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# URBAN ENVIRONMENTAL HEALTH IN DEVELOPING COUNTRIES: A CASE STUDY OF PENANG ISLAND, MALAYSIA

A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

in Partial Fulfillment of the Requirements for the Degree of

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# URBAN ENVIRONMENTAL HEALTH IN DEVELOPING COUNTRIES: A CASE STUDY OF PENANG ISLAND, MALAYSIA

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Cornell University, 1997

This dissertation contends that environmental health conditions in urban areas of developing countries take precedence over other environmental concerns. It focuses on Malaysia and Penang Island. The purpose is to highlight the sorry state of environmental health conditions in many urban areas of developing countries and the urgent need to address the problem due to the rapid urbanization that is taking place in those countries. Malaysia, at the macro level, and Penang Island, at the micro level, provide case studies on how adequate and efficient environmental infrastructure and urban services have been able to significantly reduce and even eliminate environmentally related diseases.

The research is a descriptive study of issues that directly affect environmentally related diseases. Specifically, they are a safe and adequate water supply; satisfactory collection, treatment and disposal of sewage; efficient collection and disposal of solid waste; control of rodents and insects; good water and air quality; and well-conceived land development practices.

The study argues that rapid urbanization in developing countries requires substantial resources in order to reduce and eliminate environmentally related diseases. It contends that while the accumulation of urban infrastructure over the years has helped cities to contain these diseases, more resources are needed to upgrade them to raise standards

and to provide for the new urban population. Further, all types of existing environmental infrastructure are not equal, some are adequate while others are inferior. Thirdly, the spread of urban areas into larger areas at lower densities as growth and development occur compounds the problem of infrastructure provision.

The dissertation confirms the critical importance of a safe water supply and adequate sewerage services along with efficient collection, and disposal of garbage in arresting environmentally related diseases in urban areas in developing countries. The threat of an outbreak of environmentally related diseases requires that governments continually upgrade and expand this infrastructure and services to serve the needs of existing and dramatically expanding urban populations. Otherwise, the health effects on the population can be real, immediate, and devastating.

## BIOGRAPHICAL SKETCH

Jamalunlaili Abdullah was born on September 30, 1965 and raised in Bota Kiri, a small Malay village on the bank of the Perak River. After primary Malay school, he went to Anglo Chinese School, Ipoh and Sekolah Tuanku Abdul Rahman, Ipoh for his high school education.

He was awarded a federal scholarship by the Public Services Department (JPA) to pursue college education in the United States in 1983. He obtained a B.Sc. in Urban and Regional Planning from East Carolina University, Greenville, North Carolina, in 1987. Two years later he obtained a Master of Urban and Regional Planning from Virginia Commonwealth University, Richmond, Virginia. He worked for more than two years as an assistant to the Zoning Administration Manager at the Chesterfield County Planning Department in Virginia.

In 1991, he worked as a lecturer at the MARA Institute of Technology (ITM), Shah Alam and a researcher at the Institute of Strategic and International Studies, Kuala Lumpur. Under a joint JPA/ITM Young Lecturer Scheme Fellowship he enrolled in the Ph.D. program in City and Regional Planning at Cornell University in January 1992. After 13 years in the U.S. he will return to Malaysia to assume a lecturer position in the Department of Urban and Regional Planning, ITM, Shah Alam, in April 1997.

*Untuk abah dan emak*

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# CHAPTER 1: INTRODUCTION

## General Problem Statement

Environmental issues are rapidly gaining prominence in the field of city and regional planning. As experts and authorities acknowledge the linkage between the rate of growth in global urbanization, and deterioration in the quality of the environment, environmental planning is receiving increasing attention in urban planning and development projects worldwide.

Since the turn of the century, rapid urbanization has taken place globally. Until the 1950s, developing and developed nations had similar urban growth rates. However, since then, most of the growth has taken place in developing countries, where future growth is also anticipated to be disproportionately high. While the rural population in the developing region is predicted to increase by a mere 10 percent between 1990 and 2025, the urban population is expected to almost triple.[1] During this period, the urban population in the developing countries is anticipated to surpass the rural population.

