

**An Analysis of Science- and Technology-Related Health Assistance
Provided to Lesser Developed Nations
From 1985 to 1995**

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ABSTRACT

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The problem of this research was to analyze science- and technology-related health assistance provided to Third World nations between 1985 and 1995 by four donor agencies: Ford and Rockefeller Foundations, USAID, and World Bank. The research examined health assistance in terms of (1) the number and value of projects by region, sub-region, and country; (2) the amount of assistance provided by individual donor agencies; (3) the types of projects initiated; and (4) the impact that these projects had on 8 health-related and 1 economic-related indicator in selected countries.

A total of 610 health projects, valued at \$1.6 billion, were identified. These projects were implemented in 63 nations and fell into 9 general categories: public health, epidemiology surveillance, immunization, reproductive biology and fertility regulation, maternal and child health, injuries, prosthetic and orthotic services, communicable diseases, and noncommunicable diseases. No strong correlation between health assistance and health or economic improvement was found.

DEDICATION

This thesis is dedicated to the two persons I cherish most in this world—my parents, Charlotte and Glenn Spitznogle. Only through their love, support, encouragement, and prayers was I able to continue my education and complete this work. They are truly a blessing from God.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
DPT	Diphtheria, Pertussis, and Tetanus
GDP	Gross Domestic Product
GNP	Gross National Product
HIV	Human Immunodeficiency Virus
IMF	International Monetary Fund
NSF	National Science Foundation
STDs	Sexually Transmitted Diseases
UN	United Nations
UNCTAD	United Nations Conference on Trade & Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific, & Cultural Organization
US	United States
USAID	United States Agency for International Development
WHO	World Health Organization

CHAPTER ONE

Introduction

Science and technology have long been associated with development. From the earliest civilizations of Mesopotamia and the Nile Valley to the Industrial Revolution and the Information Age, science and technology have been crucial to humanity's ability to manipulate and improve its environment (Faruqui, 1986; Johnston & Sasson, 1986; Sagasti, 1980; Volti, 1995).

While science deals with the analysis of natural phenomena for the generation and advancement of knowledge, technology deals with the application of knowledge for practical and beneficial purposes, including industrial and commercial objectives like the production of goods and services (Haller, 1985; Morris, 1992). Yet it is the interaction between these two activities—scientific findings breeding technology and technological advances enhancing scientific research—that has proven most critical to the development of nations (Faruqui, 1986; Jamison, 1988; Pytlik, 1978; United Nations Conference on Trade & Development [UNCTAD], 1984).

The potential that such an alliance holds has tempted many to speculate about the future benefits of science and technology on society. Sagasti (1980) alluded to this potential, especially with regard to humanity's desire for universal prosperity:

The formidable advances in the generation of knowledge during the twentieth century have given contemporary man an unprecedented degree of control over the phenomena that surround him. This increased power, based on improved understanding, is largely the product of modern science and its cumulative evolution during the last four centuries. The possible applications of science and technology . . . for the benefit of mankind appear boundless, and the promises of a new age of prosperity for all through the use of science have been heralded by many. (p. 321)

Inequity in Development

Yet the promise of universal prosperity has not been fulfilled. Sadly, as nations and regions developed at differing rates throughout history (Bagchi, 1988), wide disparities in personal income and living standards evolved around the world (Streeten, 1984). Furthermore, with the onset of the Industrial Revolution, the international distribution of income grew increasingly unequal (Streeten, 1984).

At the same time that Europe and America achieved tremendous gains in technology and economic growth amid the Industrial Revolution, the nations of Africa, Asia, Latin America, and the Middle East were “incorporated into an international division of labor as colonies” (Sagasti, 1980, p. 324) to support industrialization. Because Third World colonies were viewed simply as sources of inexpensive natural resources or as potential consumer markets, their endogenous scientific and technological capacities were neglected during the colonial period (Sagasti, 1980). Instead of “building incrementally upon existing knowledge and technique, drawing upon existing human ingenuity, and encouraging research to flourish and find new, endogenous

answers to economic and social problems” (Childers, 1979, p. 22-23), little investment was made into Third World nations and the disciplines of science and technology were left to wither and waste away (Faruqui, 1986; Sagasti, 1980). As a result, the Third World became technologically dependent upon industrialized nations as a “*look North, think North* mentality [evolved]” (Childers, 1979, p. 23), and the global economy was essentially dichotomized.

International Assistance

In the 1950s when Third World countries emerged as independent nations, the industrialized world was shocked and concerned by the underdevelopment found in the wake of retreating colonial power (Castle, 1972). Third World nations were “plagued by poverty, very high rates of population growth, low growth rates of gross domestic product, low rates of industrialization, [an] extremely high dependence on agriculture, [a high] rate of unemployment, and uneven income distribution” (Ghosh, 1984, p. 3).

Due to the persistent problems of poverty, insufficient amounts of arable land, limited technology, and inefficient labor productivity caused by illness, illiteracy, and a lack of technical skills, most of these nations were unable to sufficiently support societal development (Stockwell, 1981). With the realization that “two-thirds of the world’s population . . . were subsisting on one-sixth of the world’s income” (Castle, 1972, p. 3), industrialized nations along with international agencies began to support Third World development through foreign aid and assistance (Childers, 1979; Evans, 1979).

In the 1960s, the United Nations (UN) heralded in the Development Decade, described by Castle (1972) as “a period of urgent endeavor on the part of wealthy nations to reduce the gap between the rich and the poor” (p. 8). During this time, the importance of science and technology in the development process grew in recognition (UN, 1963) and over the next several decades, various efforts were initiated that promoted the use of science and technology in the developing world, including (1) the 1963 UN Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas (UN, 1963), (2) the 1974 conceptualization of the New International Economic Order, which advocated the use of technology to help achieve international economic equality (Evans, 1979), (3) the 1979 UN Conference on Science and Technology for Development (Morita-Lou, 1985), (4) the 1980 establishment of the UN Intergovernmental Committee on Science and Technology for Development (Morita-Lou, 1985), and (5) the 1984 formulation of the UNESCO’s (United Nations Educational, Scientific, & Cultural Organization) Major Programme I, which incorporated the use of science and technology to help stimulate developing economies (Johnston, 1986).

