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Environment and Urbanization 1993 5: 87

DOI: 10.1177/095624789300500208

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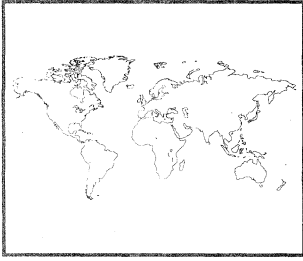
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The impact on health of urban environments

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1. An earlier version of this paper was presented at the International Workshop on "Planning for Sustainable Urban Development", University of Wales College of Cardiff in July 1992 and part of it was incorporated into a paper presented at the Expert Group Meeting on "Population Distribution and Migration" organized by the UN Population Division and UNFPA in Santa Cruz, Bolivia, January 1993; the paper has benefitted much from comments made by

I. INTRODUCTION

THIS PAPER REVIEWS the range of environmental hazards present in urban areas and their impact on human health.⁽¹⁾ It suggests that low-income groups (and within such groups women and children) bear most of the health burden of such hazards. It also illustrates how the range and relative importance of environmental hazards differ between urban centres and between districts within urban centres. The paper does not seek to specify priorities for urban environmental improvements in Africa, Asia and Latin America. Priorities should differ for each of the 30,000 or so urban centres within these regions. But it emphasizes the variety of environmental hazards that must be considered in any urban locality and how the groups most affected must have a much more influential role in setting priorities for environmental improvement, if limited resources are to permit significant improvements.

II. ENVIRONMENTAL HAZARDS AND THEIR IMPACT ON HEALTH

a. Introduction

IN MOST URBAN areas in the Third World, environment related diseases or accidents remain among the major causes of illness, injury and premature death. In many urban areas or in particular districts within larger cities, they are the leading causes of death and illness. Most of this health burden is preventable. Environmental hazards were also major causes of ill-health, injury and premature death in cities in Europe and North America just 120 or so years ago.⁽²⁾ The fact that this is no longer so reveals the extent to which human interventions can modify the urban environment and protect populations from hazards.

participants at both these meetings.

2. See for instance Wohl, Anthony S. (1983), *Endangered Lives: Public Health in Victorian Britain*, Methuen, London, 440 pages.

Box 1 lists seven kinds of health hazard that are common in urban environments. Four have a direct bearing on health: biological disease-causing agents (pathogens), chemical pollutants, a shortage of (or lack of access to) particular natural resources, and physical hazards. These are the four most pressing urban environmental problems in terms of their health impact in Africa and much of Asia and Latin America. Three others also influence health, although less directly: aspects of the built environment with negative consequences on people's health; natural resource degradation; and national/global environmental degradation (including a rising concentration of greenhouse gases in the atmosphere and the depletion of the stratospheric ozone layer).

Box 1: Hazards To Health Within the Urban Environment

1. Biological pathogens or pollutants within the human environment that impair human health - including pathogenic agents and their vectors (and reservoirs) - for instance the many pathogenic microorganisms in human excreta, airborne pathogens (for instance those responsible for acute respiratory infections and tuberculosis) and disease vectors such as malaria-carrying (*Anopheline*) mosquitoes.

2. Chemical pollutants within the human environment - including those added to the environment by human activities (e.g. industrial wastes) and chemical agents present in the environment independent of human activities.

3. The availability, cost and quality of natural resources on which human health depends - for instance food, water and fuel.

4. Physical hazards (e.g. high risks of flooding in houses and settlements built on floodplains or of mud slides or landslides for houses on slopes).

5. Aspects of the built environment with negative consequences on physical or psycho-social health (e.g. overcrowding, inadequate protection against noise, inadequate provision of infrastructure, services and common areas).

6. Natural resource degradation (e.g. of soil and water quality) caused by wastes from city based producers or consumers which impacts on the health/livelihoods of some urban dwellers.

7. National/global environmental degradation with more indirect but long-term influences on human health:

- * the depletion of finite non-renewable resource bases;**
- * wastes from human activities that contribute to possible threats to the functioning and stability of global cycles and systems and the increasing frequency of extreme climatic conditions (e.g. greenhouse gas emissions and gaseous emissions that contribute to the depletion of the stratospheric ozone layer).**

3. WHO (1992), *Our Planet, Our Health*, WHO Commission on Health and Environment, World Health Organization, Geneva, April.

4. See reference 3.

5. Rossi-Espagnet, A., G.B. Goldstein and I. Tabibzadeh (1991), "Urbanization and health in developing countries; a challenge for health for all", *World Health Statistical Quarterly*, Vol. 44, No. 4, pages 186-244.

6. See for instance Songsore and McGranahan in this issue of *Environment and Urbanization*, Misra, Harikesh (1990), "Housing and health problems in three squatter settlements in Allahabad, India" in Jorge E. Hardoy et al. (editors), *The Poor Die Young: Housing and Health in Third World Cities*, Earthscan Publications, London; and Adedoyin, M. and S. Watts (1989), "Child health and child care in Okele: an indigenous area of the city of Ilorin, Nigeria", *Social Science and Medicine*, Vol. 29, No. 12, pages 1333-1341.

7. See for instance Songsore and McGranahan in this issue and Surjadi, Charles (1988), *Health of the Urban Poor in Indonesia*, Urban Health Problems Study Group paper No. 29, Atrna Jaya Research Centre, Jakarta, 45 pages.

8. WHO (1990), *Global Estimates for Health Situation Assessments and Projections 1990*, Division of Epidemiological Surveillance and Health Situation and Trend Analysis, World Health Organization, WHO/HST/90.2, Geneva, 61 pages.

9. Many of these are summarized in Bradley, David, Carolyn Stephens, Sandy Cairncross and Trudy Harpham (1991), *A Review of Environmental Health Impacts in Developing Country Cities*, Urban Management Program Discussion Paper No. 6, The World Bank, UNDP and UNCHS (Habitat), Washington DC, 58 pages.

10. See references 5 and 9.

11. See reference 5.

b. Biological Pathogens

Biological pathogens in the human environment - in water, food, air or soil - represent the single most serious environmental problem in terms of their impact on human health.⁽³⁾ These pathogens can be classified according to the medium through which human infection takes place: foodborne, airborne or water related. For some, infection may occur through contaminated food or water.

Box 2 lists the main water related infections with estimates of morbidity, mortality and population at risk (where these are available). These are global estimates covering rural and urban areas; there are no figures which cover only urban areas. Waterborne diseases are the single largest category of communicable diseases worldwide and account for more than 4 million infant and child deaths per year.⁽⁴⁾ In many Third World cities or city districts, waterborne diseases are among the major causes of infant and child death and a major cause of adult death. In contrast, very few fatal cases of waterborne diseases are now recorded in Europe or North America.

Diarrhoeal diseases account for most water related infant and child deaths in urban areas, and a high proportion of illnesses. Risk factors include overcrowding, poor sanitation, contaminated water and inadequate food hygiene.⁽⁵⁾ Many studies of poor urban districts have shown diarrhoeal diseases to be a major cause of morbidity and mortality.⁽⁶⁾ Where water supplies and provision for sanitation are inadequate for high proportions of the entire population, they can remain one of the most serious health problems within city-wide averages.⁽⁷⁾

Among the various water related diseases listed in Box 2, filariasis and intestinal worms (especially ascariasis/roundworm) stand out for the millions of urban people who are debilitated by them; only a small proportion of those infected with these diseases will die of them but they cause severe pain to hundreds of millions of people.⁽⁸⁾ Various case studies in low-income settlements have shown that a high proportion of the population have large intestinal worm burdens.⁽⁹⁾

Many disease vectors live, breed or feed within or around houses and settlements in urban areas. The diseases they cause or carry include some of the major causes of ill-health and premature death in many cities - especially malaria (*Anopheles* mosquitoes) and diarrhoeal diseases (cockroaches, blowflies and houseflies). There are severe problems with malaria in urban areas in large parts of Africa, Asia and Latin America.⁽¹⁰⁾ In many cities or poor peripheral city districts, malaria is one of the main causes of illness and death.⁽¹¹⁾ There are also many other diseases caused or carried by insects, spiders or mites including bancroftian filariasis (*Culex* mosquitoes), Chagas disease (triatomine bugs), dengue fever (*Aedes* mosquitoes), hepatitis A (houseflies, cockroaches), leishmaniasis (sandfly), plague (certain fleas), relapsing fever (body lice and soft ticks), scabies (scabies mites), trachoma (face flies), typhus (body lice and fleas), yaws (face flies), and yellow fever (*Aedes* mosquitoes).⁽¹²⁾ Many of these vectors thrive when there is poor drainage and inadequate provision for garbage collection, sanitation and piped water supply water. *Anopheles* mosquitoes breed in standing water. The sandflies which transmit leishmaniasis can breed in piles of refuse or in pit latrines while the *Culex quinquefasciatus* mosquitoes which are one of the vectors for bancroftian leishmaniasis can breed in open or cracked septic tanks, flooded pit latrines and drains.⁽¹³⁾ Leptospirosis outbreaks have been

Box 2: Examples of Water Related Infections With Estimates of Morbidity, Mortality and Population At Risk

DISEASE (Common name)	(Name)	MORBIDITY	MORTALITY (No of deaths/year)	POPULATION AT RISK
1. WATERBORNE (and water washed; * also foodborne)				
Cholera	Cholera*	More than 300,000	More than 3000	
Diarrhoeal diseases	this group includes salmonellosis,* shigellosis,* <i>Campylobacter</i> ,* <i>E. coli</i> , rotavirus, amoebiasis* and giardiasis*	700 million or more infected each year with over 1,500 million episodes in children under five	More than four million	More than 2,000 million
Enteric fevers	Paratyphoid Typhoid	500,000 cases; 1 million infections	25,000	
Infective jaundice	Hepatitis A*			
Pinworm	Enterobiasis			
Polio	Poliomyelitis	204,000 (1990)	25,000	
Roundworm	Ascariasis	800-1,000 million cases; 1 million cases of disease	20,000	
Leptospirosis				
Whipworm	Trichuriasis			
2. WATER WASHED				
<i>(a) Skin and eye infections</i>				
Scabies	Scabies			
School sores	Impetigo			
Trachoma	Trachoma	6-9 million people blind		500 million
Leishmaniasis	Leishmaniasis	12 million infected; 400,000 new infections/yr		350 million
<i>(b) Other</i>				
Relapsing fever	Relapsing fever			
Typhus	Rickettsial diseases			
3. WATER BASED				
<i>(a) Penetrating skin</i>				
Bilharzia	Schistosomiasis	200 million	Over 200,000	500-600 million
<i>(b) Ingested</i>				
Guinea worm	Dracunculiasis	Over 10 million		100 million+
4. WATER RELATED INSECT VECTOR				
<i>(a) Biting near water</i>				
Sleeping sickness	African Trypanosomiasis	At least 20,000 new cases		50 million
<i>(b) Breeding in water</i>				
Filaria	Filariasis (lymphatic)	90 million		900 million
Malaria	Malaria	267 million (107 million clinical cases)	1-2 million (three quarters children under 5)	2,100 million
River blindness	Onchocerciasis	18 million (over 300,000 blind)	20-50,000	85-90 million
Yellow fever	Yellow fever	10-25,000		
Breakbone fever	Dengue fever	30-60 million infected every year		

Source: Adapted from WHO (1992) *Our Planet, Our Health*, Report on the World Commission on Health and Environment, Geneva. Derived from Cairncross, Sandy and Richard G Feachem (1983) *Environmental Health Engineering in the Tropics - An Introductory Text*, John Wiley and Sons, Chichester; and White GF, Bradley DJ and White, AU (1972) *Drawers of Water: Domestic Water Use in East Africa*, University of Chicago Press, Chicago. Figures for morbidity, mortality and population at risk from WHO (1990) *Global Estimates for Health Situation Assessment and Projections 1990*, Geneva.

