

Urban Environmental Health Hazards and Health Equity

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ABSTRACT *This paper outlines briefly how the living environment can affect health. It explains the links between social and environmental determinants of health in urban settings. Interventions to improve health equity through the environment include actions and policies that deal with proximal risk factors in deprived urban areas, such as safe drinking water supply, reduced air pollution from household cooking and heating as well as from vehicles and industry, reduced traffic injury hazards and noise, improved working environment, and reduced heat stress because of global climate change. The urban environment involves health hazards with an inequitable distribution of exposures and vulnerabilities, but it also involves opportunities for implementing interventions for health equity. The high population density in many poor urban areas means that interventions at a small scale level can assist many people, and existing infrastructure can sometimes be upgraded to meet health demands. Interventions at higher policy levels that will create more sustainable and equitable living conditions and environments include improved city planning and policies that take health aspects into account in every sector. Health equity also implies policies and actions that improve the global living environment, for instance, limiting greenhouse gas emissions. In a global equity perspective, improving the living environment and health of the poor in developing country cities requires actions to be taken in the most affluent urban areas of the world. This includes making financial and technical resources available from high-income countries to be applied in low-income countries for urgent interventions for health equity. This is an abbreviated version of a paper on "Improving the living environment" prepared for the World Health Organization Commission on Social Determinants of Health, Knowledge Network on Urban Settings.*

KEYWORDS *Economic resources, Environment, Equity, Social determinants, Urban health*

INTRODUCTION

When humans started to live in large numbers in close proximity to each other approximately 5,000 years ago, health challenges included the import of water, food and other essentials to the population, and transport of excreta and other waste products away from the population. Many million people in low-income and

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informal settlements (“slums”) in cities of our own era face similar health challenges.^{1,2} As most of the urban slum dwellers live in tropical countries, their health is also threatened by a variety of tropical diseases influenced by social and environmental determinants.³ Health equity can only be achieved by “leveling up” living conditions for the poor⁴ and by reducing differential exposure and vulnerabilities among different groups in society.

People are exposed to a whole variety of factors that can either promote good health or be hazardous to health, including the physical living environment. Modern cities can improve health via their material, service-provision, cultural, and aesthetic attributes.⁵ They also offer opportunities for cost-effective interventions that can serve many people even if carried out on a small scale. Existing health-promoting infrastructure (e.g., drains and distribution networks for kerosene for cooking) can, in some situations, be upgraded to meet the local health demands. Health hazards and inequities remain, however, and new threats have emerged, but the knowledge and technologies for creating a healthy city are available.⁶

It has been pointed out by Sen⁷ and Kawachi and Wamala⁸ that poverty is not only a question of money, but it has four other dimensions: lack of *opportunities* (for employment and access to productive resources), lack of *capabilities* (access to education, health, and other public services), lack of *security* (vulnerability to economic risks and violence), and lack of *empowerment* (absence of voice, power, and participation). This paper suggests adding a fifth dimension: lack of a *health-supporting physical living environment*. These five dimensions stem from inequality as the root causes of poverty.

SOCIAL DETERMINANTS AS DRIVING FORCES BEHIND ENVIRONMENTAL DETERMINANTS

Social determinants often cause their health effects via webs or pathways of environmental exposures. A framework to describe such pathways (the Driving Forces–Pressures–State–Exposure–Effects–Action [DPSEEA] framework) was developed at World Health Organization (WHO).^{9,10} The social determinant *driving forces* lead to *pressures* on the environment that change the *state of the environment*, which create *exposures* that cause health *effects* (Table 1).

The DPSEEA framework is intended to visualize pathways or causal webs for how policies and actions at driving force level are linked to more proximal exposures and finally the health effects. For example, urban people with low incomes and those affected by social discrimination are likely to end up living in “slum” conditions with an unhealthy living environment and exposure to pathogens and disease vectors. Lack of research on many of these interlinkages is an obstacle to quantitative impact analysis of the higher level interventions. The development of environmental burden of disease estimates by WHO¹¹ for different hazards at different levels in the DPSEEA cause–effect framework, and analysis of the environmental health risks in vulnerable groups, such as the Children’s Environmental Health analysis,^{12–14} are starting to fill the gaps.