Prominent among these efforts was the UN Conference on Science and Technology for Development held in Vienna in 1979, which focused on the key objective of strengthening endogenous scientific and technological capacity in developing nations (Morita-Lou, 1985). As Wad (1988) reported:

For many, the Vienna conference still represents a major landmark in terms of the manner in which the relationship between science, technology and development was conceptualized, with its emphasis on “horizontal,” cross-sectorial approaches, its concern with “endogenous” self-sustaining capabilities and the importance given to international cooperation to achieve these ends. (p. 1)

The importance of endogenous scientific and technological capacity was deemed essential to long-term national development because, in a technologically diverse global economy, such capacity enabled countries (1) to keep abreast of scientific and technological advancements (Wad, 1988), (2) to acquire, absorb, and utilize transferred technologies successfully (Streeten,

1984; Wad, 1988), and (3) to innovate existing manufacturing and agriculture processes in order to produce a wider variety of consumer goods (Haller, 1985).

As it became apparent that a critical need for any nation was technological self-reliance (Sagasti, 1980; Streeten, 1984; Wad, 1988), development assistance agencies initiated a new type of internationally-coordinated science and technology policy that focused on strengthening the endogenous capacity of Third World nations (Jamison, 1988; Morita-Lou, 1985). Today, international and bilateral agencies, including the Food and Agricultural Organization, the World Health Organization, the United Nations Educational, Scientific, and Cultural Organization, the World Bank, and the United States Agency for International Development, provide scientific and technological development assistance (Weiss, 1985).

Economic Development

While the ultimate objective of international assistance is to remedy Third World deficiencies and promote social progress, including strengthening endogenous scientific and technological capacity, development agencies initially targeted economic growth, and in particular Gross National Product (GNP) maximization, as the principal means to achieve immediate change (Abiaka, 1991; Evans, 1979).

The justification for GNP maximization rested on four grounds. First was the belief that the best way to attain rapid, widespread public benefit, like increased employment opportunities, higher productivity, higher wages, and lower prices, was through economic growth in an unhindered, free-market environment (Streeten, 1981). Second, it was believed that free-market operations would quickly distribute economic gains through all sectors of society, eventually trickling down to even the poorest sectors (Abiaka, 1991). Third, it was assumed that as national economies improved, governments would take additional steps to accelerate poverty alleviation through increased public service and social welfare spending (Bullock, 1986; Streeten, 1981). Fourth, cross-national research from the 1950s indicated that short-term inequality between the rich and the poor was an inevitable consequence of rapid economic growth (Bullock, 1986). These research findings suggested that in the initial stages of development, concern should focus on the economic environment rather than on the circumstances of the poor. As Streeten (1981) explained:

It was thought necessary first to build up the capital, infrastructure, and productive capacity of an economy so that it could improve the lot of the poor later. For a time—and it could be quite a long period—the poor would have to tighten their belts and the rich would receive most of the benefits. But if the rewards of the rich were used to provide incentives to innovate, to save, and to accumulate capital which could eventually be used to benefit the poor, the early poverty would turn out to have been justified. (pp. 9-10)

As a result, GNP maximization became the focal point of international assistance and the principal measure by which development activities were assessed, often to the neglect of other non-economic indicators (Abiaka, 1991).

From 1950 to 1975, development efforts, at least from the standpoint of GNP maximization, were considered an unprecedented and unexpected success as developing nations reported historic rates of economic growth (Streeten, 1981). Average gains of 3% were achieved in per capita income in the Third World as a whole, with regional increases of 5.2% in West Asia, 3.9% in East Asia, 2.6% in Latin America, 2.4% in Africa, and 1.7% in South Asia (Streeten, 1981). But at the same time that spectacular rates of economic growth were being attained, the quality of life for the vast majority in developing nations remained largely unimproved (Bullock, 1986).

Examining the social progress made in Third World countries during the economic growth years of the 1960s and 1970s provided researchers with a somewhat different assessment of developmental success. Bullock's (1986) analysis of 83 developing nations between 1960 and 1980, for instance, revealed disparity between the economic progress and the social progress that had been achieved in many of the study countries. Several nations including Brazil, for example, which were formerly considered developmental success stories for their economic achievements, actually experienced relatively poor success in the areas of health, nutrition, water, and sanitation over the 20-year period. Other nations that had attained only modest economic growth, like Guyana, showed high levels of progress in these social sectors, while a few countries, like South Korea, experienced success in both economic and social sectors during the study period.

Bullock (1986) concluded that while measurable social progress had been made in the developing world between 1960 and 1980, it was "not comparable to the dramatic economic gains [that were achieved] over the same period" (p. 337). His findings revealed that even after 20 years of unprecedented economic growth, Third World living standards remained fairly deplorable. He reasoned that "without national priorities to create institutions and programs to help channel economic gains into social investments" (p. 338), the short-term effect of economic growth more often negatively impacted social progress in the areas of health, nutrition, water, and sanitation for the vast majority of Third World inhabitants.

Abiaka (1991) also discovered evidence of disparate economic and social development in his examination of International Monetary Fund (IMF) assistance provided to 66 Third World countries from 1976 to 1988. Although significant correlations were found between IMF assistance and economic growth, no such correlations were found between IMF aid and social progress in the areas of health, education, water, food, or nutrition. Abiaka's findings indicated that while IMF assistance had stimulated economic expansion during the study period, the gains of such expansion had affected the "various sectors of the population disproportionately . . . [with] the poor being the most adversely affected of all" (p. 168). Instead of trickling down to the masses and promoting needed social development, the economic opportunities provided by IMF aid had remained confined to small sectors of the society.

To illustrate the disparity of progress made between economic and social sectors, Abiaka (1991) compared GNP per capita and life expectancy ratios for five of the study countries: Brazil, China, Mexico, South Africa, and Sri Lanka. Although South Africa reported seven times the GNP per capita (\$2340) of Sri Lanka (\$360) and China (\$310), it showed a substantially lower life expectancy of 54 years than the other two countries, at 70 and 69, respectively. Brazil and Mexico, with similarly high per capita GNPs, also reported lower life expectancies than Sri Lanka and China.