12. Schofield, C.J., R. Briceno-Leon, N. Kolstrup, D.J.T. Webb and G.B. White (1990), "The role of house design in limiting vector-borne disease", in Jorge E. Hardoy et al. (editors), *The Poor Die Young - Housing and Health in Third World Cities*, Earthscan Publications, London, pages 189-212; and WHO (1992), see reference 3.

13. Cairncross, Sandy and Richard G. Feachem (1993), *Environmental Health Engineering in the Tropics; an Introductory Text (second edition)*, John Wiley and Sons, Chichester, 306 pages.

14. Sapir, D. (1990), *Infectious Disease Epidemics and Urbanization: a Critical Review of the Issues*, Paper prepared for the WHO Commission on Health and Environment, Division of Environmental Health, WHO, Geneva.

15. Blacklock, D.B. and A.M. Evans (1926), "Breeding places of Anopheline mosquitoes in and around Freetown, Sierra Leone", *Annals of Tropical Medicine and Parasitology*, Vol. 20, pages 59-86, quoted in reference 5.

16. Aradeon, David, Tade Akin Aina and Joe Umo (1986), "South-West Nigeria", in Jorge E. Hardoy and David Satterthwaite (editors), *Small and Intermediate Urban Centres; their Role in Regional and National Development in the Third World*, Hodder and Stoughton (UK) and Westview (USA), pages 228-278.

17. See reference 5.

18. See reference 3.

19. See reference 5.

20. See reference 13.

21. Gomes Pereira, M. (1989), "Characteristics of urban mortality from Chagas' disease in Brazil's Federal District", *Bulletin of the Pan American Health Organization*, Vol. 18, No. 1; and Briceno-Leon, Roberto (1990), *La Casa Enferma: Sociología de la Enfermedad de Chagas*, Consorcio de Ediciones, Capriles C.A. Caracas, 156 pages.

associated with flooding in Sao Paulo and Rio de Janeiro - the disease passing to humans through water contaminated with the urine of infected rats or certain domestic animals.⁽¹⁴⁾

Some diseases transmitted by insect vectors have long been an urban problem; for instance reports on malaria in Freetown (Sierra Leone) date from 1926,⁽¹⁵⁾ while colonial town planning regulations in Nigeria sought to protect the colonial populations from malaria by insisting on a building-free zone between European and non-European residential areas.⁽¹⁶⁾ Other diseases remain concentrated in rural areas - especially those such as schistosomiasis which are associated with water reservoirs and irrigation canals and ditches - although even schistosomiasis is widespread in many cities.⁽¹⁷⁾ One reason for this is the number of infected rural inhabitants who move to urban areas. Another is that some disease vectors have adapted to urban environments or the expanding urban areas have produced changes in the local ecology that favour the emergence or multiplication of a particular disease vector; these help explain the rapid increase in lymphatic filariasis and malaria in urban populations.⁽¹⁸⁾ The diseases spread by the *Aedes* group of mosquitoes (which include dengue, dengue haemorrhagic fever and yellow fever) are serious health problems in many cities; pots and jars, small tanks, drums and cisterns used for storing water in houses lacking regular piped supplies can provide breeding habitats for these mosquitoes.⁽¹⁹⁾ So too can small pools of clean water within residential areas in, for instance, discarded tin cans and rubber tyres.⁽²⁰⁾ Chagas disease, with an estimated 18 million people infected in Latin America, primarily affects poor rural households, as the insect vector rests and breeds in cracks in house walls. But it is increasingly an urban problem too, both through the migration of infected persons to urban areas (there is no effective treatment for the disease) and through the peri-urban informal settlements where the insect vectors are evident.⁽²¹⁾

Acute respiratory infections (especially pneumonia) are a major cause of infant and child death and ill-health in urban (and rural) areas although their extent, their health impact and the risk factors associated with them remain poorly understood.⁽²²⁾ One-fifth of all infant deaths in Porto Alegre (Brazil) were found to be due to pneumonia. Mortality rates from pneumonia were six times higher in illegal settlements than in other areas (and the main cause of infant death there).⁽²³⁾ Respiratory infections are also among the most common sources of ill-health among children and adults; the papers by Charles Surjadi (pages 78-86), and Jacob Songsore and Gordon McGranahan (pages 10-34) show the toll taken by respiratory infections in Accra and Jakarta. The quality of the indoor environment has an important influence on the incidence and severity of respiratory infections - perhaps most especially through over-crowding, inadequate ventilation, dampness and indoor air pollution from coal or biomass combustion for cooking and/or heating. A child who contracts bronchitis or pneumonia in the Third World is 50 times more likely to die than a child in Europe or North America.⁽²⁴⁾ A recent WHO report summarized the problem:

"Acute respiratory infections tend to be endemic rather than epidemic, affect younger groups, and are more prevalent in urban than in rural areas. The frequency of contact, the density of the population and the concentration and proximity of infective and susceptible people in an urban population promote the transmission of the infective organisms. Poorer groups ... are much more at risk because

22. See references 5 and 9.

23. Guimaraes, J.J. and A. Fischmann (1985), "Inequalities in 1980 infant mortality among shantytown residents and non-shanty town residents in the municipality of Porto Alegre, Rio Grande do Sul, Brazil", *Bulletin of the Pan American Health Organization*, Vol. 19, pages 235-251.

24. Pio, A. (1986), "Acute respiratory infections in children in developing countries: an international point of view", *Pediatric Infectious Disease Journal*, Vol. 5, No. 2, pages 179-183.

25. See reference 3, page 204.

26. Foster, S.O. (1990), "Measles, the ultimate challenge in urban immunization", in *Universal Child Immunization - Reaching the Urban Poor*, Urban Examples 16, UNICEF, New York.

27. See reference 3.

28. See reference 3.

29. Cauthen, G.M., A. Pio and H.G. ten Dam (1988), *Annual Risk of Tuberculosis Infection*, World Health Organization, Geneva; see also reference 8.

30. See references 3 and 12.

31. McGranahan, Gordon (1991), *Environmental Problems and the Urban Household in Third World Countries*, The Stockholm Environment Institute, Stockholm, 38 pages.

32. Esrey, S.A. and R.G. Feachem (1989), *Interventions for the Control of Diarrhoeal Disease: Promotion of Food Hygiene*, WHO/CDD/89.30, World Health Organization, Geneva, quoted in reference 3.

33. Needleman, Herbert L., Alan Schell, David Bellinger, Alan Leviton and Elizabeth N. Alford (1991), "The long-term effects of exposure to low doses of lead in childhood: an eleven year follow-up report", *The New England Journal of Medicine*, Vol. 322, No. 2, January, pages 83-88.

34. UNEP and WHO (1988), As-

of the greater proportion of younger age groups, limited health and financial resources, and over-crowded households in congested settlements with limited access to vaccines and antibacterial drugs. The constant influx of migrants susceptible to infection and possible carriers of new virulent strains of infective agents, together with the inevitable increase in household numbers fosters the transfer of nasopharyngeal microorganisms."⁽²⁵⁾

A combination of overcrowded conditions and a lack of health care services which can implement effective immunization programmes help ensure that the diseases spread by airborne infection or contact which are easily prevented by vaccines, such as diphtheria, measles, pertussis (whooping cough) and chickenpox, remain major causes of ill-health and infant and child death. Measles is a major cause of infant and child morbidity and mortality in poor urban areas.⁽²⁶⁾ Tuberculosis, another vaccine-preventable disease, is the single largest cause of adult mortality worldwide, accounting for some 3 million deaths a year.⁽²⁷⁾ The incidence of tuberculosis is also linked to overcrowded conditions in urban areas. The highest incidence tends to be among populations living in the poorest areas, with high levels of overcrowding and high numbers of social contacts.⁽²⁸⁾ A combination of overcrowding and poor ventilation often means that TB infection is transmitted to more than half the family members.⁽²⁹⁾ Rheumatic fever and meningococcal meningitis are also among other diseases transmitted by biological pathogens where overcrowded conditions increase the likelihood of transmission.⁽³⁰⁾

Crowded cramped conditions, inadequate water supplies and inadequate facilities for preparing and storing food greatly exacerbate the risk of food contamination. McGranahan notes that:

"...microbially contaminated food contributes to a high incidence of acute diarrhoea in Third World countries and foodborne diseases including cholera, botulism, typhoid fever and parasitism ... microbial activity generally contributes to food spoilage while unsafe chemicals may deliberately be added to retard or disguise spoilage ... food contamination is intimately linked to the sanitary conditions of food preparation, processing and even production."⁽³¹⁾

In addition, "within the home, there are likely to be numerous interconnections and interactions among water, sanitation, flies, animal, personal hygiene and food that are responsible for diarrhoea transmission."⁽³²⁾

c. Chemical Pollutants in the Urban Environment

Box 3 lists some chemical pollutants, commonly found in urban areas, which affect human health or about which there is concern, even if the precise health impact remains unknown. To date, most concern regarding health effects has centred on lead (in food, water and air); indoor air pollutants from fuel combustion; toxic/hazardous wastes; and ambient air pollution.