MAJOR ENVIRONMENTAL HEALTH CHALLENGES IN DEPRIVED URBAN AREAS

Diarrhea, worm infections, and other infectious diseases spread via contaminated water^{15,16} and lack of water creates difficulties for families to carry out basic

TABLE 1. Overview of indicators and issues in the hierarchy of social and environmental health determinants

DPSEE level	Indicator items	Key issues
Driving forces	Population size and structure (age, sex)	Demographic transition
	Birth rate, fertility	Fertility level
	Life expectancy	Aging
	Poverty prevalence	Economic development
	Social barriers to equality	Economic inequalities
	Income distribution	Gender, ethnic, and social discrimination
	Economic level and growth (GDP in straight dollars or PPP\$)	Globalization
	Types of economic activity and trade	Urban/rural development
	Health and environment policies and legislation	Urban planning and design
	Technology use	Knowledge development
Pressures	Energy use	Sustainability
	Agricultural land use and production	Resource conservation
	Water use, water access	Emergence of deprived urban areas
	Availability of sanitation	Infrastructure development
	Solid waste volumes	
	Hazardous waste volumes	
	Transport trends	
	Existence of breeding grounds of disease vectors	

State of the environment	<ul style="list-style-type: none"> Climate, trends Air quality River water quality Ground water contamination Drinking water quality Food contamination Housing quality 	<ul style="list-style-type: none"> Geographic constraints Natural conditions Microenvironmental variations
<ul style="list-style-type: none"> Exposures (it is the differential exposure and vulnerability at the exposure level where we see direct relationships with inequalities in health effects) Effects 	<ul style="list-style-type: none"> Specific exposure studies (air, lead, water, and climate) Studies of specific disease vectors (e.g., mosquitoes) Workplace environment surveys General health situation, mortality trends Specific environmental effects Environmental burden of disease Occupational injuries and diseases Traffic crash injuries 	<ul style="list-style-type: none"> Risk transition Exposure hot spots Total human exposure Epidemiologic transition Health inequalities
Actions	Policies and programs for prevention at each DPSEEA level	Development of new policies to meet the health challenges of the future

hygiene around the home. Almost half of the urban population in Africa, Asia, and Latin America is suffering from these diseases because of lack of access to improved water and sanitation.² In addition, lack of access to water means hours wasted carrying water from far away or substantial amount of scarce household resources spent on essential human needs. It is mainly women and girls that end up responsible for these chores.¹⁵

Proper sanitation is just as important for health.¹⁵ Women and girls are again vulnerable as many of them, for reasons of culture and modesty, will not attend to their sanitary needs during daylight hours if required to use a communal latrine. In 2002 51% of populations in developing countries still lacked proper sanitation whereas 21% lacked safe and sufficient drinking water.¹⁵ In urban areas the coverage is higher, but most people in slums have inadequate facilities. Exposure to disease vectors, including mosquitoes, because of lack of liquid or solid waste management is an increasing health threat in these areas.

More than three billion people depend on solid fuels, including biomass (wood, dung, and agricultural residues) and coal to meet their most basic energy needs: cooking, boiling water, and heating.¹⁷ A study in Thailand showed a very strong social gradient for fuel use: low-income families use fuel-wood and higher income families use LPG or charcoal.¹⁸ In urban areas, inequalities are particularly stark: for example, more than 90% of urban Bangladeshis in the poorest income quintile cook with solid fuels, compared with less than 25% among the richest quintile.¹⁹ Burning solid fuels produces high levels of indoor air pollution: typical 24-h levels of PM₁₀ in biomass-using homes range from 300 to 3,000 µg/m³.²⁰ By comparison, the WHO air quality guidelines recommend a limit for daily average PM₁₀ is 50 µg/m³.²¹

Indoor smoke exposure doubles the risk of child pneumonia and other acute respiratory infections.²⁰ It can also increase chronic obstructive pulmonary diseases in women, and double the risk of lung cancer if the smoke comes from use of coal for cooking.²⁰

Deprived urban areas often contain workplaces with health hazards because of toxic products, injury and ergonomic hazards, noise, external pollution, and traffic generation.^{22,23} The problems in “cottage industries” are increased because of inappropriate zoning, town planning, and location of industrial activities.²⁴ The mix of workplaces and settlements increase the health risks when major industrial accidents occur, as in Bhopal, India, in 1984.²⁵ Some serious workplace hazards that have been common in developed countries in the past have now been transferred to developing countries.²⁶ Work injuries and poor health because of work hazard exposures lead in themselves to poverty: a vicious circle.

HEALTH EQUITY ISSUES RELATED TO THE MODERN LIVING ENVIRONMENT IN URBAN AREAS

Epidemiological studies have documented increased morbidity and mortality from motor vehicle air pollution, and poor people often live in the most exposed areas.²⁷ In Bangkok as much as 29% of all cardiovascular disease deaths may be because of current air pollution.²⁸ In children and young people injuries related to motor vehicle traffic are among the most common causes of death²⁹ and the problem is rapidly increasing in developing countries contributing to health inequity.³⁰

The contemporary use of the private motor vehicle is associated with another health threat in urban areas: the obesity epidemic. Walking and bicycling as a

natural part of daily transport has diminished and lack of daily physical activity contributes to increasing body weight in many populations. Cars are also implicated in changing dietary patterns with increasing consumption of high-energy and high-fat “fast foods.”³¹ Major visible economic inequalities within cities contribute to social tensions, and pervasive fear of crime which further limits outdoor physical activities.⁶