The literature, therefore, indicated that economic expansion did not automatically translate into social development during the so-called growth years of the 1960s and 1970s (Abiaka, 1991; Bullock, 1986). The failure of economic strategies to promote social progress appeared to be two-fold. First, the economic growth attained by Third World nations, although unprecedented in nature, failed to produce an increase in employment opportunities sufficient for the needs of the rapidly growing labor force (Streeten, 1981). Second, the benefits of such growth failed to be distributed widely throughout society (Abiaka, 1991; Bullock, 1986; Streeten, 1981). With much of the gain remaining in upper societal sectors, little benefit was felt by lower income groups and preexisting inequalities in income, assets, and power were either unaffected or, even worse, reinforced by the rapid economic expansion (Bullock, 1986; Streeten, 1981).

Thus, the distribution of income was found to be as critical to the social development process as was the growth of income (United Nations Development Programme [UNDP], 1990). With the

“realization that man will not necessarily benefit adequately and equitably simply as a consequence of the economic enlargement of political states [and that] the economic gains of industrialization . . . will not automatically *trickle down* to the benefit of all” (Evans, 1979, p. 3), attention shifted from economic development to human development (UN, 1963).

Human Development

Disappointment with the lack of social progress during the economic growth years of the 1960s and 1970s prompted the international development community to refocus its attention on human development issues, including poverty, equity, and basic human needs (Streeten, 1981; World Bank, 1991). As human welfare and quality of life issues were repeatedly expressed in development discussions (Abiaka, 1991; Bullock, 1986; Castle, 1972; UNDP, 1990; World Bank, 1991), policy makers rediscovered that human beings were not simply tools to be used in the economic development process, rather it was their welfare and their advancement that the economic expansion was intended to improve (UN, 1963). The World Bank (1991) commented on the importance of quality of life in the development process:

The challenge of development, in the broadest sense, is to improve the quality of life. Especially in the world’s poor countries, a better quality of life generally calls for higher incomes—but it involves much more. It encompasses, as ends in themselves, better education, higher standards of health and nutrition, less poverty, a cleaner environment, more equality of opportunity, greater individual freedom, and a richer cultural life. . . . Any notion of strictly economic progress must, at a minimum, look beyond growth in per capita incomes to the reduction of poverty and greater equity, to progress in education, health, and nutrition, and to the protection of the environment. (p. 4)

So after years of emphasis on economic growth, the late 1970s ushered in a new era of development policy that centered on the promotion of basic human needs as its primary target (Lewis, 1986). As a result, development progress began to be measured not only in terms of economics, but also in terms of life expectancy, infant mortality, malnutrition rates, and other social indicators (Bullock, 1986).

The principal objective of the *basic needs approach* to development was to provide all people with the opportunity for a full life by ensuring that all had equal access to minimum levels of certain basic needs and services, including adequate nutrition (food and water), health care, housing, sanitation, and education (Abiaka, 1991; Evans, 1979; Streeten, 1981). Based on “the idea that the basic needs of all should be satisfied before the less essential needs of a few are met” (Streeten, 1981, p. 8), this development approach, unlike economic growth theory, gave priority to the conditions of the poor and the deprived (Stewart, 1985).

Rather than relying on economic growth to indirectly bring about social development, the *basic needs approach* focused on providing social improvements first—through widespread poverty alleviation and basic needs satisfaction—and promised economic growth thereafter (Bullock, 1986). The potential advantages of this approach included more immediate social progress at a much lower cost. As Streeten (1981) explained:

The hypothesis of the basic needs approach is that a set of selective policies makes it possible to satisfy the basic human needs of the whole population at levels of income per head substantially below those required by a less discriminating strategy of all-round income growth—and it is therefore possible to satisfy these needs sooner. . . . Attacking the evils of hunger, malnutrition, disease, and illiteracy with precision will eradicate (or at least ameliorate) these evils with fewer resources (or sooner) than would the roundabout method of raising income. (pp. 37-38)

From the 1960s through 1980s, the basic needs approach to development was expressed in deliberations of global fora including the World Employment Conference (Lewis, 1986), the UN Conference on Trade and Development (Evans, 1979), and the UN Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas (UN, 1963). It also became widely accepted by major development agencies like the World Bank, the International Labor Organization, and the Organization for Economic Co-Operation and Development (Lewis, 1986).

Today, human development and basic needs promotion remains at the forefront of international development policy, albeit under different terminology. The United Nations Development Programme (1990), in fact, reported that the decade of the 1990s revealed a strong consensus within the development community about the continued importance of human development:

The 1990s are shaping up as the decade for human development, for rarely has there been such a consensus on the real objectives of development strategies. The UN Committee for Development Planning summarises [sic] this emerging consensus best: “In the 1990s people should be placed firmly in the centre of development.” (p. 61)

One possible reason for the continued interest in human development may be the fact that global poverty statistics are still on the rise. The United Nations Development Programme (1990) estimated that during the decade of the 1990s, more than 1/2 billion people would be added to the ranks of those living in absolute poverty, representing a 150% increase from the 1990 figure of 1 billion. Yet whatever the reason, since the late 1970s, human development has remained one of the constant objectives of international assistance, as experience has shown that the “accumulation of human capital [is] . . . one of the most powerful engines of development” (World Bank, 1991, p. 34).

Health for All

Health and development are intrinsically linked (Borrini, 1987). To strive for one without pursuing the other is, according to the World Health Organization (WHO), altogether impractical (Stroot, 1991).

As a vital component of human development, improved health is viewed as both an objective and a resource in international assistance (Grosse & Harkavy, 1980; WHO, 1998e). Its role as an objective is due in large part to the fact that improved health contributes significantly to the overall quality of life (World Bank, 1997). Its importance as a resource for promoting development in other areas lies in the fact that health substantially impacts human productivity and learning capacity (World Bank, 1997). By contributing to human capital, improvements in health can, therefore, facilitate economic growth and poverty reduction (Grosse & Harkavy, 1980; World Bank, 1997). As the WHO (1998e) pointed out, “without good health, individuals, families, communities and nations cannot hope to achieve their social and economic goals” (para. 100).