Lead is a particular concern, especially for children because of increasing evidence that relatively low concentrations of lead in the blood may greatly affect their mental development - and this is an effect that persists into adulthood.⁽³³⁾ Exposure to lead may also contribute significantly to higher risks of heart attacks and strokes in adults. The four major sources of lead are: exhausts from petrol

assessment of Urban Air Quality, Global Environment Monitoring Service, United Nations Environment Programme and World Health Organization, 100 pages.

35. UNEP and WHO (1987), *Global Pollution and Health* - results of health-related environmental monitoring, Global Environment Monitoring System.

36. Rothenburg, Stephen J., Lourdes Schnaas-Arrieta, Irving A. Perez-Guerrero and others (1989), "Evaluacion del riesgo potencial de la exposicion perinatal al plombo en el Valle de Mexico" *Perinatologia y Reproduccion Humana*, Vol. 3, No 1, pages 49-56.

37. US AID (1990), *Ranking Environmental Health Risks in Bangkok*, Office of Housing and Urban Programs, Washington DC.

38. See reference 3.

39. See reference 3, page 163; drawn from Pandey, M.R., B. Basnayak and R.P. Neupane (1989), "Indoor air pollution in developing countries and acute respiratory infection", *The Lancet*, Vol. 1, pages 427-429.

40. See reference 31, page 23.

41. See reference 3.

engined motor vehicles (except vehicles that use lead-free petrol); lead water piping (especially where water supplies are acidic); industrial emissions; and lead in paint. A study of blood lead levels in adult volunteers in ten cities between 1979 and 1981 found the highest lead concentration in Mexico City residents; lead blood levels were above the WHO guideline - and also 2-4 times higher than in cities where low-lead or lead-free gasoline was used.⁽³⁴⁾ In Mexico City and in Bangalore (one of India's major metropolitan centres), 10 per cent of the sampled population had blood lead concentrations well above the WHO guideline above which biochemical changes in the blood begin to occur.⁽³⁵⁾ A study in Mexico City in 1988 found that over a quarter of the newborn infants in Mexico City had lead levels in their blood high enough to impair neurological and motor-physical development.⁽³⁶⁾ A study in Bangkok that sought to rank urban environmental problems based on their health risks suggested that lead should be ranked with airborne particulates and biological pathogens (primarily acute diarrhoea, dengue fever, dysentery and intestinal worms) as the highest risk environmental problems.⁽³⁷⁾

Regarding indoor air pollution, emissions from coal, wood and other biomass fuels burnt indoors are likely to be the main chemical hazard. These certainly affect more rural than urban dwellers, since many more rural households are regularly exposed to potentially harmful emissions from open fires or poorly designed stoves with inadequate attention to venting the flue gases. Estimates suggest hundreds of millions of rural inhabitants suffer from ill-health as a result; perhaps tens of millions of urban households are similarly affected. Certainly, in many cities coal and biomass fuels are widely used, especially among poorer households. The most serious health risks are from burns and smoke inhalation.⁽³⁸⁾ Chronic effects of smoke inhalation include inflammation of the respiratory tract caused by continued exposure to irritant gases and fumes which "...reduces resistance to acute respiratory infection, and infection in turn enhances susceptibility to the inflammatory effects of smoke and fumes, establishing a vicious circle of pathological change. These processes may lead to emphysema and chronic obstructive pulmonary disease which can progress to the stage where impaired lung function reduces the circulation of blood through the lungs, causing right-side heart failure (cor pulmonale)."⁽³⁹⁾ Cor pulmonale is a crippling killing disease, characterized by a prolonged period of distressing breathlessness preceding death. However, McGranahan notes that while some studies have suggested that indoor air pollution has significant effects on health, others have been unable to show a clear link. "It is not clear whether this variation reflects methodological differences in discerning important real effects which do exist, spurious results in the few cases where significant health effects have been detected or underlying differences in the relative importance of indoor air pollution in different areas."⁽⁴⁰⁾ In some cities, the contribution to indoor air pollution of materials used in housing (e.g. those that emit formaldehyde, chloroform, asbestos fibres or radon) may be a problem. These are recognized as having a significant health impact in many cities in Europe or North America but their importance in Africa, Asia and Latin America is not known.

There are also the health impacts of air pollutants outdoors. In many Third World cities, the concentrations of air pollutants are already high enough to cause illness in more susceptible individuals, and premature death among the elderly, especially those with respiratory problems.⁽⁴¹⁾ Current levels of air pollution may also be impair-

Box 3: Examples of Chemical Pollutants within the Urban Environment

Chemicals which can be found in food and water:

- * **Lead (in food, in drinking water, especially where there is a combination of lead water pipes and acidic water)**
- * **Deliberate or accidental food adulteration**
- * **Nitrates in drinking water (and their conversion into nitrites in the body)**
- * **Aflatoxins and other natural food toxicants**
- * **Trace pollutants in water supply, many from agro-chemicals (for instance various halogenated organic chemicals)**
- * **High mineral content in drinking water**
- * **Aluminium (food and drinking water)**
- * **Arsenic and mercury**

Chemicals commonly found in the indoor environment (home/workplace):

- * **Carbon monoxide (incomplete combustion of fossil fuels)**
- * **Lead (paint)**
- * **Tobacco smoke**
- * **Asbestos (usually from roofing insulation or air conditioning conduits)**
- * **Smoke from combustion of coal and wood (or other biomass fuel)**
- * **Potentially dangerous chemicals used without health and safety safeguards (by home-workers and in occupational setting)**
- * **Formaldehyde (most from insulation; also some wood preservatives and adhesives)**

Chemicals found outdoors in the air (ambient):

- * **Lead (exhausts of motor vehicles using gasoline with lead additive, external paint, some industrial emissions)**
- * **Sulphur dioxide, sulphates and smoke/suspended particulates (mainly from coal or heavy oil combustion by industries, power-stations and, in some cities, households)**
- * **Oxides of nitrogen (in most cities, mostly from motor vehicle emissions; also some industries)**
- * **Hydrocarbons (motor vehicles, petrol stations, some industries)**
- * **Ozone (secondary pollutant formed by reaction of nitrogen dioxide and hydrocarbons in sunlight)**
- * **Carbon monoxide (incomplete combustion of fossil fuels, mostly by motor vehicles)**

Chemicals which may contaminate land sites:

- * **Cadmium and mercury compounds and other heavy metal compounds (industrial wastes)**
- * **Dioxins, PCBs, arsenic, organochlorine pesticides (industrial wastes)**

Also in both indoor and outdoor settings:

- * **Micro-pollutants**
- * **Mixtures each at trace level (with possible additive effects)**
- * **Pollens and organic dusts**

42. See reference 34.

43. UNEP (1991), *Environmental Data Report, 1991-2*, GEMS Monitoring and Assessment Research Centre, Blackwell, Oxford and Massachusetts, 408 pages.

44. Hofmaier, V.A. (1991), *Efeitos de Poluicao do ar sobre a Funcao Pulmonar: un Estado de Cohorte em crianacas de Cubatao*, Sao Paulo School of Public Health, quoted in reference 3.

45. Jarzelski, L.S. (1992), *Case Study of the Environmental Impact of the Non-ferrous Metals Industry in the Upper Silesian Area*, Paper prepared for the WHO Commission on Health and the Environment and quoted in reference 3.

46. See reference 3.

47. Romieu, Isabelle et al. (1990), "Urban air pollution in Latin America and the Caribbean: Health perspectives", *World Health Statistics Quarterly*, Vol. 23, No 2, pages 153-167.

ing the health of far more people but the links have not been proven. The (limited) data on air pollution in Third World cities also suggests that it is generally getting worse. Box 4 outlines the effects on health of the most common urban air pollutants.

An estimated 1.4 billion urban residents worldwide are exposed to annual averages for suspended particulate matter or sulphur dioxide (or both) which are higher than the standards recommended by the World Health Organization.⁽⁴²⁾ The (limited) data available for Third World cities suggest the trend is towards increasing concentrations.⁽⁴³⁾ Comparable estimates are not possible for nitrogen oxides and carbon monoxide although studies in particular cities or city-districts suggest ambient air pollution levels that can impair health. There are also concerns about the health impacts of secondary pollutants formed as a result of reactions between primary pollutants and the air - for instance acid sulphates and ozone (see Box 4).

In certain industrial centres, air pollution levels can be sufficiently high to show demonstrable health impairment. For instance, in Cubatao (Brazil), air pollution levels have been linked to reduced lung functions in children.⁽⁴⁴⁾ Non-ferrous metal smelters are often major contributors to air pollution. Although no well-documented example was found in the Third World, a recent study in the Katowice district in Upper Silesia (Poland) showed how four non-ferrous metal industrial plants were responsible for a high output of lead and cadmium into the air, and this showed up as elevated lead and cadmium concentrations in the blood of 20 per cent of children. Some of those tested (especially children) were also found to exhibit the early detectable symptoms of toxic lead effects.⁽⁴⁵⁾

Links between health problems and air pollution levels have been suggested by comparisons between the health of people in highly polluted areas within cities and those in less polluted areas; some of these have shown a strong association between the incidence of respiratory infections and pollution levels. In addition, in cities where acute episodes of high concentrations of air pollution occur at particular times (for instance when high emissions coincide with particular weather conditions), an increased incidence of mortality among particularly vulnerable groups is common.⁽⁴⁶⁾ In Latin America, recent studies suggest that air pollution levels are sufficiently high in Sao Paulo, Rio de Janeiro and Belo Horizonte, Bogota, Santiago, Mexico City, Monterrey and Guadalajara, Caracas and Lima that a high priority should be given to their control. One estimate suggests that over 2 million children suffer from chronic coughs because of urban air pollution, and that air pollution causes an extra 24,300 deaths a year in Latin America.⁽⁴⁷⁾ This same source estimated that some 65 million person days of workers' activities were lost to respiratory related problems caused by air pollution. While the authors emphasize that these are rough estimates, they give an idea of the order of magnitude of the problem. Local topographical and climatic conditions can exacerbate problems, as in Mexico City where thermal inversions help trap pollutants within the valley in which the city is located.