Due to the rapid growth of urban population in the developing countries, "[b]y 2010, the second stage of the urban revolution will have begun when the world population will become for the first time predominantly urban, 51.8 percent." Although the developed regions will still have a greater percentage of its population in urban areas than the

[1] Carl Bartone, "Environmental Challenge in the Third World Cities," *Journal of the American Planning Association* 57, no. 4 (Autumn 1991): 411-415.

developing ones (76.0 percent compared to 46.2 percent) the latter urban population will be two and half times as large as the former (2,611.6 million compared with 1,011.4 million).[2]

Unless adequate preventive measures are undertaken, increasing urbanization is likely to lead to a deterioration of the environment in two ways.[3] First, urban expansion requires land to be cleared and developed for residential, commercial, and industrial uses which are more intensive than agricultural use in rural areas. Second, the concentration of population and industries leads to greater demand for finite natural resources, and the generation of more waste, which results in land, water, and air pollution.

Studies indicate that urbanized populations need more water for drinking and cleaning, more energy sources for cooking and heating, and more material for the construction of dwellings and other structures. At the same time, an increasing concentration of industries and population in

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[2] Barclay G. Jones with the assistance of William A. Kandel, "Population Growth, Urbanization and Disaster Risk and Vulnerability in Metropolitan Areas: A Conceptual Framework," ed. Alcira Kreimer and Mohan Munasinghe, *Environmental Management and Urban Vulnerability*, World Bank Discussion Paper #168 (Washington, D.C.: The World Bank, 1992), 53. The first stage of world urbanization started in 1850 when England became the first country to have more than 50 percent of its population living in urban areas.

[3] It should be noted that environmental health conditions tend to be much better in urban areas than in rural areas. Based on the World Bank data, there is a high correlation between level of urbanization and environmental health in countries throughout the world resulting in the fact that percentage of the population that is urban is positively correlated with life expectancy. However, this situation comes about due to various factors, one is that the most urbanized nations tend to be developed nations which spend substantial amounts on infrastructure and urban services, and the second is that many developing nations with high urbanization rates tend to be those with middle income which can afford infrastructure development for urban areas. The situation is likely to get worse when poor developing countries experience rapid urbanization and cannot provide sufficient infrastructure for the new urbanites.

urban areas will produce a larger volume of waste and pollution. Greater quantities of untreated sewage and wastewater will pollute streams, rivers, and coastal waters in and around the urban areas. These are the sources of water that many urbanites rely on for drinking and washing. The pollution of waterways will compound the existing problem of an inadequate safe water supply in many cities.

The amount of garbage and other types of solid wastes will also increase as the urban population rises. These solid wastes have to be efficiently collected and disposed of properly to reduce the spread of diseases brought on by rodents and insects associated with garbage. In addition, the concentration of industries in urban areas may lead to an increase in hazardous wastes which have to be disposed of properly. Emissions released by industries, residences, and motor vehicles associated with the urban population further pollute air in and around the cities.

The demand for more natural resources and the greater pollution generated by the rapid rise in urban pollution may adversely affect the health, safety, comfort, and aesthetics of the people in urban areas. These effects can be physical, social, and psychological.

The adverse effects of rapid urbanization and its corresponding repercussions on the environment, are more profound in the developing countries of the world. In these by-and-large poor countries, governments are already hard pressed to cope with the needs of the existing urban population and pollution they generate. A greater increase in their urban populations will make their environmental problems even tougher to handle.

In many developing countries, environmental problems affect the health of the people in more profound ways than in the developed countries. Waterborne diseases caused by the lack of safe and adequate water, and sewage and waste water pollution, have led to many illnesses and deaths in the developing countries of Africa, Latin America, and Asia. A lack of urban services has led to the unsatisfactory collection and disposal of garbage and other solid wastes. The result is the proliferation of insects and rodents which carry diseases, some of which are fatal. The greater concentration of the population in urban areas in these poor countries will make the situation much worse in the future.

## Scope

Environmental degradation in urban areas of developing countries significantly affects the physical health of the urban population. The physical health effect is much more profound than the effects of environmental degradation on the comfort, social, and aesthetic aspects of the urban areas. Diseases related to the environment lead to a loss of vigor and productivity and in some cases even death (especially among children below the age of five) in the populations they affect, and in a loss of economic output.

This dissertation focuses on the environmental health aspect of environmental planning. This deals with the effect of the environment on the health of the people. Moreover, it will restrict its examination to environmental health problems in the urban areas of developing countries that are linked to environmentally related diseases. Specifically, it will

explore environmental health problems that affect diseases, and the environmental infrastructure and urban services which can effectively reduce these diseases.

This dissertation explores this general question in the context of Malaysia, specifically focusing on the island of Penang, one of the most urbanized regions in the country. Malaysia is selected since it represents a developing country that has experienced rapid industrialization and urbanization during the past three decades. This phenomenon has intensified greatly during the past decade.