Whereas water- and food-borne infections because of poor sanitation and inadequate hygiene have receded, emerging respiratory infections (e.g., SARS and avian influenza) retain the potential for rapid spread in areas with high population density. Other hazards in urban areas are lead in paint on houses and use of asbestos-cement building products.²⁴

Cities require constant energy and resource inputs, as well constant waste disposal to be able to sustain human life.³² To achieve sustainability modern cities need to be planned and managed with these resource and waste issues in mind. An important contemporary resource depletion issue is global climate change.^{33,34} Cities contribute to climate change through their large energy demands. The health effects of a warming world are likely to be overwhelmingly negative,³⁵ particularly in the poorest communities, which have contributed least to greenhouse gas emissions.³⁶ Some health effects may affect rural people more than urban people (e.g., effects of reduced local food production) whereas other effects are more prominent in cities. For instance, the effects of heat waves are exacerbated by the urban “heat island” effect.³⁷ The excess mortality in Europe in 2003^{38,39} was more than 40,000 people (mainly elderly low-income people.)⁴⁰ Whereas the effects in temperate regions may be partly compensated by lower winter mortality and adaptation⁴¹, tropical cities do not experience such compensation.⁴²

Sea level rise, more violent tropical cyclones and river floods, water- and food-borne gastrointestinal infections, and vector-borne diseases (e.g., dengue fever⁴³) are other health risks of the urban poor because of climate change.³⁵

Levels of air pollutants, such as ozone, because of motor vehicle emissions tend to be higher on warmer days. Ozone-related deaths may increase by ~4.5% because of climate change by the 2050s.⁴⁴ This is likely to affect millions of people in urban populations across the world.⁴⁵ Half of the 15,000 additional deaths during the 2003 heat wave in France may have been because of increased ozone levels associated with the high temperatures.⁴⁶

Urbanization also involves a shift in consumption from wild game meat or small landholder/householder reared poultry and pork to industrially reared beef, pork, and chickens. This has happened in less than 50 years and has numerous environmental consequences,^{31,47-49} e.g., land-clearing; extensive use of fertilizers, pesticides, and water; the recycling of feathers, carcass, and waste; and use of veterinary antibiotics and large numbers of livestock that contribute to methane production, a more potent greenhouse gas than carbon dioxide. Urbanization limits possibilities for household food production and contributes to environmental damage through long distance food transportation (greenhouse gases etc.)⁵⁰

COMPREHENSIVE APPROACHES TO ACHIEVING EQUITABLE ENVIRONMENTAL HEALTH CONDITIONS

The Millennium Development Goal target number 11 states: “have achieved by 2020 a significant improvement in the lives of at least 100 million slum dwellers.” This is a very modest target (less than 10% of dwellers) as there is already one

billion people living in slums and the number is increasing.¹ “Slum upgrading” offers an opportunity for rapid scale-up of concrete action¹ in a cost-effective manner.⁵¹ It consists of improving security of tenure (often through regularization of land rights) and improving the basic services provision (e.g., water services, energy for cooking and lighting, storm water drainage systems, and security lighting) and housing, mitigation of environmental hazards, provision of incentives for community management, improving access to health care and education, and enhancement of livelihoods through training and microcredit.^{52,53}

Improved water supply should be combined with improved sanitation^{54,55} and a separate toilet in each household to facilitate personal hygiene, particularly for women and girls. These interventions are highlighted in the Millennium Development Goals target number 10: “Halve, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation.” When water resources are severely restricted alternatives to water-borne sewerage would be the best solution.⁵⁶ Other interventions include clean fuels and efficient stoves, liquid and solid waste management, and improved housing.² The cost can be surprisingly low (US \$500 per household⁵⁷), if the slum upgrading is carried out with active community participation.

Another approach is to build whole new housing areas with all the necessary facilities available from the beginning. If it is done in a way that takes into account the fears and desires of the poor, as was done in Singapore several decades ago⁵⁸, it can be very successful.

A comprehensive approach that combines infrastructure improvement, health promotion, and community participation is the Health City, Municipality and Settings approach promoted by WHO and Pan-American Health Organization for many years (see WHO websites for references). It engages local governments in health development through a process of political commitment, institutional change, capacity building, partnership-based planning, and innovative projects.^{59,60} It promotes comprehensive and systematic policy and planning with an emphasis on health inequalities and urban poverty. There are now several thousand “healthy cities” linked through national, regional, metropolitan, and thematic networks.