There is also the health impact of chemical wastes dumped into water bodies or onto land sites. In most Third World cities, toxic/hazardous industrial and commercial wastes are disposed of in water bodies or land sites without special provision to treat them before disposal (to render them less damaging to human health and the local environment) or without measures to ensure that disposal itself isolates them from the environment. There is often little incentive for

Box 4: Some Urban Air Pollutants and their Effects on Health

1. Traditional ("reducing") pollutants from coal/heavy oil combustion

<i>Smoke/suspended particulates</i> (some contribution from diesel traffic too)	Can penetrate to lungs; some retained: possible long-term effects. May also irritate bronchi	} <p>LONDON SMOG COMPLEX Short term effects: sudden increases in deaths, in hospital admissions and in illness among bronchitic patients. Temporary reductions in lung function (patients and some normal people)</p> <p>Long term effects: increased frequency of respiratory infections (children). Increased prevalence of respiratory symptoms (adults and children) Higher death rates from bronchitis in polluted areas.</p> <p>Possible carcinogenic effects: may take some part in the higher incidence of lung cancer in urban areas</p>
<i>Sulphur dioxide</i>	Readily absorbed on inhalation: irritation of bronchi, with possibility of bronchospasm	
<i>Sulphuric acid</i> (mainly a secondary pollutant formed from sulphur dioxide in air)	Hygroscopic; highly irritant if impacted in upper respiratory tract. Acid absorbed on other fine particles may penetrate further to promote bronchospasm	
<i>Polycyclic aromatic hydrocarbons</i> (small contribution from traffic also)	Mainly absorbed on to smoke; can penetrate with it to lungs	

2. Photochemical ('oxidizing') pollutants from traffic or other hydrocarbon emissions

<i>Hydrocarbons</i> (volatile: petrol etc.)	Non-toxic at moderate concentrations	} <p>LOS ANGELES SMOG COMPLEX</p> <p>Short term effects: primarily eye irritation. Reduced athletic performance. Possibly small changes in deaths, hospital admissions</p> <p>Longer term effects: Increased onsets of respiratory illnesses (children), increased asthma attacks (adults). No clear indication of increased bronchitis.</p>
<i>Nitric oxide</i>	Capable of combining with haemoglobin in blood but no apparent effect in humans	
<i>Nitrogen dioxide and ozone</i> (mainly secondary pollutants formed in photochemical reactions)	Neither gas is very soluble: some irritation of bronchi but can penetrate to lungs to cause oedema at high concentrations. Urban concentrations too low for such effects, but evidence of reduced resistance to infections in animals	
Aldehydes, other partial oxidation products, peroxyacetyl nitrate	Eye irritation, odour	

3. Others from traffic

<i>Carbon monoxide</i> (other sources contribute - smoking an important one)	Combines with haemoglobin in blood, reducing oxygen-carrying capacity	Possible effects on central nervous system (reversible unless concentrations are very high). Some evidence of effects on perception and performance of fine tasks at moderate concentrations
<i>Lead</i> (some industrial sources contribute to air lead; human intake often dominated by lead in food and drink)	Taken up in blood, distributed in soft tissues and some to bone	Possible effects on central nervous system (longer time scale than in case of CO and not necessarily reversible). Indications of neuropsychological effects on children within overall environmental exposure range, but role of traffic lead uncertain.

SOURCE: Waller, Robert E. (1991), "Field investigations of air", in W.W. Holland, R. Detels and G. Knox (Editors), *Oxford Textbook of Public Health Volume 2* (second edition), Oxford University Press, Oxford, New York, page 438.

48. Hardoy, Jorge E., Diana Mitlin and David Satterthwaite (1993), *Environmental Problems in Third World Cities*, Earthscan Publications, London, 302 pages.

49. Pepall, Jennifer (1992), "Occupational poisoning", Report on the work of Mohamad M. Amr in *IDRC Reports*, Vol. 20, No 1, Ottawa, page 15.

50. Castonguay, Gilles (1992) "Steeling themselves with knowledge" report on the work of Cristina Laurell, *IDRC Reports*, Vol. 20, No 1, April, pages 10-12.

51. Phantumvanit, Dhira and Wanai Liengcharernsit (1989), "Coming to terms with Bangkok's environmental problems", *Environment and Urbanization*, Vol. 1, No. 1, April, pages 31-39.

52. Askoy, M. and others (1976), "Types of leukaemia in a chronic benzene poisoning", *Acta haematologica*, Vol. 55, pages 67-72.

53. Matte, T.D., J.P. Figueroa, S. Ostrowski, G. Burr et al. (1989), "Lead poisoning among household members exposed to lead-acid battery repair shops in Kingston, Jamaica (West Indies)", *International Journal of Epidemiology*, Vol. 18, pages 874-881.

industry and commerce to cut down polluting emissions since few are penalized and the penalties, when finally imposed, are so small as to be little deterrent. Reports from Third World cities of severe health problems arising from human contact with toxic or hazardous wastes are increasingly common.⁽⁴⁸⁾

The health impacts of occupational exposures to chemical pollutants are also an important cause of ill-health. Environmental hazards are evident in workplaces from large factories and commercial institutions down to small "backstreet" workshops and work from the home. They include dangerous concentrations of toxic chemicals and dust, as well as other environmental hazards such as inadequate lighting, ventilation and space, and inadequate protection of workers from machinery and noise. Many case studies show a high proportion of workers in particular industries or industrial plants whose health is affected by workplace exposures. For instance, a study of an Egyptian pesticide factory found that "...about 40 per cent of the workers had problems related to pesticide poisoning, ranging from asthma to enlarged livers."⁽⁴⁹⁾ In most countries, the scale of occupational injuries and diseases is almost certainly greatly under-reported. For instance, the Mexican Social Security Institute reported an average of 2,000 to 3,000 cases of work-related illnesses across the country in 1988 but a study in just one large steel mill found 4,000-5,000 cases alone, with more than 80 per cent of the workers exposed to extreme heat, loud noise and toxic dust.⁽⁵⁰⁾ A paper on Bangkok's environmental problems noted that a remarkable number of Thai workers are exposed to poor working environments but that the number of workers suffering from occupational diseases is small. "This may be a reflection of the difficulties of linking disease to working conditions rather than revealing a satisfactory condition."⁽⁵¹⁾ Other studies have shown serious health impacts for workers from exposure to toxic chemicals - for instance benzene poisoning for leather workers in Turkey⁽⁵²⁾ and lead poisoning for people working in lead-acid battery repair shops in Kingston, Jamaica.⁽⁵³⁾

Consideration must also be given to the large-scale accidents where chemicals had the central role in health impacts: the accidental release of methyl iso-cyanate at Bhopal (over 3,000 dead and perhaps 100,000 seriously injured) or the natural gas explosions in Mexico City in 1984 (over 1,000 dead) or, more recently, the loss of life and property resulting from explosions of gases that had accumulated in the sewers and drains in downtown Guadalajara; early reports suggest that the illegal disposal of industrial wastes into the sewers was the main cause. These and other large-scale accidents are often quoted as of major significance in terms of the health impact on urban populations. The attempts by European and North American industries to dispose of their toxic wastes in Third World nations have also received much publicity. The scale of the health impact arising from occupational exposures and from exposure to indoor and outdoor air pollution is likely to be larger and more widespread - but it remains largely undocumented. The next 20-30 years may show that the health impact of chemical pollutants in the Third World - in the air and water and through direct exposure in the home or workplace - has been considerably underestimated.

d. The Availability, Cost and Quality of Natural Resources

The availability to any individual or household of such natural resources as food, fuel and freshwater is obviously central to health.

The environmental dimension is prominent in that the ecosystem defines the limits for the availability of freshwater, soils, and forests but social, economic and political factors are usually the dominant influences on who has access to them or to the land and water sources from which they can be drawn. While access to land and forests for fuel and food is normally considered a rural issue, there is increasing evidence that access to land on which food can be grown is important to poorer households in many cities, especially in poorer and less urbanized nations. For instance, a study by the Mazingira Institute pointed to the importance for most households in Nairobi (Kenya's capital and largest city) and other Kenyan urban centres of food they grow or produce themselves; under such circumstances, access to land on which crops can be grown and some livestock raised becomes of great importance to most households.⁽⁵⁴⁾

Only rarely does a shortage of freshwater explain why so many urban households lack access to safe and sufficient supplies. It is much more common for these to be the result of the refusal by the government to allow them an adequate supply - for instance, because they live in illegal settlements and are considered to have no right to public services, or because they live in a peripheral municipality within a large metropolitan centre where local authorities lack the resources to provide water supplies. Although there are cities where overall shortages inhibit improved supplies, this is not the norm. In addition, it is not necessarily poorer households' lack of capacity to pay for water which explains inadequate provision. It is common for those in squatter settlements to pay private water vendors between four and 100 times as much per litre as the middle and upper-income groups pay for publicly provided piped water. It is generally neither a lack of water nor a lack of willingness to pay which stops piped water supplies reaching poorer areas.

e. Physical Hazards

The true extent of accidental injuries is often grossly underestimated in Third World cities - to the point where accident prevention and emergency services for rapid treatment receive little or no attention in environmental improvement programmes. An analysis of accidents in children in ten Third World nations found that they were the main cause of death for 5-9 year olds and 10-14 year olds.⁽⁵⁵⁾ For every accidental death, there are several hundred accidental injuries.⁽⁵⁶⁾ One of the most common accidents is road accidents - responsible worldwide for some 500,000 deaths each year and many times this number of serious injuries.⁽⁵⁷⁾ Many accidental injuries are linked to poor quality, overcrowded housing. Burns, scalds and accidental fires are more common in overcrowded shelters, especially when five or more persons often live in one room and there is little chance of providing occupants (especially children) with protection from open fires, stoves or kerosene heaters. The risk of accidental fires is further increased in most urban dwellings because of the use of flammable materials (wood, cardboard, plastic, canvas, straw). Overcrowded dwellings also make it difficult to keep medicines and dangerous household chemicals (such as bleach) out of children's reach. Here, as in many environmental problems, the level of risk is usually compounded by social factors such as a lack of adult supervision if most adults have to work. The health impact of accidents is also compounded by the lack of a health service that can rapidly provide emergency treatment, followed by longer-term treat-

54. Lee Smith, Diana, Mutsempi Matundu, Davinder Lamba and P. Kuria Gathuru (1987), *Urban Food and Fuel Study*, Mazingira Institute, Nairobi, Kenya.

55. Manciaux, M. and C.J. Romer (1986), "Accidents in children, adolescents and young adults: a major public health problem", *World Health Statistical Quarterly*, Vol. 39, No. 3, pages 227-231.

56. See reference 55.

57. See reference 3.

58. Goldstein, Greg (1990) "Access to life-saving services in urban areas" in J.E. Hardoy et al. (editors), *The Poor Die Young: Housing and Health in Third World Cities*, Earthscan Publications, London, pages 213-227.

