 million people worldwide are blind due to trachoma, and more than

150 million are threatened with blindness because of trachoma infection.

Drinking water can also be contaminated with naturally occurring chemicals. For example, in the Gaza Strip section of the Palestinian Occupied Territories, the already-scarce drinking water supply has become increasingly salty as rapid population increase and overuse deplete the regional aquifer, allowing seawater to intrude. According to Anna Bellisari, an assistant professor of anthropology at Wright State University in Dayton, Ohio, many Gaza physicians believe the excess salt is responsible for the area's high incidence of liver and kidney diseases. Chronic ingestion of salt can predispose people to hypertension, edema, and neurological problems, as well.

Drinking water is also the most common pathway for arsenic exposure. According to the WHO's Arsenic Fact Sheet No. 210, in Bangladesh, the United States, Australia, and a number of other countries, arsenic has been detected at levels above the 0.01 milligram per liter (mg/L) denoted by the

WHO as the "realistic limit to measurement"—that is, a limit imposed by the restrictions of the measurement technology rather than by a known health effect threshold. The fact sheet estimates that 28–35 million people worldwide are exposed to arsenic concentrations above 0.05 mg/L. The U.S. Environmental Protection Agency (EPA) estimates that 13 million Americans use drinking water with arsenic concentrations above 0.01 mg/L. Acute arsenic poisoning symptoms include vomiting, abdominal pain, and diarrhea, while chronic exposure leads to skin pigmentation and cancer of the lung, skin, bladder, and kidney.

Lead exposure. Lead paint is still used in much of the developing world, as is leaded gasoline. According to the *World Health Report 2002*, 120 million people worldwide have blood lead levels between 5 and 10 micrograms per deciliter ($\mu\text{g}/\text{dL}$), with 40% of the world's children having blood lead levels above 5 $\mu\text{g}/\text{dL}$. For children, blood lead levels above 10 $\mu\text{g}/\text{dL}$ are considered elevated by the Centers for Disease



Bleak prognosis. Overcrowding, poor indoor air quality from the use of biofuels, and lack of clean water and sanitation—all apparent in this slum in Nairobi, Kenya—are only a few of the many housing-related deficiencies that can lead to serious health problems.

Control and Prevention (CDC). In the United States, lead exposure is one of the most prominent and most studied health risks associated with housing.

In the United States, lead was removed from paint in 1978 (and from gasoline in 1986). However, paint is still the most common pathway for U.S. children's exposure. In addition to ingestion of paint chips and dust tracked into the home, exposure can also occur by drinking water carried through lead pipes and by ingesting or inhaling material used in hobbies such as stained glass-making.

According to HUD, 24 million U.S. housing units still have lead-based paint hazards, exposing 5.6 million children to enough lead to interfere with their development. Lead poisoning can reduce IQ and cause learning and attention disabilities. In high doses it can cause kidney damage, anemia, and death. Although the current CDC threshold for health and developmental effects is 10 $\mu\text{g}/\text{dL}$, a study by Bruce Lanphear of the Children's Hospital Medical Center in Cincinnati, Ohio, published in the November/December 2000 issue of *Public Health Reports*, suggested that there are cognitive effects below 5 $\mu\text{g}/\text{dL}$.

Low-income and ethnic populations continue to bear a disproportionate burden of lead exposure in developed countries. For example, the Environmental Health Coalition of San Diego, California, an environmental justice advocacy group, determined that 81% of the children in San Diego County with elevated blood lead levels are Latino. The most recent nationwide estimates from the CDC show that whereas 4.4% of all U.S. children have blood lead levels above 10 $\mu\text{g}/\text{dL}$, 16% of low-income children living in old housing and 22% of black children living in old housing have blood lead levels above 10 $\mu\text{g}/\text{dL}$.