The inherent right to health has grown in acceptance over the last four decades (WHO, 1998e). From its introduction in the late 1940s in the Constitution of the WHO and the UN Universal Declaration of Human Rights (Evang, 1973; WHO, 1998d), the belief in an equal chance for survival and the opportunity for optimal health has become recognized as a fundamental human right (Colletta, Balachander, & Liang, 1996; WHO, 1998e). As Evang (1973) explained:

Most countries in the world have accepted the idea of the right to health through a solemn process of ratification by their appropriate constitutional bodies. The ordinary citizen, I think, does not regard this “right” as a lofty ideal but as plain common sense.

The right to health for everyone has in fact become one of the basic guidelines of practical policy. Life without health is not a full life, not a “real” life. Disease is an unacceptable, painful, anxiety-creating, unstable, intermediary position between the two normal and acceptable situations, life and death. [For the UN and the WHO] to declare 25 to 30 years ago that health was a right for everybody was simply a way of spelling out in words what the ordinary citizen had always felt as being obvious and natural. (p. 3)

Two international initiatives that have recognized the universal right to health have played prominent roles in global health promotion. The first initiative, the 1977 WHO campaign to achieve *Health for All by the Year 2000*, was an attempt to remedy the unacceptable health standards found for large numbers of people in developing nations (WHO, 1998d). This campaign envisioned “the universal attainment by the year 2000 of a level of health that would permit all people to lead socially and economically productive lives” (WHO, 1998e, para. 15) through the means of increased life expectancy, widespread access to quality health care, and health equity among and within countries. In 1995, the renewal process for this initiative began, involving the WHO, the UN, the World Trade Organization, participating countries, nongovernmental organizations, the educational and research community, and the private sector, to ensure that Health for All remained the central vision for health in the 21st century (WHO, 1998d).

The second initiative, the 1990 UN World Summit for Children, provided continued momentum towards the goal of universal health (World Bank, 1993). The Plan of Action agreed to by the 159 nations that attended the Summit committed to improving the health of women and children in the developing world by targeting specific goals for reductions in mortality, morbidity, malnutrition, and disease rates by the year 2000 (Grant, 1991; World Bank, 1993; World Bank, 1997).

Because human participation is critical to the development process (UN, 1963) and because health is central to human development (WHO, 1998e), it becomes essential for international assistance agencies to promote effective health programs in the developing world.

Problem Statement

The problem of this research was to analyze science- and technology-related health assistance provided to lesser developed nations by selected donor agencies from 1985 to 1995.

Purpose of the Research

The purposes of this research were to:

1. Provide evaluative information on past health assistance to donor agencies.
2. Determine if a relationship existed between science- and technology-related health assistance and changes in quality of life.

Research Questions

The following questions were deemed pertinent to this research:

1. How many science- and technology-related health projects were implemented in Third World nations between 1985 and 1995 by the selected donor agencies?

2. What were the total dollar expenditures (by region, by sub-region, and by country) and the per capita expenditures (by country) of such health projects?
3. Of the selected donor agencies, who were the major health funders in Third World countries during the 10-year study period?
4. What types of health projects were initiated by the donor agencies during the study period?
5. Have the health-related indicators of selected Third World countries improved or declined during the study period?
6. Have the economic-related indicators of selected Third World countries improved or declined during the study period?

Assumptions

The following assumption was basic to this research: Data collected by the National Science Foundation Project #SBR-9510548 (Pytlik, Vasudevan, Bayles, & Spitznogle, 1997) is valid and accurate.

Limitations

The limiting factors of this research included:

1. Analysis was limited to the data collected by the National Science Foundation Project #SBR-9510548 (Pytlik et al., 1997) executed between 1995 and 1997.
2. Selected donor agencies were limited to the Ford Foundation, the Rockefeller Foundation, the World Bank, and the United States Agency for International Development.

Procedures

This research was executed in accordance with the following procedures:

1. Review and select science- and technology-related health projects from the database developed for the National Science Foundation Project #SBR-9510548 (Pytlik et al., 1997).
2. Review and select appropriate development performance indicators related to health, economic, and population variables from Social Indicators of Development 1996 published by the World Bank.
3. Analyze health data in terms of dollar amounts and number of projects by region, sub-region, and country.
4. Analyze health data in terms of the source of such assistance.
5. Analyze health data in terms of the types of projects implemented.
6. Select six countries within each region (three that received the highest and three that received the lowest amount of health assistance) in terms of the total number of completed projects during the study period.
7. Select six countries within each region (three that received the highest and three that received

the lowest amount of health assistance) in terms of the total dollar amount spent on completed projects during the study period.

8. Correlate the health data of selected Third World countries with development performance indicators.

9. Determine findings and draw conclusions based on the research questions.

10. Provide recommendations for further research.

Definitions

For the purposes of this research, the following terms were defined as:

Acquired Immunodeficiency Syndrome (AIDS): “a disease involving a defect in cell-mediated immunity that has a long incubation period, follows a protracted and debilitating course, is manifested by various opportunistic infections, and has a poor prognosis” (Anderson, Anderson, & Glanze, 1994, p. 84).

Anemia: “a decrease in hemoglobin in the blood to levels below the normal range . . . [which] may be caused by a decrease in red cell production, increased red cell destruction, or blood loss” (Anderson et al., 1994, p. 20).

Ascariasis: “an infection caused by a parasitic worm, *Ascaris lumbricoides*, that migrates through the lungs in its larval stage; the eggs are passed in human feces, contaminating the soil and allowing transmission to the mouths of others through hands, water, or food; after hatching in the small intestine, the larvae travel through the wall of the intestine, whence they are carried by the lymphatics and blood to the lungs; early respiratory symptoms of coughing, wheezing, and fever are caused by the passage through the respiratory tract; the larvae are swallowed, they mature in the jejunum, where they release eggs, and the cycle is repeated; intestinal infection may result in abdominal cramps and obstruction; in children, migration of the adult worms into the liver, gallbladder, or peritoneal cavity may cause death” (Anderson et al., 1994, p. 128).

Cancer: “general term frequently used to indicate any of various types of malignant neoplasms, most of which invade surrounding tissues, may metastasize to several sites, and are likely to recur after attempted removal and to cause death of the patient unless adequately treated” (Hensyl, Felscher, & Cady, 1990, p. 236).