The research provides a macro study on the effects of investment on environmental infrastructure and urban services on the health of Malaysia's population, especially in urban areas. Being the first country in Southeast Asia (with the exception of the city state of Singapore) to have more than fifty percent of its population residing in urban areas,[4] Malaysia provides a lesson for other developing countries on the threshold of becoming urbanized.

Penang Island provides a suitable case study on environmental health issues at the micro level. It is an excellent case of the effect of urbanization on environmental health since the whole island is urban[5] and administered by one urban local government. It is located in the highly urbanized Peninsular Malaysia, perhaps the most urbanized region in

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[4] In 1991, Malaysia became predominantly urban when 51.4 percent of its population resided in urban areas. Peninsular Malaysia has always been the most urbanized region in Southeast Asia since the colonial days. See Rozi Ali, "Recipe for Orderly Urban Development," *New Straits Times* (Kuala Lumpur), 25 July 1993.

[5] While the western part of the island is mostly rural, the island is classified as 100 percent urban by the Malaysian authorities since the effect of urban areas in other parts of the island significantly affect the western part.

Southeast Asia. Being one of the earliest towns founded in Malaysia and the first town to be elevated to the status of a city in the country, Georgetown, the largest urban center in Penang Island, provides an interesting case of the development of a colonial city into what has become one of the major cities in a Third World country. The same situation is found in many other cities throughout the developing countries. Thus, lessons learnt from Penang Island can be applied to other urban areas in the developing countries with modifications made to suit local situations.

There are many elements that can be investigated in a thesis on urban environmental health. However, this research will focus on those basic environmental elements that directly affect public health. These elements impact the prevalence and magnitude of waterborne, landborne, and airborne diseases. Specifically, these are: adequate treatment and supply of safe water; adequate collection, treatment and disposal of sewage and wastewater; efficient collection and sanitary disposal of garbage and other solid wastes; safe disposal of toxic waste; protection of waterways from excessive water pollution; and control of air pollution within safe limits. The availability or absence of environmental infrastructure and urban services will be compared with incidences of environmentally-related diseases in Penang Island.

Finally, this research examines the basic premise that adequate basic environmental infrastructure and urban services have the greatest impact on reducing, or even eliminating environmentally related diseases. It does so by examining the extent and the availability of this infrastructure and services in Malaysia and Penang, and their impact on environmentally related diseases.

## Hypotheses

This study deals with the impacts of basic environmental infrastructure and urban services on environmentally related diseases in urban areas. Since the study area is in a developing country, it is the assumption of the study that environmentally related diseases, especially waterborne diseases, are widespread, unless infrastructure and urban services to tackle them are adequate and accessible to a majority of the urban population.

There are three hypotheses made in this study. The first is that increased urbanization in developing countries can cause environmental degradation in urban areas to worsen. Due to a concentration of greater numbers of people in urban areas, there are greater possibilities for more people to be subjected to environmentally related diseases. A greater population concentration in turn has the effect of making environmentally related diseases more noticeable. On the other hand, a higher population concentration can make environmentally related diseases easier to control, since the area to be covered is much smaller than when most of the population is scattered, as in rural areas. However, this can only come about if basic environmental infrastructure and services are adequately provided for, and delivered to most of the urban population.

This study shows that excellent provision of some of these infrastructures, especially those dealing with the treatment and delivery of an adequate and safe water supply, has significantly reduced the incidence of waterborne diseases.

The second hypothesis of the study is that despite the excellent provision of water supply and health care in Penang, some aspects of environmental infrastructure in the Island are still inferior and reminiscent of those found in most other developing countries. Specifically, these include the provision of sewerage, collection and disposal of garbage and other solid wastes, disposal of toxic waste, and the quality of river and coastal water. Safe water supply notwithstanding, these environmental infrastructure and services are also important for the health of the urban population. This study stresses the importance of adequate collection, treatment and disposal of sewage and waste water by arguing that an outbreak of waterborne diseases occasionally occurs in Penang Island due to the lack of a satisfactory sewerage system; this despite the fact that Penang Island has a safe water supply.

The third hypothesis argues that increased urbanization in developing countries leads to the spread of urban areas from city centers to peripheral areas which are at lower densities. This is comparable with the experiences of developed countries, especially that of the United States. As urbanization increases, the rate of population increase in the peripheral areas will be much larger than the rate of increase in the city center.[6] This confirms the concept of the density gradient formulated by Clark, which states that as urbanization increases, the density gradient will be less steep.[7]

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[6] In some cases, as found in Georgetown, the city center may lose population while peripheral areas gain significant number of population.