Indoor air quality. The burning of solid fuels such as dung, wood, and coal, which are used by nearly half the world's population, exposes people who use them to particulates, nitrogen and sulfur compounds, and benzene. The resulting poor indoor air quality is associated with respiratory infection, chronic obstructive pulmonary disease, respiratory tract cancers, tuberculosis, cataracts, and asthma. According to the *World Health Report 2002*, indoor air pollution is estimated to cause 36% of all lower respiratory infections and 22% of chronic obstructive pulmonary disease in the world.

In the United Kingdom, a 1999 report by Diana Wilkinson of the Scottish Office Housing Research Branch titled *Poor Housing and Ill Health: A Summary of Research Evidence* states that even though much of the research is fragmented and inconclusive, a strong relationship between defective housing and health is evident. Wilkinson cited several studies showing strong associations between dampness and headaches, sore throats, and respiratory problems including asthma, especially among children. Radon, dust mites, environmental tobacco smoke, carbon monoxide, and fungal growth were the next-highest risks.

Asthma. Asthma is increasing at an alarming rate in the United States and disproportionately affects blacks. According to the Children's Environmental Health

damage that can encourage mold growth. Dan Morris of Healthy Buildings Incorporated, a private consulting firm in Seattle, compares these materials with wood: "When solid wood stays wet for extended periods, many cellulose-digesting molds will start growing on the surface. Only a few of these will [penetrate] into the core of the wood, and then very slowly," he says. "Particleboard and oriented strand board provide pathways and food for fungi through the entire thickness of the material very quickly." Mold is known to be an allergen and a lung irritant, particularly for people with asthma, but the scientific evidence for health risks from mycotoxins released by molds is still inconclusive, says Tim Takaro, an acting assistant professor of medicine and environmental health at the University of Washington.

According to the EPA, the resin glue used in some particleboard, plywood paneling, and fiberboard also releases formaldehyde, a volatile organic compound that above concentrations of 0.1 part per million can cause watery and burning eyes, nausea, coughing, skin rash, and severe allergic reactions, among other symptoms. More seriously, it can impair lung function at high enough doses. The EPA classifies it as a probable human carcinogen.

Chris Leffel, senior vice president of the Composite Panel Association, which represents manufacturers of materials used in cabinetry, shelving, millwork, and furniture, says,

"The composite panel industry continues to educate architects and designers on proper installation techniques for interior products made with composite wood [to minimize mold growth]." Leffel also notes that industry efforts have successfully reduced formaldehyde emissions by over 80% in the last 20 years, and that emissions from finished products made with today's composite panels fall below 0.1 part per million. But Morris maintains that, although formaldehyde emissions are much lower now in products made in the United States due to HUD requirements, the North American Free Trade Agreement and the World Trade Organization allow the import of products with no emission standards.

Home, Toxic Home?

Probably no place on earth illustrates the environmental health challenges of inadequate housing better than Porto Romano,



A special population at risk. Sights such as this, of children playing among hazardous waste—in this case, among piles of toxic chemicals in Porto Romano, Albania—are common around the world.

Network, a Washington, D.C.-based non-profit group, between 1980 and 1993 death rates for asthma were consistently highest among blacks aged 14–24 years. Asthma sensitizers and triggers found indoors include dust mites; cockroach, pet, and rodent allergens; molds; fine dust; tire fragments; and chemical air pollution such as environmental tobacco smoke, wood smoke, and volatile organic compounds from building materials. Many of these sensitizers are present in higher concentrations in low-income housing, but according to the most recent (October 2001) draft of the HUD report *Healthy Homes Issues: Asthma*, "residence in an urban area has been implicated as an important risk factor for all children."

Building materials. An emerging source of housing-related health problems is building materials commonly used in new housing, which can influence respiratory health. Composite wood panels such as particleboard are vulnerable to moisture

Albania. Located on the Adriatic coast near Durrës, which is Albania's major port and second-largest city, Porto Romano is a community of an estimated 6,000–10,000 people, half of whom live amid the rusting skeletons of a former factory that made the pesticide lindane and chromium-6, which is used in tanning leather.