59. Sarin, Madhu (1983), "The rich, the poor and the land question", in Shlomo Angel, Raymond W. Archer, Sidhjai Tanphiphat and Emiel A. Wegelin (editors) *Land for Housing the Poor*, Select Books, Singapore, pages 237-253.

60. See reference 3.

61. See reference 9.

62. Fundacao SEADE 1990 quoted Leitmann, Josef (1991), "Environmental profile of Sao Paulo", Urban Management and the Environment: Discussion Paper Series, UNDP/World Bank/UNCHS, Washington DC.

63. This paragraph draws heavily on Ekblad, Solvig et al. (1991), *Stressors, Chinese City Dwellings and Quality of Life*, D12, Swedish Council for Building Research, Stockholm; also on Schaeffer, B. (1990), "Home and health - on solid foundations?", *World Health Forum*, Vol. 11, pages 38-45.

ment and care.⁽⁵⁸⁾

There are also the physical hazards of the land sites on which housing develops. In nearly all Third World cities, there are large clusters of illegal housing on dangerous sites (for instance steep hillsides, floodplains or desert land) or housing built on polluted sites (for instance around solid waste dumps, beside open drains and sewers or in industrial areas with high levels of air pollution). Or housing develops in sites subject to high noise levels - for instance close to major highways or airports. Most cities have large areas of unused and well-located land not subject to such hazards.⁽⁵⁹⁾ The problem is rarely a shortage of the resource (safe land sites) but the fact that poorer groups have no means of getting access to such sites and governments do not intervene in their favour.

f. Aspects of the Built Environment with Negative Consequences on Health

Psychosocial health problems such as depression, drug and alcohol abuse, suicide, and inter-personal violence (including child and spouse mistreatment and abuse and target violence such as teacher assault and rape) now represent among the most serious health problems in many cities in Europe and North America.⁽⁶⁰⁾ Many psychosocial disorders are associated with poor quality housing and living environments. Many non-environmental factors are also important - for instance the stress associated with inadequate income and insecure and strenuous livelihoods and insecure tenure of the shelter (for tenants or squatters), especially for those living with a constant threat of eviction.

Psychosocial health problems are becoming a major cause of death and morbidity among adolescents and young adults in many urban areas of the Third World or in particular districts within urban areas. For instance, psychosocial disorders are among the most important causes of death in cities as diverse as Shenyang and Rio de Janeiro.⁽⁶¹⁾ Homicides were responsible for 5 per cent of all deaths in Sao Paulo City in 1986.⁽⁶²⁾ Poor quality and overcrowded housing and living environments contribute to the stress that underlies most psychosocial disorders and these disorders may develop into particular diseases or impair the body's immune system.

Many physical characteristics of the housing and living environment can influence the incidence and severity of psychosocial disorders. These include noise, overcrowding, inappropriate design and the stresses and difficulties caused in any house or residential area when there is inadequate or no provision for sanitation, garbage collection and maintenance.⁽⁶³⁾ Good quality housing and living environments can greatly reduce stress and its health consequences - through sufficient space, location close to friends and family, easy access to desired services and facilities for safe play for children and for recreation, minimum noise, and few personal hazards. Within the wider neighbourhood in which the house is located, a sense of security, good quality physical infrastructure (roads, pavements, drains, street lights) and services (e.g. street cleaning), the availability of emergency services and easy access to educational, health and social services as well as cultural and other amenities all reduce stress and contribute to good mental health. In addition to the quality of the dwelling and its neighbourhood, the subjective experience of the dweller is also important for health i.e. their level of satisfaction with the house and its neighbourhood and its location within the urban

64. Jacobs, Jane (1965), *The Death and Life of Great American Cities*, Pelican, London, 474 pages.

65. Newman, Oscar (1972), *Defensible Space: Crime Prevention through Urban Design*, MacMillan, New York, 264 pages.

66. See for instance Turner, John F.C. (1976), *Housing By People - Towards Autonomy in Building Environments*, Ideas in Progress, Marion Boyars, London and Turner, John F.C. and Robert Fichter (editors) (1971), *Freedom to Build*, Macmillan, New York and London, 301 pages.

67. Duhl, Leonard J. (1990), *The Social Entrepreneurship of Change*, Pace University Press, New York, 159 pages.

68. See references 3 and 67.

69. See reference 3, page 215.

70. See Turner (1976) listed in reference 66; also reference 5.

area.

Many characteristics of urban neighbourhoods that are not easily identified or defined may have important influences on an individual's level of satisfaction and on the incidence of crime, vandalism and inter-personal violence. These are aspects more fully explored in cities in Europe and North America - for instance the critique of urban planning by Jane Jacobs⁽⁶⁴⁾ which was concerned with what makes city neighbourhoods and streets pleasant, safe and valued and how to ensure they avoid urban degradation. The work of Oscar Newman on what he termed "Defensible Space" suggested how the particular form of open space within a neighbourhood, including the extent to which it was subject to informal supervision and the extent to which there was a clear visual definition as to who had the right to use it and was responsible for its maintenance could be linked to levels of crime and vandalism.⁽⁶⁵⁾

What is probably a more important influence on health is the extent to which any individual or household has the possibility of modifying or changing their housing environment and working with others in the locality to effect change in the wider neighbourhood. Many critiques of public housing and of urban planning in Third World cities (especially "slum" and squatter clearance and redevelopment) have centred on the loss of individual, household and community control.⁽⁶⁶⁾ These often document the hardships caused to households and, on occasion, the negative health consequences, although they do not examine the social pathologies that might be associated with such changes. There is also a large and varied literature on the importance for the physical and mental health of individuals and "communities" of being able to command events which control their lives;⁽⁶⁷⁾ medical doctors and psychiatrists are increasingly recognizing the importance of such a link.⁽⁶⁸⁾

There are also interacting variables that can promote or prevent the process that might lead to psychosocial disorder or disease. For instance, a social support network may prevent stress from developing into stress related disorders or diseases; "... strong social networks and a sense of community organization in many rundown inner city districts ...and squatter settlements ...might help explain the remarkably low level of psychosocial problems."⁽⁶⁹⁾ The importance of such networks can also be seen in the increase in physical and mental ill-health among populations relocated from inner city tenements or illegal settlements to "better quality" housing, partly because such networks became disrupted.⁽⁷⁰⁾ However, the precise linkages between different elements of the physical environment and each psychosocial disorder or disease are difficult to ascertain - and to separate from other variables - as discussed in the paper by Solvig Ekblad (pages 125-134). In addition, care must be taken not to overstate the effects of environmental factors on psychosocial health when more fundamental social, economic and political factors such as low and very unstable incomes and oppression or discrimination underlie psychosocial disorders and very poor living environments (see the paper by Susan Swift and Larry Cohen, pages 50-66).

g. Local, Regional, National and Global Natural Resource Degradation

Natural resource degradation caused by pollutants from city based enterprises or households can influence the health of urban dwellers in a variety of ways. One example is through land or water used by

71. See reference 48 for many examples.

urban households for urban horticulture being polluted by urban wastes. A second, more indirect route is damage to local food production outside the city from air or water pollution, which then impacts on the health of poorer households through decreased food availability or higher prices - for instance through local fisheries being damaged or local fish and seafood being prohibited for human consumption because of their contamination by industrial wastes. An increasing number of reports document how city generated wastes damage or pollute fish stocks in rivers, estuaries and coastal waters or damage vegetation through acid deposition derived from the emissions of urban based vehicles, households and industries.⁽⁷¹⁾ Some urban populations suffer from water pollution caused by city based activities degrading particular rivers or other water bodies "upstream".

The depletion of the stratospheric ozone layer and the increasing concentrations of what are termed "greenhouse gases" in the earth's atmosphere (and the possible, continued atmospheric warming) will have major health impacts for urban (and rural) populations. Some will be direct - for instance increased heat stress from higher temperatures and a growing incidence of skin cancer from stratospheric ozone depletion. But the indirect health impacts are likely to be much greater - for instance those arising from changes in agricultural production, sea-level rises (including flooding and damage to buildings, sewers and drains), disruption to cities' freshwater resources and an expansion of the areas where some of the most serious tropical disease vectors can survive and breed.

III. WHO BEARS THE HEALTH COSTS OF ENVIRONMENTAL PROBLEMS?

THE PRESENCE OF an environmental hazard (for instance a pathogen, pollutant, physical hazard or psychosocial stressor such as high noise level) does not necessarily mean that it will harm someone. This depends on characteristics of the individual, household and social group exposed to the hazard. Certain individual or group characteristics can also influence the severity of the health impact.

Characteristics which influence whether ill-health or injury can be avoided, and/or the severity of the health impact include:

- * **for biological pathogens**, weak body defence (some a function of age and of nutritional status, some a function of acquired immunity);

- * **for physical hazards**, limited mobility, strength and balance (e.g. children, older groups and people with physical disabilities facing greater risks of injury in unsafe houses built on slopes, floodplains or otherwise dangerous sites);

- * **for exposure to chemicals**: age, activity (when exposed) and health status at the time of exposure. Certain groups are particularly susceptible to certain pollutants; for instance asthmatics are more sensitive to certain common urban air pollutants. Genetic factors may influence sensitivity to some chemicals;

- * **social roles** that increase duration and/or severity of exposure to environmental hazards.

Factors that influence how easily the individual, household or social group can cope with environmentally induced illness or injury include:

72. This list draws from Corbett, Jane (1989), "Poverty and sickness: the high costs of ill-health" and Pryer, Jane (1989), "When breadwinners fall ill: preliminary findings from a case study in Bangladesh" in *Vulnerability: How the Poor Cope*, IDS Bulletin, Vol. 20, No 2, April, pages 58-62 (an updated version of which appears in this issue of *Environment and Urbanization*). In general, the literature on rural poverty seems to have developed a much more detailed understanding of what underpins vulnerability for poorer groups.

73. Stephens, Carolyn and Trudy Harpham (1992), "The measurement of health in household environmental studies in urban areas of developing countries: factors to be considered in the design of surveys", Urban Health Programme, London School of Hygiene and Tropical Medicine, London, 20 pages.

74. See reference 48; also Douglass, Mike (1992), "The political economy of urban poverty and environmental management in Asia: access, empowerment and community based alternatives", *Environment and Urbanization*, Vol. 4, No. 2, October, pages 9-32.