[7] Colin Clark, "Urban Population Density," *Journal of the Royal Statistical Society* 114, Part 55 (1964): 490-495.

This phenomenon has far-reaching consequences on urban environmental health, especially with regard to financing, since the areas to be provided with infrastructure and urban services will expand. The inability of many local governments in the developing countries to provide infrastructure for existing populations in compact urban areas will be compounded by the need to provide for new urban population in much larger urban areas. It will force authorities to refocus environmental expenditure on basic but vital urban environmental infrastructure and services.

The dissertation further argues that throughout the world, at low levels of economic development, there is a low level of urbanization. The standards of environmental infrastructure and urban services are also low. As development takes place and incomes grow, urbanization increases. Thus, governments have to provide better standards of environmental infrastructure and urban services to not only the existing urban population, but also the new urban population.

Urban environmental conditions in many developing countries are bad due to rapid urbanization which has outstripped the ability of authorities to invest in urban infrastructure. The situation in Malaysia is somewhat better than other places, since early investments in infrastructure during colonial times have allowed the current government to keep up with growth in the population. This has significantly reduced the incidence of environmentally related diseases. For many developing countries that have not been as fortunate as Malaysia, this study shows that a focus on basic environmental infrastructure and services in urban areas should take precedent over other environmental issues.

## Methodology

A substantial amount of data has been gathered and tabulated descriptively and analyzed in this study. These data were gathered from various departments in the Municipal Council of Penang Island as well the state and federal governments. These include the Penang Water Authority, Sewerage Engineering Department and Indah Water Konsortium, Health Departments of the city and the state as well as the two districts on the island, the City Urban Services Department, Federal Department of Environment, Local, State, and Federal Town and Country Planning Departments, and Drainage and Irrigation Department. Published data from these departments, as well as unpublished departmental reports and confidential consultant reports were collected and consulted. In addition, interviews were conducted with heads and key personnel in each department.

The data were descriptively analyzed and tabulated by section. Thus, the section on water supply used data provided mostly by the Penang Water Authority, while that on garbage and solid waste relied on data provided by the Urban Services Department and the Town Planning Department. The data were analyzed to see trends over the years, starting as early as 1970 until the present (1996). The method primarily used was time series analysis.

## Plan of Work

There are seven chapters in this study. Chapter Two reviews relevant literature on global urban growth and urban environment with a focus on urban environmental health. Waterborne, airborne, and landborne diseases are described in this chapter, and an explanation is provided on water supply treatment and distribution, and sewage collection, treatment, and disposal. Chapter Three outlines the theoretical framework and the model on which the study is based.

Chapter Four analyzes environmental health conditions in Malaysia, focusing mostly on urban areas of the country. It provides important statistics on infrastructure development and cases of environmentally related diseases. Chapter Five provides a background on the history of development in Penang as well other important socio-economic data and the evolution of urban planning in the island.

Chapter Six descriptively analyzes environmental infrastructure and urban services in Penang and their effects on environmentally related diseases. Most of these are time series analyses. The chapter is broken down into individual sections on water supply, sewage, garbage and solid waste, hazardous waste, water pollution, air pollution, and diseases. Chapter Seven summarizes the results and concludes the study.

# CHAPTER 2: LITERATURE REVIEW

## Introduction

Concern with the world environment is a relatively new and evolving issue which can be traced back to the 1973 United Nations' Conference on the Environment in Stockholm. Two years later, the World Commission on Environment and Development, established after the Conference, published a report entitled *Our Common Future* which brings global environmental degradation into policy debates and public focus. In 1992, a most important and comprehensive conference was held in Rio de Janeiro, the U.N. Conference on Environment and Development (The Earth Summit), and attended by almost all world leaders. Due to this, the 1990s are labeled the decade of the environment.

The world is rapidly urbanizing at the same time that environmental degradation takes place. This has led researchers and scholars to link environmental degradation with urbanization especially in the developing regions of the world. Consequently, the subject of urban environment becomes a focus of discourse during the second half of the 1990s.[1] The emergence of the terms "urban environment", "sustainable cities", and "ecological cities" symbolizes the greater awareness of policy analysts towards the effects of urbanization on the environment.