Cardiovascular Disease: “any abnormal condition characterized by dysfunction of the heart and blood vessels; some common kinds of cardiovascular disease are atherosclerosis, cardiomyopathy, rheumatic heart disease, syphilitic heart disease, and systemic hypertension” (Anderson et al., 1994, p. 271).

Cataracts: “an abnormal progressive condition of the lens of the eye, characterized by loss of transparency; a gray-white opacity can be seen within the lens, behind the pupil; most cataracts are caused by degenerative changes, occurring most often after 50 years of age” (Anderson et al., 1994, p. 277).

Dengue: “an acute arbovirus infection transmitted to humans by the *Aedes* mosquito and occurring in tropic and subtropic regions; the disease usually produces a triad of symptoms: fever, rash, and severe head, back, and muscle pain” (Anderson et al., 1994, p. 451).

Developing Countries, Developing Nations, Developing World, Least Developed Countries, Lesser Developed Nations, and Third World (synonymous terms): developing economies in Africa, eastern and southern Asia, the Middle East, the Pacific, and the Americas which have been classified by the World Bank (1996a) on the basis of gross national product (GNP) per capita as low-income and middle-income economies (\$725 or less GNP per capita and \$726 to \$8,955 GNP per capita, respectively).

Diabetes Mellitus: “a complex disorder of carbohydrate, fat, and protein metabolism that is primarily a result of a relative or complete lack of insulin secretion by the beta cells of the pancreas or of defects of the insulin receptors; the disease is often familial but may be acquired, such as in Cushing’s syndrome, as a result of the administration of excessive glucocorticoid” (Anderson et al., 1994, p. 469).

Diarrheal Diseases: diseases characterized by “the frequent passage of loose, watery stools; the stool may contain mucus, pus, blood, or excessive amounts of fat; diarrhea is usually a symptom of some underlying disorder” (Anderson et al., 1994, p. 476).

Encephalitis: “an inflammatory condition of the brain; the cause is usually an arbovirus infection transmitted by the bite of an infected mosquito, but it may be the result of lead or other poisoning or of hemorrhage” (Anderson et al., 1994, p. 545).

Epilepsy: “a group of neurologic disorders characterized by recurrent episodes of convulsive seizures, sensory disturbances, abnormal behavior, loss of consciousness, or all of these; common to all types of epilepsy is an uncontrolled electric discharge from the nerve cells of the cerebral cortex; although most epilepsy is of unknown cause, it may sometimes be associated with cerebral trauma, intracranial infection, brain tumor, vascular disturbances, intoxication, or chemical imbalance” (Anderson et al., 1994, p. 562).

Fertility Rate: the “average number of children who would be born alive to a woman during her lifetime, if she were to bear children at each age in accordance with prevailing age-specific fertility rates” (World Bank, 1996a, p. 387).

Filariasis: “a disease caused by the presence of filariae or microfilariae in the tissues of the body; filarial worms are round, long and threadlike and are common in most tropic and subtropic regions of the world; they tend to infest the lymph glands and channels after entering the body as microscopic larvae through the bite of a mosquito or other insect; the infection is characterized by occlusion of the lymphatic vessels, with swelling and pain of the limb distal to the blockage; after many years, the limb may become greatly swollen and the skin coarse and tough” (Anderson et al., 1994, p. 618).

Glaucoma: “a disease of the eye characterized by increased intraocular pressure, excavation, and atrophy of the optic nerve; produces defects in the field of vision” (Hensyl et al., 1990, p. 651).

Gross National Product (GNP) Per Capita: indicates the average amount of economic resources available to each person in a given country (De Neufville, 1982) and is calculated by dividing the total market value of all goods and services, estimated at current market prices in US dollars, by a country’s total population (World Bank, 1993).

Guillian-Barre Syndrome: “an idiopathic, peripheral polyneuritis occurring between 1 and 3 weeks after a mild episode of fever associated with a viral infection or with immunization; symmetric pain and weakness affect the extremities, and paralysis may develop; the neuritis may spread, ascending to the trunk and involving the face, arms, and thoracic muscles” (Anderson et al., 1994, p. 697).

Hepatitis: “an inflammatory condition of the liver, characterized by jaundice, hepatomegaly, anorexia, abdominal and gastric discomfort, abnormal liver function, clay-colored stools, and tea-colored urine; the condition may be caused by bacterial or viral infection, parasitic infestation, alcohol, drugs, toxins, or transfusion of incompatible blood; it may be mild and brief or severe, fulminant, and life-threatening” (Anderson et al., 1994, p. 730).

Human Immunodeficiency Virus (HIV): “a type of retrovirus that causes AIDS; retroviruses produce the enzyme reverse transcriptase, which allows transcription of the viral genome onto the DNA of the host cell; it is transmitted through contact with an infected individual’s blood, semen, cervical secretions, cerebrospinal fluid, or synovial fluid; HIV infects T-helper cells of the immune system and results in infection with a long incubation period, averaging 10 years; with the immune system destroyed, AIDS develops as opportunistic infections such as Kaposi’s sarcoma, pneumocystis carinii pneumonia, candidiasis, and tuberculosis, that attack organ systems throughout the body” (Anderson et al., 1994, p. 752).

Immunization: “a process by which resistance to an infectious disease is induced or augmented” (Anderson et al., 1994, p. 793).

Immunization Rate: the “full vaccination coverage of children under one year of age for two of the target diseases of the Expanded Programmed [sic] of Immunization—measles and DPT (diphtheria, pertussis and tetanus)” (World Bank, 1996a, p. 387).

Infant Mortality Rate: the “number of deaths of infants under one year of age per 1,000 live births in a given year” (World Bank, 1996a, p. 387).

Influenza: “an acute infectious respiratory disease, caused by orthomyxoviruses, in which the inhaled virus attacks the respiratory epithelial cells of susceptible persons and produces a catarrhal inflammation; characterized by sudden onset, chills, fever of short duration (3 days), severe prostration, headache, muscle aches, and a cough which is usually dry until secondary infection occurs; the disease commonly occurs in epidemics, sometimes in pandemics, which develop quickly and spread rapidly” (Hensyl et al., 1990, p. 782).