75. This point is developed more fully in reference 48.

76. See reference 9.

77. See Songsore and McGranahan in this issue of *Environment and Urbanization* for a detailed case study of this.

78. See references in 72.

79. See reference 58.

* the extent of public, private and community provision for health care, including emergency response to accidental injuries or acute diseases;

* the individual's or household's ability to afford health care and emergency response, to purchase medicines, and take time off to recuperate when sick or injured;

* individual, household or community coping mechanisms once the hazard has caused sickness or injury; for instance, knowing what to do, who to visit and how to rearrange individual/household survival strategies.⁽⁷²⁾

The people who are most vulnerable to environmental hazards are those least able to avoid them and/or least able to cope with the illness or injury they cause. Once one begins to examine what causes people's vulnerability to environmental hazards, the interaction between environmental hazards and social, economic, political and demographic factors becomes much clearer. "Health outcomes are not only influenced by environmental conditions but also by the inputs of health services, by the characteristics of the population and by the socio-economic conditions in which people live."⁽⁷³⁾ Virtually all environmental health problems in urban areas have a social, economic or political underpinning in that it is social, economic or political factors which determine who is most at risk and who cannot obtain the needed treatment and support, when illness or injury occurs.⁽⁷⁴⁾ To give but one example, the high incidence of diseases associated with contaminated food and water in most poor urban communities is an environmental problem in that the disease-causing agents infect humans through water or food they ingest - but this high incidence can also be judged to be a political problem since nearly all governments and aid agencies have the capacity to greatly reduce current levels of morbidity and mortality by improved provision of water, sanitation and drainage.⁽⁷⁵⁾ It can also be judged as a social or economic problem in that it is lower income groups' limited means to pay for accommodation which usually underlies their poor housing conditions. This makes it difficult to isolate the impact of environmental factors on health as distinct from other factors.

The economic underpinning of environmental hazards becomes clear when comparing the hazards faced by poorer groups with those faced by richer groups. Most studies on communicable diseases and morbidity and mortality show that the most vulnerable group are predominantly the poor - be they children, adults in crowded, unhygienic conditions or workers in particular occupations.⁽⁷⁶⁾ Low-income groups are the least able to afford the homes that protect against environmental hazards e.g. good quality housing in neighbourhoods with piped water and adequate provision for sanitation, garbage collection, paved roads and drains.⁽⁷⁷⁾ In addition, higher-income groups will generally have less dangerous jobs and work in occupations where occupational hazards are minimized.

Low-income households are also more vulnerable because they lack the buffers to cope with illness or injury.⁽⁷⁸⁾ Low-income individuals/households generally have most difficulty in getting treatment for any injury or illness - for instance emergency services in the case of a serious accident and treatment from a health centre or hospital.⁽⁷⁹⁾ They have the least means to afford medicines and (generally) the least possibility of taking time off to allow recovery because the loss of income from doing so would press heavily on their survival, and because they are unable to afford health insurance - or

obtain the jobs for which health insurance is paid by the firm.

IV. THE GEOGRAPHY OF INEQUALITY

IF THERE WAS sufficient information available to construct a map of a city, showing the level of risk from environmental hazards in each neighbourhood, the areas with the highest risks would coincide with the areas with a predominance of low-income groups. In most Third World cities, the correlations between income levels and environmental hazards would be particularly strong with respect to the quality and quantity of water, the level of provision for sanitation, drainage and solid waste collection, and the risk from floods, landslides and other natural hazards. The reason for this is simply that poorer groups are priced out of safe, well-located, well-serviced housing and land sites. In many cities, there will be a strong correlation between indoor air quality and income because poorer groups use more polluting fuels and more inefficient stoves (or open fires) which ensure a much worse air quality indoors. The fact that poorer groups also live in more overcrowded conditions exacerbates this and the transmission of infectious diseases. A high proportion of poor groups live in shacks made of flammable material, with higher risks of accidental fires. Poorer groups will generally have the least access to playgrounds, parks and other open spaces managed for public use. The correlations between income level and level of air pollution may not be so precise. In certain "hot-spots" such as close to quarries, cement works and industries with high levels of air pollution in their immediate surroundings, the correlation is likely to be strong. But the correlations are less clear when an entire city suffers from air pollution.

Many studies on the differentials in health status or mortality rates between city districts (or boroughs or municipalities) show conditions in poorer areas to be much worse than in the more wealthy areas or for the city average.⁽⁸⁰⁾ Infant mortality rates in poorer areas are often four or more times higher than in richer areas, with much larger differentials often apparent if the poorest district is compared to the richest district. Large differentials between rich and poor districts are also common in the incidence of many environment related diseases - for instance tuberculosis and typhoid. Differentials in the number of people dying from certain environment related diseases are often very large; for instance many more deaths in poorer communities are likely to come from diarrhoeal diseases and acute respiratory infections such as pneumonia and influenza. Maternal mortality rates are likely to be much higher than any city average in low-income districts where homes lack basic services, especially community based health care with good pre-natal services and emergency services. To date, the statistics showing differentials in maternal mortality have concentrated on those between rich and poor nations (where among the poorest nations, maternal mortality rates can be 100 or more times that of the richer nations).⁽⁸¹⁾ There are also likely to be large differentials between most low and high-income areas in the proportion of people who are disabled or chronically ill.

80. For summaries of case studies and discussions about this issue, see reference 9 and Harpham, Trudy, Patrick Vaughan and Tim Lusty (1988), *In the Shadow of the City: Community Health and the Urban Poor*, Oxford University Press, Oxford. See also Jacobi, Pedro (1990), "Habitat and health in the municipality of Sao Paulo", *Environment and Urbanization*, Vol. 2, No. 2, October, pages 33-45.

81. WHO (1992), *Reproductive Health: a Key to a Brighter Future*, WHO Special Programme of Research Development and Research Training in Human Reproduction, Geneva, 171 pages.

V. WHAT UNDERLIES VULNERABILITY?

a. Introduction

TO A LARGE extent, capacity to pay for housing defines the scale and range of environmental hazards present in the housing and living environment, including whether or not there are safe, sufficient water supplies, sanitation, garbage collection and drainage. In most Third World cities, low-income individuals and households have very little chance of obtaining healthy legal accommodation within a neighbourhood where environmental risks are minimized - i.e. one with sufficient space, security of tenure, services and facilities, and on a site not prone to flooding, waterlogging or landslides. Many low-income groups also have the constant fear of eviction; this is usually a permanent worry for most tenants, temporary boarders in cheap rooming houses, those in illegal settlements and "land" renters.

The insecurity and the environmental hazards evident within the homes and neighbourhoods of poorer groups are in effect a combination of three factors: of low-incomes; of the refusal or inability of government to intervene to guarantee poorer groups access to shelters that are not so dangerous or to the resources that allow them to build these themselves; and the refusal or inability of government to provide the community based health care and emergency services which can do so much to prevent illness or injury and to limit its impact.

Ironically, dangerous or polluted land sites often serve poorer groups well. For these are the only sites, well-located with regard to income-earning opportunities, on which they have some possibility of living (illegally) because the environmental hazards make the sites unattractive to other potential users. It was the high concentration of low-income residents around the Union Carbide Factory in Bhopal that resulted in several thousand deaths and over 50,000 serious injuries.⁽⁸²⁾

Among those with low incomes, there will be considerable differentiation in the scale and nature of environmental hazards to which they are exposed and in the severity of the illness or injury to which these hazards contribute. Health indicators for particular poor districts are generally averages which can obscure the more serious health problems suffered by the poorer groups within that district. The paper by Jane Pryer (pages 35-49) shows the sharp differentials in work days lost to illness or injury among the inhabitants of a low-income settlement when comparing the wealthier households to the poorer households. It also shows how in the poorer households, such illness or injury often means growing indebtedness and undernutrition for all family members.

There are particular groups that face greater environmental risks because of their work and because of the ineffectiveness of government provision to promote occupational health and safety. There are also particularly dangerous settlements⁽⁸³⁾ and particular groups who face most difficulty getting access to water and washing and bathing facilities - such as pavement dwellers or those who sleep in open spaces, parks and graveyards. There is also the differentiation within low-income groups caused by demographic, health or social characteristics.

82. Centre for Science and Environment (1985), *The State of India's Environment: a Second Citizens' Report*, Delhi, India.

83. Poorer groups often choose to live on particularly hazardous sites such as those subject to landslides or flooding because these are the only cheap (or free) land sites within cities with good locations in regard to income-earning opportunities.

b. Infants and Children

Foetuses, infants and children are particularly vulnerable to certain environmental hazards. Environmental factors exert a strong influence on the child in the womb - for instance through the mother's exposure to toxic chemicals in the workplace.⁽⁸⁴⁾ The influence may be less direct as a result of environmental factors that influence the health and nutritional status of the mother - for instance malaria contracted by pregnant mothers is often associated with low birth weights (which is also associated with higher rates of infant mortality).

Infants and young children are at greater risk of dying from many environment related diseases than older children or adults - for instance diarrhoeal diseases, malaria, pneumonia or measles.⁽⁸⁵⁾ Infections and parasites arising from contaminated food or water can contribute much to undernutrition which, in turn, retards a child's growth and lowers their immunity. Infants are also more at risk than adults from various chemical pollutants such as lead (in food, water and air) and high nitrate concentrations in water. The transfer of infants and young children from exclusive reliance on breast milk to formula milk and semi-solid and solid foods is often particularly hazardous for those living in housing which lacks safe water and the facilities needed for hygienic food preparation and storage. Infants and children are particularly at risk from various hazards commonly found in low-income areas: for instance, housing made of flammable materials combined with overcrowding and widespread use of open fires or stoves or kerosene heaters/cookers means a high risk of accidental fires. Open sites used by children for play and sport are often contaminated with faecal matter and with household wastes (which also attract rats and other disease vectors). The increasing mobility of the infant and young child as they learn to crawl and then to walk and their natural curiosity and desire to explore can also expose them to many environmental hazards, especially where space and facilities are lacking, both indoors and outdoors. For instance, in poor and overcrowded dwellings, it is difficult to keep chemicals used in the home out of their reach. Where provision for safe playsites is deficient, children will play on roads and garbage tips and other hazardous places.

From the time that an infant first learns to crawl through childhood and adolescence, the size and quality of the home and its surroundings will exert a powerful influence on the level of risk. This is illustrated in a survey of 599 slum children in Rio de Janeiro which found that accidents accounted for 19 per cent of all health problems; most reported accidents were falls (66 per cent), cuts (17 per cent) and burns (10 per cent).⁽⁸⁶⁾ The age of the child was an important determinant of accidents; peaks in accidents were in the second and fifth year of life. The hazardous physical environment is only one variable in this; another is the limited possibility for parental child care and supervision when all adult members of a household work.⁽⁸⁷⁾

A poor physical environment can also inhibit or damage a child's physical and mental development.⁽⁸⁸⁾ Children are especially vulnerable to deficiencies in provision for play and informal learning from their peers - with the particular needs also varying considerably at different ages. In most poor districts in cities, there is little formal provision of open space and facilities for such needs. Yet the importance of safe and stimulating play is increasingly recognized in, for instance, the evolution of a child's motor skills and communication skills, problem-solving, logical thinking, emotional development and

84. UNICEF (1992), *Environment, Development and the Child*, Environment Section, Programme Division, New York, 88 pages.