This chapter reviews literature on the environment and following the focus of this dissertation concentrates on environmental health in

[1] Urban environment issues received a great boost during the United Nations' Conference on Cities (Habitat II) in Istanbul, Turkey in June 1996.

urban areas, especially in the developing countries. To underscore the importance of infrastructure and urban services in the rapidly urbanizing developing countries, the bulk of the review is on urban environmental infrastructure.

## Major Current Literature on the Environment

Two of the most famous recent policy oriented publications on the environment are perhaps *Our Common Future*, published after the 1973 Stockholm Conference, and *Agenda 21*, produced after the 1992 Earth Summit. In addition to documenting global environmental destruction and stressing the urgency to address the problems, *Our Common Future* coins the term "sustainable development," which is perhaps the most popular term in environment and development literature. The Bruntland Commission defines sustainable development as development that "meets the needs of the present without compromising the ability of future generations to meet their own needs."[2] It provides an environmental rationale through which claims of development to improve the quality of all life can be challenged and tested.

*Agenda 21*, on the other hand, outlines programs of action to address environmental problems into the twenty first century. The major goal of the document is to achieve the concept of "sustainable

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[2] World Commission on Environment and Development, *Our Common Future*, (New York: Oxford University Press, 1987). There are other definitions of sustainable development formulated by various scholars. For example, the World Bank's definition of sustainable development in practice is basically incorporating environmental considerations in the Bank's activities.

development" through a program of actions in various disciplines and areas of the world.

Sustainable development as well as most of the issues covered in *Agenda 21* focuses on various global environmental issues, from basic ones such as poverty, provisions of water supply, and deforestation, to the complex such as global warming, depletion of ozone layers, and disposal of toxic wastes. While most of these issues relate directly to urban areas throughout the world, there is not much reference to the idea of integrated urban environment in the text.

Among the forty chapters included in the more than 500 pages of text in *Agenda 21*; only Chapter Seven, "Human Settlements," is primarily devoted to the environment of the cities. Most importantly, human health, the most crucial aspect of the environment, is not at the top of the issues discussed in Agenda 21; it is discussed and analyzed in Chapter 6, not in earlier chapters.

In the "Human Settlements" chapter, the U.N. strives to achieve seven objectives towards the goal of sustainable urban settlement.[3] However, the provision of integrated environmental infrastructure, namely water, sanitation, drainage, and hazardous and solid waste management, is only listed as the fourth priority of the United Nations. This underscores the argument of this dissertation, that environmental

[3] The seven programs listed in this chapter, in order are: a) providing adequate shelter for all, b) improving human settlement management, c) promoting sustainable land use planning and management, d) promoting the integrated provision of environmental infrastructure: water, sanitation, drainage, hazardous and solid waste management, e) promoting sustainable energy and transport systems, f) promoting human settlements planning, and g) promoting human resources development and capacity-building for human settlement development.

health is not at the forefront of current literature on the urban environment.[4]

In addition to these two famous publications, there are many other publications on the urban environment. They deal with various issues of environmental degradation associated with urbanization, including poverty, overcrowding and lack of shelters, traffic congestion, urban sprawl, a loss of green space, air and water pollution, all of which contribute to the deterioration in health.

Much of the literature on environmental health also tends to emphasize and credit medical health, especially availability of vaccines in controlling the spread of environmentally related diseases. This literature, which is written almost exclusively by experts in the field of medical health, treat medical services as the "cure" or miracle that can arrest the spread of environmentally related diseases.

While it is undeniable that the field of medicine has contributed greatly to the reduction of environmentally related diseases, progress in this field would not come about without a corresponding investment in infrastructure and urban services. Further, medical services tend to treat the diseases after they have occurred without going into the underlying sources of the diseases themselves. In other words, they act more as curative than as preventive measures of environmentally related

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[4] Environmental health once again became prominent very recently due to a series of two articles on the front page the *New York Times* in January 1997 and an editorial in a January 1997 issue of *Asiaweek* which argue for more resources in fighting environmentally related diseases. See "In Third World's Impoverished Lands, Water is a Deadly Drink," *New York Times*, 9 January, 1997 and "Killer on the Loose" *Asiaweek* (editorial), 24 January, 1997.

diseases.[5] Most importantly, these measures are not viable in the long run and do not address the real need of the people for satisfactory infrastructure and urban services for a healthy and comfortable life.

Thus, especially in the field of city planning and public policy, environmental infrastructure should be the focus of strategies in dealing with environmentally related diseases in urban areas.

The following sections focus exclusively on literature on environmental health in urban areas and on literature on the prospect of global urbanization.