The Porto Romano factory was closed in 1990, but people settled on the site after the collapse of Albania's communist system in 1991 triggered massive migrations from countryside to city. The 1999 war in neighboring Kosovo also brought an estimated 450,000 Kosovar refugees into Albania. Porto Romano, as unoccupied land with building materials to appropriate and still-functioning water and electricity supplies, was an inviting prospect for poor, displaced migrants.

About 400 tons of chemicals remain on the 750-acre site, with another 20,000 tons of hazardous waste lying in an open dump and leaching into the groundwater and the bay. The air in Porto Romano is bitter with the smell of lindane, and children, cart horses, cats, and dogs roam among mounds of neon-yellow chromium-6.

Lindane has been linked to breast cancer and endocrine disruption, according to the Pesticide Action Network North America, and is classified by the EPA as a possible human carcinogen. Large doses can cause seizures and blood disorders, and ingesting or touching small amounts of lindane can cause headaches, nausea, dizziness, tremors, and muscular weakness, according to the U.S. Agency for Toxic Substances and Disease Registry. As a persistent organic pollutant, it has been banned for commercial and agricultural uses in Europe since 2001.

Chromium-6 is the most toxic of the chromium compounds, according to the Agency for Toxic Substances and Disease Registry [see "Reflections on Hexavalent Chromium: Health Hazards of an Industrial Heavyweight," *EHP* 108:A402–A407 (2000)]. Breathing high concentrations can cause nasal irritation, ulcers, and holes in the septum. Long-term exposure is

associated with lung cancer. Ingesting large amounts can cause stomach upset, convulsions, kidney and liver damage, and death.

In 2001 the UN Environment Programme assessed the site, declared it a disaster area, and urged the Albanian authorities to close it and relocate its residents. But Albania's new national and local governments have had shaky authority, little money, and overwhelming challenges. No official action has been taken except the building of a wall across the access road, which was soon torn down by residents.

People continue to settle at Porto Romano. Most residents know about the contamination, and many have exposure symptoms, especially nausea and abdominal cramps. They say their cows' milk and their vegetables taste strange. In July 2002, *The New York Times* reported that milk from one resident's cow contained 100 times the European safety limit for lindane.

Thousands of miles away, the Mongolian capital of Ulaanbaatar also faces a housing crisis of fairly recent origin. Since communism collapsed in Mongolia about a decade ago, thousands of nomads and rural dwellers have flocked to Ulaanbaatar. A third of the Mongolian population now lives there.

The influx of new people has resulted in the rise of *ger* districts circling the

developed city center. (A *ger*, also known as a yurt, is a round felt tent used by nomadic herders in Mongolia.) The *ger* districts have no potable water or sewer infrastructure, according to Marlow Ramsay, development manager for JCS International. JCS International, an alliance of Christian groups working in Mongolia, is operating a joint project in the city with Habitat for Humanity to build homes using traditional Mongolian and Russian building techniques combined with Western methods (such as more efficient stove design) and materials (such as Styrofoam insulation).

Most heating and cooking in Mongolia is done with coal or wood, resulting in large amounts of particulate matter both indoors and outdoors. "On cold winter nights the smoke is overpowering throughout the city," says Ramsay. "Respiratory problems are common. The smoke, in addition to the cold, extremely dry air, makes this a serious problem. Chronic cough is a way of life for many people through the winter season." Tuberculosis also is common, Ramsay adds.

Water in Ulaanbaatar comes from two sources: wells and natural springs. The Mongolian government trucks water from several deep wells to distribution stations in the *ger* districts, where it is sold for a few cents a liter. But people have to hand-carry



Home at what price? Abandoned industrial sites such as Porto Romano are attractive to settlers because they offer buildings and utilities for the taking. Unfortunately, they also offer the health risks associated with contaminated soil and water.

water from the stations to their homes in their own containers, and often the stations are far enough away that some people take water from nearby ditches instead.

The WHO recently determined that 18 of Ulaanbaatar's 29 natural springs are now contaminated. New residents are building homes and latrines uphill of the spring outflows; they also dip their personal containers into the water, thus spreading any disease-causing agents they may be carrying to the common supply. Diarrheal diseases are a leading cause of death among young Mongolians, according to the World Bank's 2002 report, *Mongolia Environment Monitor*.