85. See references 3 and 84.

86. Reichenheim, M. and T. Harpham (1989), "Child accidents and associated risk factors in a Brazilian squatter settlement", *Health Policy and Planning*, Vol. 4, No. 2, pages 162-167.

87. See reference 86 and Evans, Judith L. (1988), "Urban slum and squatter settlements: implications for psycho-social development and well-being", in *Child Abuse and Urban Slum Environments*, WHO/ISPCAN, Pre-Congress Workshop, WHO/MCH/86.15, WHO, Geneva, pages 31-45.

88. Myers, Robert (1991), *The Twelve Who Survive: Strengthening Programmes of Early Child Development in the Third World*, Routledge, London and New York, 468 pages; also Evans 1988, see reference 87.

89. Hughes, Bob (1990), "Children's play - a forgotten right", *Environment and Urbanization*, Vol. 2, No. 2, October, pages 58-64.

90. See reference 88.

91. See for instance Furedy, Christine (1992) "Garbage: exploring non-conventional options in Asian cities", *Environment and Urbanization*, Vol. 4, No 2, October, pages 42-61.

92. Lee-Wright, Peter (1990), *Child Slaves*, Earthscan Publications, London, 280 pages.

93. Patel, Sheela (1990), "Street children, hotels boys and children of pavement dwellers and construction workers in Bombay: how they meet their daily needs", *Environment and Urbanization*, Vol. 2, No. 2, October, pages 9-26.

94. See reference 84.

95. See reference 93.

social and socialized behaviour.⁽⁸⁹⁾ Infants and children often suffer not only from a poor physical environment in the sense of overcrowded and hazardous housing and inadequate provision for play (including dangerous and unsuitable play sites) but also from the stress and possible psychosocial disorders which deficiencies in the physical environment promote in their parents or carers. Among the key psychological and social development needs of children are a need for interaction (to provide stimulation and reaction to the child), the need for consistency and predictability in their caregiving environment and a need to explore and discover.⁽⁹⁰⁾ It is easy to see how a poor physical environment makes these more difficult for parents to provide although perhaps a more important factor is that in many low-income households, all adults work long hours to obtain sufficient income to survive; ensuring child supervision, stimulation and care is particularly problematic in such circumstances.

Certain occupations in which it is common for children or youths to work are associated with particular environmental risks - for instance, those who make a living from picking through garbage⁽⁹¹⁾ or those working in particularly hazardous industries. Many industries in Asia and Latin America make widespread use of child labour, with such children exposed to high levels of risk from dangerous machinery, heat, toxic chemicals and dust.⁽⁹²⁾ Street children who have been abandoned by their families (or have run away from home) generally face a whole range of environmental hazards: the work they undertake may be particularly hazardous (for instance dodging traffic on major highways, selling goods to passing motorists) and they often have no adult to whom to turn when sick or injured. They generally have very poor quality accommodation (often sleeping in the open or in public places) and great difficulty in finding places to wash and defecate and to obtain drinking water and health services.⁽⁹³⁾ They are also exposed to child abuse - not least when child prostitution is one of the more dependable ways of ensuring sufficient income for survival. In addition, many children and youths imprisoned for crimes or vagrancy or placed in corrective institutions may not only have to live in a very poor quality environment but also be deprived of the child-adult relationships and stimulation that are so important for child development.⁽⁹⁴⁾ There are also other children in especially difficult circumstances who face particular environmental risks. For instance, a study by the Indian NGO SPARC in Bombay identified children of pavement dwellers and construction workers and "hotel boys" as particularly vulnerable, along with street children.⁽⁹⁵⁾ The children of construction workers who live on site lack access to schools, day care, health facilities, water and sanitation; living on construction sites also poses particular hazards for children.

c. Women

Women are more vulnerable than men to many environmental hazards, some because of their sex (i.e. as a result of biological differences), some because of gender (i.e. as a result of the particular social and economic roles that women have, determined by social, economic and political structures). Pregnant mothers (like their foetuses) are particularly vulnerable to certain environmental hazards. As a recent WHO report noted:

"The reproductive system is particularly sensitive to adverse environmental conditions. Every stage of the multi-step process of

96. See reference 81.

97. UNICEF (1991), *The State of the World's Children 1991*, Oxford University Press, Oxford, 128 pages.

98. Moser, Caroline O.N. (1987), "Women, human settlements and housing: a conceptual framework for analysis and policy-making" in Caroline O.N. Moser and Linda Peake (editors), *Women, Housing and Human Settlements*, Tavistock Publications, London and New York; and Lee-Smith, Diana and Catalina Hinchey Trujillo (1992), "The struggle to legitimize subsistence: women and sustainable development", *Environment and Urbanization*, Vol. 4, No 1, April, pages 77-88.

99. See reference 14; also the paper by Sara Jordan and Fritz Wagner in this issue of *Environment and Urbanization*.

100. See reference 3.

101. See Lee-Smith and Trujillo 1992 listed in reference 98.

102. See the paper by Jordan and Wagner in this volume for more details.

103. See Moser (1987) listed in reference 98; also Oruwari, Yomi (1991), "The changing role of women in families and their housing needs: a case study of Port Harcourt, Nigeria", *Environment and Urbanization*, Vol. 3, No. 2, October, pages 6-12.

104. Germain, Adrienne and Jane Ordway (1989), *Population Control and Women's Health: Balancing the Scale*, International Women's Health Coalition in cooperation with the Overseas Development Council, New York, 15 pages. See also reference 81.

105. Moser, Caroline O.N. (1993), *Gender Planning and Development; Theory, Practice and Training*, Routledge, London and New York, 285 pages.

reproduction can be disrupted by external environmental agents and this may lead to increased risk of abortion, birth defects, fetal growth retardation and perinatal death."⁽⁹⁶⁾

This particular vulnerability during pregnancy, childbirth and the period just after childbirth is biologically determined, although the low priority given by governments and aid agencies to reducing this vulnerability is socially determined. Around half a million women die each year of causes related to pregnancy and childbirth and this leaves around one million children without mothers.⁽⁹⁷⁾

There are also other environmental hazards to which women are exposed more than men, as a result of differentiation by gender as a result of women taking sole (or primary) responsibility for child-rearing, household management and subsistence production.⁽⁹⁸⁾ The fact that women take most responsibility for child care means that they also have to cope with most of the illnesses and injuries from which infants and children suffer and to which environmental hazards contribute greatly. Caring for the sick and laundering and cleaning soiled clothes are particularly hazardous tasks when water supplies and sanitation and washing facilities are inadequate.⁽⁹⁹⁾ The people within a household who are responsible for water collection and its use for laundry, cooking and domestic hygiene suffer most if supplies are contaminated and difficult to obtain - and these people are generally women. Poorer urban households most often use biomass fuels or coal for cooking and/or heating on open fires or poorly ventilated stoves. It is generally women (or girls) who take responsibility for tending the fire and cooking and who inhale larger concentrations of pollutants over longer periods.⁽¹⁰⁰⁾ It is usually women who take responsibility for firewood-gathering and subsistence crop and livestock production in the millions of urban households where these are important components of households' livelihoods; rarely if ever do urban housing schemes make allowances for these activities and urban land use and zoning regulations usually discriminate against such tasks.⁽¹⁰¹⁾ Women and children are also most vulnerable to domestic violence which may arise from, or be much increased by, poor quality and overcrowded housing and living environments.

Women's vulnerability to all the environmental hazards linked to inadequate provision for water, sanitation, drainage and garbage collection is much increased because the practical needs of those responsible for child care and household management (overwhelmingly women) are rarely given the priority they should have in government provided services or housing programmes.⁽¹⁰²⁾ Even when they are, women are rarely consulted about the most appropriate design and service provision.⁽¹⁰³⁾ For instance, provision for health clinics (and provision for ante- and post-natal care) rarely receives the priority they deserve in terms of their cost-effectiveness in reducing health burdens. Health care services rarely provide the needed focus on women's reproductive health (including advice and support for fertility control) which can do so much to reduce maternal mortality and severe health problems.⁽¹⁰⁴⁾ Where there is some public provision for health services, rarely are their locations and opening hours well-suited to women's needs. The same is true for creches and child care centres which can make it much easier for women to earn incomes.⁽¹⁰⁵⁾ Public transport provision is often scheduled to serve primary income earners but does not serve the needs of secondary income earners (often women) or those responsible for shopping, taking children to

106. See Moser 1987 listed in reference 98

107. See Moser 1987 listed in reference 98.

108. See reference 105, page 52.

109. See reference 105; also Falu, Ana and Mirina Curutchet (1991), "Rehousing the urban poor: looking at women first", *Environment and Urbanization*, Vol. 3, No. 2, October, pages 23-38.

110. See reference 14.

111. For an overview, see Hugo, Graeme J. (1993), "Migration as a survival strategy: the family dimension of migration", Paper presented at the Expert Group Meeting on Population Distribution and Migration, UN Population Division, Santa Cruz, Bolivia, January, 20 pages. For case studies, see Pryer, Jane (1992), "Purdah, patriarchy and population movement; perspectives from Bangladesh" in Sylvia Chant (editor), *Gender and Migration in Developing Countries*, Belhaven Press London, pages 139-153; and Thorbek, Susanne (1991), "Gender in two slum cultures", *Environment and Urbanization*, Vol. 3, No. 2, October, pages 71-81.

112. See Hugo 1993 in reference 111.

113. See for instance Douglass, Mike (1981), "Thailand: territorial dissolution and alternative regional development for the Central Plains" in Walter Stohr and Fraser Taylor (editors), *Development From Above or Below*, John Wiley and Sons, Chichester, pages 183-208.

and from school and visits to health centres.⁽¹⁰⁶⁾ Public provision for housing, housing finance and skill training often implicitly or explicitly exclude women, including women who are household heads.