## Environmentally Related Diseases and Urban Growth

Cities have been in existence since prehistoric times, as they satisfied the human need to congregate together for safety, comfort , and efficiency.[6] It is noteworthy that most of the early cities were along river valleys .[7] As these cities grew, urban environmental problems began to appear due to an increase in population and the advent of industrialization. This inspired writings on the unsanitary conditions of urban areas in the early nineteenth century.

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[5] It should be noted that while vaccines act as preventive measures, they are mostly administered after the spread of diseases have been confirmed or linked to certain viruses or bacteria. Most aspects of the medical field are still regarded as curative measures.

[6] Arthur Smailes, *The Geography of Towns* (London: Hutchinson's University Library, 1953).

[7] The four earliest urban cultures were in Lower Mesopotamia (in today's Iraq), in Nile Valley (in today's Egypt), in Indus Valley (in today's Pakistan), and along the Yellow River in China. Rome was another important urban civilization. See Mason Hammond, *The City in the Ancient World* (Cambridge, MA: Harvard University Press, 1972).

In 1842, Edwin Chadwick published a groundbreaking report on the poor sanitary conditions present amongst the laboring population in Britain. He asserted that over-crowding, poor sanitary services, poor drainage, and poor water services had led to the proliferation of diseases and a low life expectancy rate amongst this group of people.[8]

Chadwick's report was followed by a famous work by Hector Gavin in 1848 on the unsanitary conditions in Bethnal Green, a parish in London.[9] In Gavin's opinion, Bethnal Green was in dire need of adequate drainage and the sanitary removal of waste water, as well as improvement in the provision of privies and cesspools. He maintained that inefficient house drainage and the absence of sewers led to conditions of unhealthy privies. Gavin also stressed the urgent need to remove solid waste from residential and commercial areas in London. He assessed that "the importance of a ready and efficient means to get rid of the more solid refuse from houses is second only to efficient sewerage and drainage."

The bad environmental condition in Bethnal Green caused it to endure higher rates of sickness and mortality than other parishes in London. Gavin found that 48 percent of the deaths that occurred there took place among children below the age of five, and that 30 percent of these cases could have been prevented through better environmental

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[8] Great Britain Poor Law Commisioners. *Report on the Sanitary Condition of the Labouring Population of Great Britain,* by Edwin Chadwick.1842 ed. M.W. Flinn (Edinburgh: Edinburgh University Press, 1965), cited in Ron Macpherson, "Housing and Health: Some Basic Principles," in *Housing in the Third World Countries: Perspectives on Policy and Practice,* ed. H. Murrison and P. Lea, (Hong Kong: McMillan Press Ltd., 1974), 67-82.

[9] Hector Gavin. *Sanitary Ramblings: Being Sketches and Illustrations of Bethnal Green* (London: Frank Cass & Co., 1971).

infrastructure and services. Most importantly, Gavin argued that an additional 352 deaths and 9856 cases of diseases were penalties paid by Bethnal Green for its neglect of proper sanitary measures.

Across the Atlantic, a sanitary survey of Boston was published in 1850, in which the Sanitary Commission of Massachusetts presented its findings and recommended sanitary improvements for the city to prevent the recurrence of environmentally related diseases such as small pox, plague, yellow fever, typhus, and Asiatic cholera.[10] These fatal diseases had infected people in the state at least since 1631.

Between 1842 and 1848, Shattuck found that 28 percent of deaths were attributed to zymotic diseases, i.e. flu, malaria, and fever, which were associated with bacteria spread in an unhealthy environment. These diseases, which occurred mostly during the summer, were the second highest group of diseases after respiratory ones that occurred in the winter and spring and claimed about 30 percent of the deaths. These two groups of diseases were environmentally related.

The two reports by Chadwick and Shattuck are "hailed today as historical landmarks" mostly because of "their insights and perspectives."[11] They emphasized the importance that should be accorded to environmental infrastructure and services to cater to the needs of an expanding urban population.

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[10] Lemuel Shattuck, *Report of the Sanitary Commission of Massachusetts, 1850* (Cambridge, MA: Harvard University Press, 1948).

[11] P. Walton Purdom, "Environment and Health," ed. P. Walton Purdom, *Environmental Health* (New York: Academic Press, 1980), 1-33.

Since the publication of these works, environmental health conditions in urban areas in developed countries have improved tremendously, due for the most part to better environmental health infrastructure and health services. The number and percentage of environmentally related diseases in these countries have dropped significantly, especially since the turn of the century.