But Ulaanbaatar now faces a brighter future than settlements such as Porto Romano. According to Reijo Salmela, a WHO medical officer in Mongolia, the WHO is working with the Mongolian government to determine the extent to which indoor air pollution affects health and to improve the efficiency of, and reduce pollution from, the *ger* stoves. In addition to improving indoor air quality, the JCS International/Habitat project helps *ger* dwellers maintain consistent indoor temperatures to help protect the old and very young from exposure and immune system stress—temperatures can fall to 0°C in an unheated *ger*, according to Ramsay. Better stoves will also reduce burn injuries in children, Ramsay adds: the traditional stoves have no safety devices, and many Mongolian children carry burn scars. The WHO has also begun a project to collect data on the usage and geography of the Ulaanbaatar springs, build fountains and other safe outflow points, and place warning signs at contaminated springs in cooperation with local authorities.

What Else Is Being Done?

The idea that housing conditions strongly influence health status is not new. The great public health and housing movements of the 19th and early 20th centuries dramatically reduced infectious diseases such as cholera and tuberculosis by improving urban water, sanitation, ventilation, and overcrowding, while also improving housing quality.

But in later decades the housing and health communities went in different directions as rapid and dramatic medical advances tended to obscure the relationship between adequate housing and public health, says David Jacobs, director of HUD's Office of Healthy Homes and Lead Hazard Control. Jacobs believes that as the health effects of lead exposure became clearer and mitigation actions were taken in the latter half of the 20th century, both

housing and health professionals came to recognize once again that the solution to the public health problem of childhood lead poisoning, as well as certain other diseases and injuries, lay in remedying hazardous housing conditions. "We have come full circle," he says. "Good public health means decent, affordable housing."

In the 20th century, housing as a key policy issue gathered momentum internationally at the 1976 UN Conference on Human Settlements (Habitat I), says Roderick Lawrence, a professor at the University of Geneva's Centre for Human Ecology and Environmental Sciences. "The main idea was that housing and shelter should be a human right . . . because it should not only provide protection from harsh or severe environmental conditions but also access to clean water and sanitation," he says. The UN has included the right to safe, healthy housing in a number of international declarations, such as the Universal Declaration of Human Rights (1948), the International Covenant on Economic, Social and Cultural Rights (1966), and the International Covenant on Civil and Political Rights (1976). In 1993, UN-HABITAT adopted its first-ever resolution specifically on housing rights.

The WHO European Office for Environment and Health organized a seminar in 2001 that established the European Task Force on Housing and Health. The task force will advise the WHO on design and development of a European survey on housing and health. The survey will address

physical, social, and institutional conditions affecting health at the levels of house, neighborhood, and community, according to task force member David Ormandy, a principal research fellow at the University of Warwick Law School in Coventry, England. The WHO has drawn up a set of "health principles of housing," which include protection from communicable diseases and protection from injury, poisoning, and chronic disease. Both the UN and nongovernmental organizations (NGOs) such as the Geneva, Switzerland-based Centre on Housing Rights and Evictions have pressed for a binding international agreement to make housing a basic right that can be enforced under international law, although this has been resisted by some countries, including the United States.

Within the United States, HUD formed its Healthy Homes Initiative (HHI) in the late 1990s. The HHI continues previously existing HUD programs to mitigate lead paint hazards and serves as an umbrella to coordinate mitigation of many different housing-related health threats to children and families. In October 2002, President Bush awarded nearly \$95 million in HHI-funded grants to cities, counties, and states to increase the removal of lead-based paint hazards from housing and to support research and pilot programs aimed at mitigating asthma risks and other household dangers. Jacobs says the HHI focuses on housing interventions that will have multiple benefits, such as adding mechanical ventilation—replacing windows to



The lucky ones? Wars and regime changes such as the fall of communism leave millions around the world uprooted and homeless. Some, including these street children in the Mongolian capital of Ulaanbaatar, manage to find shelter. Others aren't so fortunate.