Leprosy: “a chronic, communicable disease, caused by *Mycobacterium leprae*, that may take either of two forms, depending on the degree of immunity of the host; tuberculoid leprosy, seen in those with high resistance, presents as thickening of cutaneous nerves and anesthetic, saucer-shaped skin lesions; lepromatous leprosy, seen in those with little resistance, involves many systems of the body, with widespread plaques and nodules in the skin, iritis, keratitis, destruction of nasal cartilage and bone, testicular atrophy, peripheral edema, and involvement of the reticuloendothelial system; blindness may result; . . . contrary to traditional belief, leprosy is not very contagious, and prolonged, intimate contact is required for it to be spread between individuals; . . . the disease is found mostly in under-developed tropic and subtropic countries” (Anderson et al., 1994, p. 896-897).

Life Expectancy at Birth: the “number of years a newborn infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life” (World Bank, 1996a, p. 387).

Malaria: “a serious infectious illness caused by one or more of at least four species of the protozoan genus *Plasmodium*, characterized by chills, fever, anemia, an enlarged spleen, and a tendency to recur; the disease is transmitted from human to human by a bite from an infected *Anopheles* mosquito; malarial infection can also be spread by blood transfusion from an infected patient or by the use of an infected hypodermic needle; although the endemic disease is limited largely to tropical areas of South and Central America, Africa, and Asia, a number of new cases

are brought to the United States by refugees, military personnel, and travelers returning from malarial areas” (Anderson et al., 1994, p. 947).

Maternal Mortality Rate: the “number of female deaths that occur during childbirth per 100,000 live births” (World Bank, 1996a, p. 387).

Measles: “an acute, highly contagious, viral disease involving the respiratory tract and characterized by a spreading maculopapular cutaneous rash that occurs primarily in young children who have not been immunized; measles is caused by a paramyxovirus and is transmitted by direct contact with droplets spread from the nose, throat, and mouth of infected people, usually in the prodromal stage of the disease” (Anderson et al., 1994, p. 963).

Meningitis: “any infection or inflammation of the membranes covering the brain and spinal cord; it is usually purulent and involves the fluid in the subarachnoid space; the most common causes in adults are bacterial infection with *Streptococcus pneumoniae*, *Neisseria meningitidis*, or *Haemophilus influenzae*” (Anderson et al., 1994, p. 976).

Mental Disorders: “any disturbance of emotional equilibrium, as manifested in maladaptive behavior and impaired functioning, caused by genetic, physical, chemical, biologic, psychologic, or social and cultural factors” (Anderson et al., 1994, p. 979).

Micronutrient Deficiency: the inadequate nutritional intake of “an organic compound, such as a vitamin, or a chemical element, such as zinc or iodine, essential only in minute amounts for the normal physiologic processes of the body” (Anderson et al., 1994, p. 995).

Onchocerciasis: “a form of filariasis common in Central and South America and in Africa, characterized by subcutaneous nodules, pruritic rash, and eye lesions; it is transmitted by the bites of black flies that deposit *Onchocerca volvulus* microfilariae under the skin; the microfilariae migrate to the subcutaneous tissue and eyes, and fibrous nodules develop around the developing adult worms; hypersensitive reactions to the dying microfilariae include extreme pruritus, a cellulitis-like rash, lichenification, depigmentation, and, rarely, elephantiasis; involvement of the eye may include keratitis, iridocyclitis, and rarely, blindness from choroidoretinitis” (Anderson et al., 1994, p. 1104).

Population Growth Rate: the “annual average growth rate . . . calculated from mid-year total and urban populations” (World Bank, 1996a, p. 388).

Population per Hospital Bed: indicates the availability of hospital facilities in a given country and is calculated by dividing total population by the total number of available hospital beds; hospitals are defined as “establishments permanently staffed by at least one physician” (World Bank, 1996a, p. 389), and include public, private, general, and specialized hospitals as well as rehabilitation centers.

Population per Physician: indicates the availability of medical practitioners in a given country and is calculated by dividing total population by the “total number of registered practitioners in the country” (World Bank, 1996a, p. 389).

Renal Disease: diseases affecting the kidney (Anderson et al., 1994).

Respiratory Infections: infections affecting the organs and structures of the respiratory tract (Anderson et al., 1994).

Rheumatoid Arthritis: “a chronic, destructive, sometimes deforming, collagen disease that has an autoimmune component; rheumatoid arthritis is characterized by symmetric inflammation of the synovium and increased synovial exudate, leading to thickening of the synovium and swelling of the joint; rheumatoid arthritis usually first appears in early middle age, between 36 and 50 years of age, and most commonly in women” (Anderson et al., 1994, p. 1368).

Schistosomiasis: “a parasitic infection caused by a species of fluke of the genus *Schistosoma*, transmitted to humans, the definitive host, by contact with fresh water contaminated by human feces; a single fluke may live in one part of the body, depositing eggs frequently, for up to 20 years; the eggs are irritating to mucous membrane, causing it to thicken and become papillomatous; symptoms depend on the part of the body infected; *Schistosoma* may be found in the bladder, rectum, liver, lungs, spleen, intestines, and portal venous system; pain, obstruction, dysfunction of the affected organ, and anemia may result” (Anderson et al., 1994, p. 1399).

Science: “the systematic observation of natural events and conditions in order to discover facts about them and to formulate laws and principles based on these facts [including] the organized body of knowledge that is derived from such observations . . . that can be verified or tested by further investigation” (Morris, 1992, p. 1926).

Sexually Transmitted Disease (STD): “a contagious disease usually acquired by sexual intercourse or genital contact; these diseases are the most common communicable diseases, and the incidence has risen over the past 2 decades despite improved methods of diagnosis and treatment; historically, the five venereal diseases were gonorrhea, syphilis, chancroid, granuloma inguinale, and lymphogranuloma venereum; to these have been added scabies, herpes genitalis and anorectal herpes and warts, pediculosis, trichomoniasis, genital candidiasis, molluscum contagiosum, nonspecific urethritis, chlamydial infections, cytomegalovirus, and AIDS” (Anderson et al., 1994, p. 1427).

Smallpox: “a highly contagious viral disease characterized by fever, prostration, and a vesicular, pustular rash; it is caused by one of two species of poxvirus, variola minor (alastrim) or variola major; because human beings are the only reservoir for the virus, worldwide vaccination with vaccinia, a related poxvirus, has been effective in eradicating smallpox; for several years no natural case of the disease has been known to occur” (Anderson et al., 1994, p. 1448).