Among "low-income households", those headed by women usually face particular problems. In many low-income settlements 30 or more per cent of households are headed by women either because a male partner is temporarily absent or because of separation or death.⁽¹⁰⁷⁾ The woman is often the only income earner in the household and has to combine income-earning with child-rearing and household management - and thus faces all the problems noted above concerning the inadequate provision of infrastructure and services, the discrimination that prohibits the kind of income-earning activities in which women commonly engage or denies them access to government programmes. Housing or serviced site projects often allocate tenure of the unit to men, as household heads, although women are the primary users of housing, and tenure rights "...are a strategic gender need which ensures protection for themselves and their children in unstable or violent domestic situations."⁽¹⁰⁸⁾ Women headed households also have particular housing needs - for instance, their triple role greatly constrains their ability to take part in "self-help" housing schemes yet rarely do government housing programmes make special allowance for them.⁽¹⁰⁹⁾

d. Migrants

Migrants or particular migrant groups may be more vulnerable to certain environmental hazards than long-term city residents. For instance, in-migrants may lack immunity to particular diseases that are common within the urban area to which they move, whereas those who have lived there a long time have developed some immunity. The susceptibility of recent migrants to an endemic disease can set off a serious epidemic;⁽¹¹⁰⁾ migrants may be more at risk from diseases such as tuberculosis, leishmaniasis and malaria if these diseases are not common in their area of origin.

Migrants arriving in a city might also be particularly at risk from being unable to find accommodation, although networks of family and kinship often provide them with accommodation and support.⁽¹¹¹⁾ Except where natural disasters, wars or other catastrophes force rural people to suddenly flee from their homes into urban areas, most migrants moving into a city have family, kin or friends to whom they turn for help when they arrive (many send one family member ahead to prepare the way for others) and have developed a strategy to minimize risk (for instance retaining the right to use rural land while living in the urban area).⁽¹¹²⁾

A certain proportion of newly arrived migrants may face greater hazards in their homes or work than city-born or long arrived inhabitants. It is perhaps obvious that, all other things being equal, those who already live in a city will have advantages over newcomers in learning about new income-earning or housing possibilities and in promotion within existing workplaces. The problem may not be that migrants cannot find paid work but that the work they take on is so poorly paid or dangerous (or both).⁽¹¹³⁾

Many migrants may be disadvantaged, in comparison to existing city dwellers, in terms of the quality of accommodation they can find (or the quality relative to cost). Immigrants (i.e. people coming from other countries) are likely to be particularly vulnerable, especially if

114. Chant, Sylvia (1992), "Conclusion: towards a framework for the analysis of gender-selective migration" in Sylvia Chant (editor), *Gender and Migration in Developing Countries*, Belhaven Press, London, pages 197-206.

illegal immigrants, since they often face discrimination in housing and job markets and may have no protection under the law against exploitation by employers or landlords. Particular categories of migrants may be at particular risk. If women face discrimination in job and housing markets, access to education and access to land, this will be reflected by gender differentiation in the form and scale of men's and women's population movements and in the incomes and the level of risk in jobs taken by men and women in urban areas.⁽¹¹⁴⁾ However, existing literature on vulnerable groups in urban areas may pay too much attention to migrants and too little attention to age, gender and income. There appears to be a tendency in the literature on health problems in cities to assume that most migrants to cities are very poor, ill-educated, ill-informed about conditions in cities, and unmotivated - which is highly inaccurate. It is also common to see assertions that migrants are at risk because they live in "slums" and illegal settlements when it is low income, not length of time in the city, which is the main influence on who lives in such areas. Many illegal settlements have a predominance of city-born residents. In most instances, the scale of environmental hazards confronting any city dweller is much more likely to be related to their income level than to their status as a recent migrant, well-established migrant or city-born person.

VI. SOME CONCLUSIONS

IN MOST URBAN centres, poorer groups face the most serious environmental hazards and the least possibility of avoiding them or receiving treatment to limit their health impact. At least 600 million urban dwellers in Africa, Asia and Latin America are estimated to live in "life and health-threatening" homes and neighbourhoods because of the environmental hazards described in this paper.⁽¹¹⁵⁾

115. This estimate was made in 1990 in Jorge E. Hardoy et al. (editors), *The Poor Die Young: Housing and Health in Third World Cities*, Earthscan Publications, London and subsequently endorsed by WHO 1992, see reference 3.

The extent of the health burden imposed by the environment on urban populations remains poorly understood. It is almost certainly underestimated, not only because of little data but also because it is usually the result of the cumulative impact of a great number of environmental problems operating concurrently with many non-environmental problems. Michael Manciaux points to the cumulative harmful effects of the ill events for children that, initiated before birth, remain with them throughout their lives.⁽¹¹⁶⁾ This may include undernutrition to which environment related diseases contribute, the illnesses and injuries that arise from environment-related diseases (whose health burden is so much increased by inadequate or no health and emergency services) and the stress to which they are exposed by their environment and by the stress related problems that their parents or carers face.

116. Manciaux, Michael (1988), "Urban slum and squatter settlements; implications for child health" in *Child Abuse and Urban Slum Environments*, WHO/ISPCAN, Pre-Congress Workshop, WHO/MCH/86.15, WHO, Geneva, pages 20-30.

There is great variety in the range and relative importance of environmental hazards both within and between cities and in the non-environmental factors that underlie or interact with them. For instance, in most major cities, the environmental priorities for health improvement in an inner-city tenement will differ from those in an illegal housing development. In both, environmental hazards may be major causes of ill-health, injury and premature death. But the range of hazards and their relative importance will differ because of differences in (for instance) income level and its distribution, age structure, quality and kind of infrastructure and service provision, risk of

flooding, access to health care and emergency services and a host of other factors. What city populations need are city-specific and neighbourhood-specific understandings of the range of environmental hazards and their relative importance for health. This must be combined with an understanding of the groups most affected by them and the diverse mix of social, economic, political and demographic factors that underlie the hazards. From this can come a city and neighbourhood directed programme to control environmental problems, reduce risks (especially for vulnerable groups) and ensure treatment is available where health impacts cannot be prevented. This emphasizes the need for national or international agencies to work with local groups - citizen groups and their community organizations, local doctors and other professional medical or paramedical staff, NGOs, municipal organizations, workers' unions or associations - if accurate diagnoses are to be made and effective interventions undertaken.

The growing interest among governments and international agencies in urban environmental problems often fails to understand this diversity within and between cities. Assumptions are made as to what are likely to be the most serious environmental problems, based on little or no data from the cities concerned. Or what had proved to be a major environmental problem in one city or city district is assumed to be the major problem in another. Or what a research project had shown to be a pressing health problem in one city (or even a few cities) is assumed also to be a pressing problem in other urban centres.

Centralized agencies that initiate or support city or neighbourhood programmes (whether national or international) usually have difficulty in coping with the variety of hazards within each location and the diversity in their range and relative importance in different locations. They often forget (or choose to ignore) the social, economic and political underpinnings of environmental hazards. As a result, many "action programmes on the urban environment" are too narrowly focused and give too little attention to some of the most life and health-threatening environmental problems. Such programmes are too influenced by Western perceptions of what the most serious urban environmental problems are. They are rooted in too little data about what causes ill-health and premature death among poorer groups. As Sarah Atkinson emphasizes (pages 146-152), the sectoral division between the public authorities responsible for health care services, for water and sanitation (and other aspects of environmental health) and for occupational health hardly lends itself to a coherent programme to identify and act on the most life and health-threatening environmental hazards. Urban governments rarely do much to counteract this. Most lack power and resources to do much and many lack the accountable structure which helps ensure they are aware of their citizens' needs and priorities.

Some caution is needed in predicting the likely impact on health of environmental improvements. An analysis of the causes of disease usually points to a wide range of factors (environmental, social, economic, political, genetic..) and it is difficult to separate the relative role of one from the others. The contribution to ill-health and premature death of diseases in which environmental factors have little or no role, such as heart disease, has also been underestimated.⁽¹¹⁷⁾ In addition, identifying causes is further complicated by the fact that environmental factors often operate concurrently and are interrelated, and many contribute by very indirect paths.⁽¹¹⁸⁾ While environmental modifications are often among the most effective

117. See reference 9.

118. Fox, John P., Carrie E. Hall and Lila R. Elveback (1970), *Epidemiology, Man and Disease*, Macmillan, London. See also reference 116.

ways of diminishing the health impact of communicable diseases, other factors need to be addressed. For instance, malnutrition is among the most serious health problems for most poor urban populations. This is largely the result of inadequate incomes (i.e. not an environmental hazard) although malnutrition may lower a person's immunity to communicable diseases such as diarrhoeal diseases (usually arising from contaminated food or water) which then exacerbates the malnutrition. In addition, it is not only environmental modification that can address environmental hazards. Some are far more easily addressed by boosting the human immune system (as in immunization for the vaccine-preventable diseases) or rapid treatment (for instance early diagnosis and rapid treatment of pneumonia would save hundreds of thousands of infants' lives) or ensuring increased incomes that allow low-income groups to choose to spend more to obtain more healthy accommodation and better health services.

However, citizen directed initiatives within poorer urban neighbourhoods are much more likely to develop integrated responses to environmental and non-environmental problems and to ensure that environmental action programmes mesh with local needs and realities. It is the sectoral nature of specialist knowledge and government structure that deters such approaches. The challenge for governments and aid agencies is to develop the institutional means to provide a large and diverse group of community based organizations with the resources to address those problems amenable to household and community action.⁽¹¹⁹⁾ This must be provided in ways that ensure that the needs and priorities of those most at risk are addressed. It must also be complemented by district and city-wide health care services and programmes to minimize environmental hazards and promote environmental health in all other areas. Where local authorities are weak and ineffective and provision for water supplies, sanitation, drainage, garbage collection and health care inadequate, innovative solutions must be sought, perhaps through partnerships between municipal organizations, NGOs and community organizations. Increasing poorer groups' control over the quality of their living environments may also have many additional (unforeseen) health benefits.

There are no blueprints to guide governments and international agencies. The form of such support and the best balance between supporting community directed action and government, private sector or NGO provision will depend on local, city and national characteristics. A healthy city (or smaller urban centre) is one in which environmental factors contribute very little to ill-health and contribute much to promoting and supporting well-being. Perhaps the two best measures of "good governance" are the extent to which environmental hazards are no longer significant threats to life and health, especially for vulnerable groups and in the poorest areas within a city, and the level of satisfaction that poorer groups derive from their homes and neighbourhoods.

119. This is a subject explored in more depth in Arrossi, Silvina and others (forthcoming), *Funding Community Level Initiatives*, Earthscan Publications, London.