Mark Henley/Panos

affect ventilation, temperature, and humidity—which in turn will improve overall respiratory health, energy conservation, and housing quality.

One such HHI-funded research project was a recent study by Takaro and James Krieger, a project leader with the health organization Public Health—Seattle & King County. Takaro and Krieger found that community outreach to low-income homes, including the provision of vacuum cleaners, information about mitigating asthma triggers, and several health worker visits over the course of a year, reduced morbidity from asthma. The outreach resulted in fewer urgent care visits and symptom days (defined as days with cough, wheeze, or chest tightness; limited activity; shortness of breath; nights wakened by symptoms; or 24-hour periods with any symptoms). Takaro and Krieger are currently conducting a HUD-funded study to determine if home remediation, such as preventing water damage and removing moldy materials, will provide further benefits beyond those seen in the intervention study.

Many organizations are working on making housing materials more sustainable, but less clear is how many are intent on making sustainable housing methods and materials that are also healthful. For example, organic insulation materials such as straw, flax, and other cellulose-based products are much more susceptible to mold and moisture problems than more conventional insulation. The Danish

Building Research Institute and Danish Working Environment Council have begun a project to assess the health consequences of organic building materials.

Many NGOs are active in housing and health issues ranging from asthma and lead paint mitigation to meeting desperate basic needs in refugee and squatter settlements. For example, JCS International works exclusively in Mongolia, and Habitat for Humanity has projects in all U.S. states and 83 other countries. Environmental Health Watch in Cleveland, Ohio, features a “Healthy House” website (http://www.ehw.org/Healthy_House/HH_home.htm) that guides visitors through a range of environmental health risks, their health effects, and mitigation steps. San Diego’s Environmental Health Coalition has trained *promotoras*—people who inspect homes and educate their neighbors about reducing home lead exposures—in three area communities.

Heading for Home

Clearly, the health of the world’s population would be well served by significant improvements in housing for all people, from the homeless in Indonesia to upscale new home buyers on the American coasts. Making relatively simple changes in basic housing, such as providing safe drinking water, reducing humidity, and improving ventilation, could save billions of lives and medical care dollars over the coming decades.

Frustratingly, despite a great deal of activity by governments, international agencies, and NGOs, the housing and health crisis is expanding rather than diminishing. “The number of people without permanent housing or living in inadequate housing appears to have increased during the era of contemporary globalization, even though the legal framework of the right to housing has improved during the same period,” says Lawrence. He attributes the continuing problem to, among other factors, a decline in the per capita investment in basic urban services globally and an increase in urban poverty among women. Regarding the latter, the Special Rapporteur to the UN Commission on Human Rights noted that women “bear the primary responsibility for sustaining and maintaining homes,” so that their economic status directly affects the quality of family housing. Moreover, women have limited rights to land tenure and home ownership in many developing countries. Yet, according to UN-HABITAT, half of all households in Africa and Latin America are headed by women. Lawrence also points to other factors: Between 1990 and 1999, he says, more than 186 million people lost their homes to natural or anthropogenic disasters; of the latter, armed conflict left about 100 million people homeless, and about 164,000 people lost their homes as a result of industrial accidents and accompanying chemical releases.

Despite the many efforts of international policy groups and NGOs, housing and health issues may get worse before they get better, as economies globalize and populations shift on a large scale. It seems the more things change, the more they stay the same, at least in times of major social upheaval. Consider the words of a 19th-century observer of British housing during the first flowering of the Industrial Revolution: “These towns have been built by small speculators with no interest for anything except immediate profit. . . . In one place we saw a whole street following the course of a ditch, in order to have deeper cellars without the cost of excavations. The streets are unpaved, with a dunghill or a pond in the middle; the houses are built back to back without ventilation or drainage.”

Yet these words may be too pessimistic—as the connection between housing and health is re-established and more research is completed, effective improvements in housing can be applied in ways that result in large health benefits at relatively low cost.

Valerie J. Brown