Progress against environmentally related diseases has been significant, in that, the most common diseases in the developed nations today are degenerative diseases such as heart attacks, cancers, and cardiovascular lesions.

In 1977, Brockington found that these degenerative diseases caused 53.5 percent of total death in four developed countries, compared to only 15.6 percent in four developing countries.[12] Heart disease and disorders of the circulatory system accounted for 45 percent of deaths in the developed nations compared to only 12 percent in the developing regions. Most degenerative diseases are due to the aging process, commonly found in the developed nations due to higher life expectancy.

Table 2.1 lists causes of death in the industrialized nations in 1985.[13] Circulatory and degenerative diseases caused more than half of the deaths in these nations while infectious and parasitic diseases, which are essentially environmentally related diseases, accounted for only 4.6 percent of deaths. Even injury and poisoning, diseases associated with

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[12] Fraser Brockington, *The Health of the Developing World* (Sussex: Book Guild Ltd., 1985), 142. The four developed nations are Australia, Britain, Canada and Denmark while the four developing nations are Colombia, Egypt, Mexico and Guatemala.

[13] In this dissertation, the terms "developed" and "industrialized" countries are used interchangeably and refer to the same group of counties.

industrialization, had a higher percentage, at 7 percent, than that of infectious and parasitic diseases. The very small percentage of deaths caused by the latter is due mainly to adequate environmental infrastructure and urban services, and excellent health care.

Table 2.1: Causes of Death in Industrial Countries, 1985

| Cause of Death | Number ('000) | Percentage |
|---|---|---|
| Infectious & Parasitic Diseases | 506 | 4.6 |
| Acute respiratory infections | 368 | 3.3 |
| Tuberculosis | 40 | 0.4 |
| Neoplasms | 2,293 | 20.8 |
| Circulatory & degenerative diseases | 5,930 | 53.7 |
| Ischemic heart disease | 2,392 | 21.7 |
| Cerebrovascular disease | 1,504 | 13.6 |
| Diabetes | 153 | 1.4 |
| Complications of pregnancy | 4 | 0.0 |
| Perinatal conditions | 100 | 0.9 |
| Chronic onstructive lung disease | 385 | 3.5 |
| Injury & poisoning | 772 | 7.0 |
| Ill-defined causes | 247 | 2.2 |
| All other causes | 807 | 7.3 |
| **Total** | **11,045** | **100.00** |

Source: Alan D. Lopez, "Causes of Death in Industrial and Developing Countries: Estimates for 1985-1990," in Dean T. Jamison, et.al., eds., *Disease Control Priorities in Developing Countries* (New York: Oxford University Press, 1993), 38.

On the other hand, environmentally related diseases still constitute most of the deaths in the developing countries. Most diseases occur as a result of infections (parasitic, bacterial, and viral) and malnutrition. In a comparison between four developing and four developed countries in 1977, 18 categories of infections caused 13 percent (144,615 deaths) of total deaths in the former group compared to only 0.5 percent (4,987 deaths) in the latter.[14] Most importantly, this information is for "intermediate class" countries which were able to return most of the data, which means that perhaps they are some of the most advanced developing countries in the world. The picture for the poorest developing countries are assumed to be worse.

Table 2.2 provides an estimate of causes of death in the developing countries in 1985. Unlike the developed nations, environmentally related diseases, specifically infectious and parasitic diseases, caused 45 percent of total deaths in the developing countries .

Diarrheal diseases, a category of infectious and parasitic diseases, caused almost as many deaths (13.2 percent) as all circulatory and respiratory diseases. Infectious and parasitic diseases killed about 17 million people in the developing countries in 1985 alone, 10.5 million of whom were children under the age of five. Despite advancement made in

[14] The 18 categories are: cholera, typhoid, bacillary dysentry and amoebiasis, enteritis and diarrhoeal diseases, respiratory tuberculosis, other tuberculosis, plague, diphtheria, wooping cough, streptococcal sore throat and scarlet fever, meningococcal infection, acute poliomyelitis, smallpox, measles, typhus and other rickettsioses, syphilis, all other infective and parasitic diseases. See Brockington, op.cit., 136.

medical sciences, these environmentally caused diseases still wreak havoc on peoples' lives.