Strongyloides: “a genus of small nematode parasites (superfamily Rhabditoidea), commonly found in the small intestine of mammals (particularly ruminants), that are characterized by an unusual life cycle that involves one or several generations of free-living adult worms” (Hensyl et al., 1990, p. 1489).

Technology: “the employment of tools, machines, materials, and processes to do work, produce goods, perform services, or carry out other useful activities [including] the application of scientific knowledge for practical purposes” (Morris, 1992, p. 2176).

Trachoma: “a chronic infectious disease of the eye caused by the bacterium *Chlamydia trachomatis*, characterized initially by inflammation, pain, photophobia, and lacrimation; if untreated, follicles form on the upper eyelids and grow larger until the granulations invade the cornea, eventually causing blindness” (Anderson et al., 1994, p. 1572).

Tuberculosis: “a chronic granulomatous infection caused by an acid-fast bacillus, *Mycobacterium tuberculosis*, generally transmitted by the inhalation or ingestion of infected droplets and usually affecting the lungs, although infection of multiple organ systems occurs” (Anderson et al., 1994, p. 1599).

Visceral Leishmaniasis: also know as kala-azar; “a disease caused by the protozoan *Leishmania donovani*, transmitted to humans, particularly to children, by the bite of the sand fly; kala-azar occurs primarily in Asia, parts of Africa, several South and Central American countries, and in the Mediterranean region; the liver and spleen are the main sites of infection; signs and symptoms include anemia, hepatomegaly, splenomegaly, irregular fever, and emaciation; patients with kala-azar are also susceptible to secondary bacterial infections; untreated, the disease has an extremely high mortality” (Anderson et al., 1994, p. 863).

Xerophthalmia (46): “a condition of dry and lusterless corneas and conjunctival areas, usually the result of vitamin A deficiency and associated with night blindness” (Anderson et al., 1994, p. 1676).

Whipworm (36): “infestation with the roundworm *Trichuris trichiura*; the condition is usually asymptomatic, but heavy infestation may cause nausea, abdominal pain, diarrhea, and, occasionally, anemia and rectal prolapse; it is common in tropical areas with poor sanitation” (Anderson et al., 1994, p. 1588).

CHAPTER TWO

Review of Literature

The world has witnessed remarkable progress in health status during the last half century, thanks to advances in science, technology, and medicine, and to improvements in income, nutrition, sanitation, literacy, and infrastructure (World Health Organization [WHO], 1998e). Dramatic gains in life expectancy and child mortality, for example, were achieved during this period. Global statistics indicate that between 1955 and 1998, life expectancy increased by 42%, from 48 years to 68 years, while infant mortality rates decreased by 60%, from 148 deaths to 59 deaths for every 1,000 live births (WHO, 1998b).

Moreover, immunization led to substantial reductions in the incidence of infectious disease. The occurrence of measles and polio, for instance, has been drastically reduced over the past 40 years through the use of vaccines (World Bank, 1993). Similarly smallpox, which formerly caused more than 5 million deaths annually in the early 1950s, was officially declared globally eradicated in 1979 (Wickett, 1986; World Bank, 1997).

Despite these remarkable improvements, however, there is still considerable disparity in health conditions among world regions. Life expectancy and mortality risks, for example, vary quite substantially between regions. The average life expectancy in high income countries is 75 years or more, while in developing countries it averages 63 years, and in Sub-Saharan African countries, it averages only 52 years (Stout, Evans, Nassim, & Raney, 1997). Furthermore, it has been reported that 50 million people currently live in countries where the average life expectancy is less than 45 years (WHO, 1998b).

Mortality risks also remain unacceptably high in developing regions, due in large part to the continuing burden of communicable disease, maternal and perinatal conditions, and malnutrition (Stout et al., 1997). In 1990, these health disorders together accounted for 16.5 million deaths in the Third World, or 42% of all deaths found there, as compared to only 0.8 million deaths, or 6%, in the First World (Murray & Lopez, 1996). Of the 16.5 million Third World deaths, more than 3.5 million were due to pneumonia, 2.9 million were caused by diarrheal diseases, 2.4 million resulted from perinatal conditions, and 2 million, from tuberculosis.

Unfortunately, these health disorders take a disproportionately high toll on children in the Third World, in fact so much so that a female baby born in Sub-Saharan Africa faces a 22% chance of dying before she reaches the age of 15, while a similar baby born in the First World encounters only a 1% risk of such death (Murray & Lopez, 1996). Global health projections regrettably predict that these health conditions will continue to affect future Third World generations, as the WHO (1998b) reported that by 2025, infectious diseases like pneumonia and diarrhea, combined with malnutrition, would continue to cause approximately 5 million deaths in children under the age of five, 97% of which will occur in developing nations (WHO, 1998b).

Current health statistics reveal similar burdens of premature mortality in the developing world. For instance, in 1997, there were 21 million global deaths in individuals under the age of 50, including 10 million deaths among children less than five years of age and 7.4 million deaths among adults in the prime of their working lives, between the ages of 20 and 49 years (WHO,

1998b). The majority of these premature deaths occurred in the least developed nations of the world, where it is reported that three out of every four people die before they reach the age of 50.

Additionally, poor maternal health and inadequate labor and delivery care contribute to premature mortality and disability in Third World nations, as every year such pregnancy-related problems result in 7.5 million perinatal deaths, 585,000 maternal deaths, and 15 million cases of long-term disability among young women (World Bank, 1997). Again, the bulk of these deaths and disabilities occur in developing regions. The risk of dying from pregnancy or childbirth, in fact, can be used to illustrate the drastic difference in health conditions between world regions: the risk of death in such circumstances in Europe averages 1 in 1,400; the risk in Asia averages 1 in 65; and the risk in Africa averages 1 in 16 (WHO, 1998b).