INTERVENTIONS FOR ENERGY, TRANSPORT, AND INDUSTRY

Switching from wood, dung, or charcoal to more efficient modern fuels, such as kerosene, LPG, and biogas, brings about the largest reductions in indoor smoke⁶¹. In many poor urban communities, however, biomass remains the most practical fuel and there, improved stoves can cut back indoor smoke levels and fuel use considerably, which improves health and reduces energy costs.¹⁹

There is a wide range of technological and planning options that supply alternatives to the private motor vehicle for people’s mobility needs. For example, the proportion of people walking or cycling to work varies from 32% in Copenhagen, to 22% in Tokyo, and to 0.3% in Atlanta. Values in developing countries are equally variable, from 30% in Santiago to 2% in Brasilia.⁶² The rapid development of the physical size of cities and town planning promoting “sprawl” and a global “car culture” add to the health concerns of private motor vehicle transport.^{63,64} Improved public transport, planning for “walkability,” and a reduction of “unnecessary” private motor vehicle travel are essential to create a healthy environment in cities.⁶⁵

Studies of the benefits and monetary costs of major air pollution control efforts²⁷ have concluded that the benefits, at least in developed countries, far outweigh the costs. Policies and actions to control air pollution from vehicles and industry can be important interventions for health equity. In general, measures aimed at the reduction of air pollution and hence the exposure of millions of urban dwellers will also decrease greenhouse gas emissions and vice versa.³³

WORKPLACE HAZARD INTERVENTIONS

Numerous reports describe prevention methods for specific hazards (lead, asbestos, organic solvents, silica dust, accidents/injuries, etc.), including materials from the occupational health and safety programs of WHO and International Labor Organization (ILO).²³ Interventions concerning these hazards improve health equity because low-income people generally end up working in jobs in the unprotected informal sector with the greatest health risks.²⁶

The ILO develops conventions and guidelines to improve occupational health and safety. An important intervention at the local urban level is the labor inspectorate⁶⁶ that needs to be appropriately resourced. Trade unions are natural partners for awareness raising and local action, as well as for promotion at government level of healthy work policies and legislation.

RESOURCES FOR HEALTH EQUITY INVESTMENTS

In the early 1970s the UN General Assembly recommended that high-income countries should provide 0.7% of their GDP to development aid and this was later reiterated in other fora, including the Rio Summit in 1992. The level never reached more than 0.36% or US \$90 billion.⁶⁷ The accumulated shortfall of aid since 1975 is about US \$2 trillion (calculated by Kjellstrom, unpublished data), which could be seen as a debt from the rich to the poor. The annual gross world product is US \$40 trillion, two thirds of which is created in the high-income countries. Aid at 0.7% of GDP would amount to US \$180 billion per year.

According to an analysis by Sachs,⁶⁸ aid needs to be doubled to achieve the Millennium Development Goals and other global equity aims. One way to collect additional resources for aid would be a small tax on foreign exchange transactions, the so-called Tobin tax (after the economist James Tobin, who suggested this more than 25 years ago). This tax was meant to discourage speculative foreign exchange transactions while the influence on long-term cross-border trade and investments would be minimal.⁶⁹ Approximately US \$2 trillion in foreign exchange transactions are carried out each day.⁷⁰ A superficial estimate indicates that a Tobin tax of 0.02% would collect US \$400 million per day, or US \$150 billion per year, similar to the aid commitment made by the high-income countries in the 1970s. However, a detailed analysis is required to make a more reliable estimate.

Low- and middle-income countries are not likely in the near future to be able to provide all the funds needed to create a truly healthy living environment. Funding from the more affluent countries will be required to back up the plans made by peoples and governments in the less affluent countries.⁶⁸ An equitable sharing of wealth and resources globally is the greatest inequity challenge facing the world.⁷¹

CONCLUSIONS, KEY MESSAGES

- Clean and sufficient drinking water, proper sanitation and drains for waste water, and proper solid waste management are the key health equity interventions in deprived urban areas, and cost-effective solutions exist.
- Household energy supply is a major environmental health issue because of the harmful effects of biomass and coal smoke. Alternative fuels for cooking and heating need to be made available and electricity for lighting and refrigerators provides great benefits for health.
- The working environment can be harmful to health of the poor and powerless. Specific interventions exist for all types of industrial activity, including cottage industries.
- Availability of and access to public transport is a key element in improving transport “equity” and reducing the negative health impacts of a “car society.”
- Providing food for the growing urban populations has its own environmental and health risks. Interventions to create a sustainable food supply based on principles of resource conservation and environmental protection is a key issue for future health equity.
- Broad environmental health policies, such as those promoted by the Healthy Cities and Municipalities movement, provide excellent frameworks for improving the living environment and health for poor people
- Global climate change is likely to particularly affect health of poor people in both rural and urban areas. Actions to reduce its severity are therefore actions for health equity.
- A timely improvement in the living environment for all deprived and disadvantaged people is necessary for health equity and this will require greater transfer of financial and technical resources from the affluent to the less affluent.

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