Table 2.2. Estimated Causes of Death in the Developing Countries, by Age, 1985. (In thousands)

| Cause of Death | Age Under Five | Age Five and over | All Ages | Percentage |
|---|---|---|---|---|
| Infectious & Parasitic Diseases | 10,500 | 6,500 | 17,000 | 44.9 |
| Diarrheal Diseases | 4,000 | 1,000 | 5,000 | 13.2 |
| Tuberculosis | 300 | 2,700 | 3,000 | 7.9 |
| Acute respiratory diseases | 4,300 | 2,000 | 6,300 | 16.6 |
| Measles, whooping cough, and diphterias | 1,500 | — | 1,500 | 4.0 |
| Other acute respi. disea. | 2,800 | 2,000 | 4,800 | 12.7 |
| Other measles and whooping cough | 700 | — | 700 | 1.8 |
| Malaria | 750 | 250 | 1,000 | 2.6 |
| Schistomiasis | — | 200 | 200 | 0.5 |
| Other infectious & parasitic dis. | 450 | 350 | 800 | 2.1 |
| Complications of pregnancy | — | 500 | 500 | 1.3 |
| Perinatal conditions | 3,200 | — | 3,200 | 8.4 |
| Neoplasms | — | 2,500 | 2,500 | 6.6 |
| Chronic obstructive lung diseases | — | 2,300 | 2,300 | 6.1 |
| Circulatory & degenerative diseases | — | 6,500 | 6,500 | 17.2 |
| External causes | 200 | 2,200 | 2,400 | 6.3 |
| Other and unknown causes | 700 | 2,800 | 3,500 | 9.2 |
| **Total** | **14,600** | **23,300** | **37,900** | **100** |

Source: Alan D. Lopez, "Causes of Death in Industrial and Developing Countries: Estimates for 1985-1990," in Dean T. Jamison, et.al., eds., *Disease Control Priorities in Developing Countries* (New York: Oxford University Press, 1993), 43.

Deaths attributed directly to environmentally related diseases describe only part of the picture. Due to the availability of medical care and vaccines in almost all parts of the world, environmentally related diseases do not cause as many deaths as they used to. Even the reduced number of deaths attributed to these diseases, at 17 million people in 1985 alone, is still too high to be ignored.

Environmentally related diseases impact the lives of the people in various other ways as well. They affect comfort, productivity, economic well-being as well as the vigor and vitality of the disease stricken. They lead to a full loss of healthy life.

The World Bank and the World Health Organization have developed a method to quantify the full loss of healthy life by a method called disability-adjusted life year (DALY). The DALY figures measure "the present value of the future stream of disability-free life lost as a result of death, disease, or injury in 1990." [15] Consequently it gives greater weight to deaths at a younger age, which are caused mostly by environmentally related diseases.

In 1990 alone, the world lost 1.36 billion of DALYs which was equivalent to 42 million infant deaths. Established market economies had a mere 6.9 percent share, despite possessing 15 percent of the world population. The main reason was that many children in the developing countries died or became disabled due to environmentally related diseases.

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[15] The World Bank, *World Development Report 1993: Investing in Health* (Washington, D.C.: The World Bank, 1993), 27. See pages 26 and 27 of the report for detailed explanations of DALY.

DALYs per 1,000 population in Sub-Saharn Africa was almost five times as much as that for the developed countries, while the corresponding figure for India was three times as high. Communicable diseases, which are environmentally related diseases (other than STDs and HIV and those due to maternal causes), constitute the bulk of DALYs in the developing nations. They push the DALY figures to be much higher than those for the developed countries.[16]

Tremendous improvements in addressing environmental health issues in the developed nations can be attributed to a rise in per capita income which led to increased urbanization among the population.[17] Due to excellent provisions of environmental infrastructure, urban services, and medical care, conditions described by Shattuck have practically disappeared from urban areas in the developed countries. Unfortunately, conditions in many urban areas in the developing countries in the 1990s still mirror those found in Bethnal Green and Boston in the 1850s.

In peri-urban areas, or *pueblos jovenes*, of Peru, the incidence of waterborne diseases, especially cholera, has increased as a result of the deterioration of water and sewerage conditions during the past decade.[18] These diseases are associated with poor living conditions.

In 1989 only 52 percent of the population had access to piped water, and only 39 percent to sewerage. Further, due to lack of access to fresh water or toilet facilities, 90 percent of the food sampled, which was sold by

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[16] Ibid. See Box Table 1.3 on page 27 of the 1993 Report for these figures.

[17] Chapter 3 of the dissertation, "A Conceptual Model," explores this linkage in detail.

[18] Sheila Webb and Associates, "Waterborne Diseases in Peru," Background Paper for the *1992 World Development Report* (Washington, D.C.: The World Bank, 1992)