Yet, Murray and Lopez (1996) and the WHO (1998b) declared that the vast majority of premature deaths are largely preventable through existing health interventions. The WHO (1998b) reported, for example, that at least 2 million of the 10 million deaths that occurred in children under the age of five in 1997 could have been prevented with currently available vaccines, while the remainder were largely avoidable with the help of other health measures. The World Bank (1997) further stated that:

More than half of the disease burden in Sub-Saharan Africa and South Asia can be addressed effectively through local adaptations of interventions such as immunization, integrated management of childhood illness, family planning, maternal and perinatal health care, food fortification, targeted nutrition programs, and school health. (p. 61)

So while much of the world today enjoys better health and longer life expectancies, developing countries continue to suffer with poor health and premature death, due primarily to the continued burden of communicable disease, childhood illness, malnutrition, and maternal and perinatal conditions (World Bank, 1997).

Although many believe that an equal chance for survival and the opportunity for optimal health is a fundamental human right (Colletta, Balachander, & Liang, 1996; WHO, 1998e), others believe that health is simply a tool that should be used to further economic growth and development through improved human capacity (Grosse & Harkavy, 1980). This latter position relies on the fact that because “the economic development of any nation depends on the effective and proper utilization of all resources, both human and material” (Thompson, Fogel, & Danner, 1977, p. 3), health and other human-resource-building techniques should be given first priority, since material resources cannot be effectively employed without able men and women.

Yet even if viewed in purely financial terms, health investments can be justified by the significant benefit that they provide to economic growth and development through improved utilization of natural resources, reductions in medical care costs, and increased labor productivity (World Bank, 1993), as illustrated in this chapter.

Natural Resources

Improved health and disease control can stimulate economic growth by raising the productivity of underutilized natural resources. In many parts of the Third World, there is a severe shortage of productive land, as much of the area consists of mountains, arid deserts, and jungle rain forests (Stockwell & Laidlaw, 1981). And in those regions where arable lands and valuable natural resources exist, accessibility is often limited because of the presence of disease (Measham, 1986). In such areas, disease control programs may contribute significantly to the development of resettlement areas and to food and cash crop production (Measham, 1986; WHO, 1998f).

One example of a tropical disease that significantly inhibits land use is onchocerciasis, or river blindness. Onchocerciasis is a painful disease that is transmitted by the bite of an infected blackfly which, left untreated, eventually leads to blindness (World Bank, 1993). Prevalent in 34 countries in Africa, Latin America, and the Arabian Peninsula, nearly 18 million people have been infected with onchocerciasis and another 120 million are seriously at risk (WHO, 1997f). Between 270,000 and 326,000 people have already been blinded by the disease, 99% of them in Africa (WHO, 1997c; WHO, 1997f). In many villages affected by the disease, in fact, the United Nations Development Programme (UNDP, 1990) reported that up to $\frac{1}{3}$ to $\frac{1}{2}$ of the adult population have already lost their eyesight.

Onchocerciasis is caused by a parasitic worm that can inhabit the human body for up to 14 years (WHO, 1997c). During this time, each adult female worm produces millions of microscopic larvae that travel throughout the body causing various disorders, including severe skin infections, chronic itching, debilitation, serious visual impairment, and blindness (WHO, 1997c; WHO, 1998f). In addition to these afflictions, onchocerciasis may also be largely responsible for a high percentage of the cases of epilepsy and growth retardation found in affected areas (WHO, 1998f).

Because the blackfly that transmits the disease inhabits fertile river valleys, many of these productive areas have remained uninhabited and, therefore, economically underdeveloped (WHO, 1995; WHO, 1998f). As a result, the Food and Agriculture Organization, the UNDP, the World Bank, and the WHO jointly developed the Onchocerciasis Control Programme in eleven West African countries (World Bank, 1993).

Since the program's inception in 1974, approximately 30 million people have been protected from river blindness at a cost of less than \$1 per person per year, including 9 million children born during the program, and another 1.5 million people have recovered from serious infection (World Bank, 1993; WHO, 1998f). In addition, the program has advanced agricultural production through the settlement and cultivation of approximately 25 million hectares of previously blighted land (World Bank, 1993). Using traditional farming practices and indigenous technology, this additional land should yield enough produce to feed an estimated 17 million people (WHO, 1998f). Because of the significant achievements in both health and land use, the WHO (1995) declared the Onchocerciasis Control Programme to be "among the largest and most successful human disease control programs anywhere in the world, and together with the eradication of smallpox is one of WHO's proudest achievements" (para. 8).

Similarly, malaria control has opened up vast amounts of land for resettlement purposes and cash crop production in countries like Mexico, Nepal, and Sri Lanka (Mesham, 1986). Although malaria is curable with prompt and adequate treatment, the WHO (1996b) considers it to be "the world's most important tropical parasitic disease . . . [that] kills more people than any other communicable disease except tuberculosis" (para. 1). Malaria is endemic in more than 90 countries and poses a health risk to 40% of the world's population, particularly to peoples in Sub-Saharan Africa where 90% of all cases occur. Every year between 300 to 500 million people are infected with the disease and 1.5 to 2.7 million people die from it (WHO, 1996b; WHO, 1998b).

In the case of Sri Lanka, however, disease control between 1947 and 1977 bolstered economic growth through the cultivation of previously mosquito-infested land (World Bank, 1993). The near eradication of malaria during this period allowed migrants to move into unsettled lands and increase their agricultural output, resulting in an estimated 9% rise in national income in 1977 and a cumulative gain of \$7.6 billion over the 31-year program period. Thus, Sri Lanka's malaria disease control program, which cost a total of \$52 million, yielded an impressive 146% return on investment.

The literature indicated, therefore, that by opening up vast amounts of previously blighted land for food and cash crop production, disease control could stimulate national growth and productivity.

Medical Care Costs

Improvements in health and disease prevention have positive effects on economic development through the reduction of medical care costs. By decreasing the incidence of disease and thereby avoiding associated health expenses, financial assets of nations and individuals can be invested in more profitable measures.

Global Savings

One estimate of the immense saving that can be achieved through the elimination of a global disease was reported by Wickett (1986). Examining the case of smallpox eradication, Wickett analyzed the costs associated with the WHO's Intensified Smallpox Eradication Programme, between 1966 and 1979, and the United States' smallpox program in 1968.

During the 13-year period between 1966 and 1979, the latter date signifying the year that the Global Commission officially certified that smallpox had been globally eradicated, the cost of the Intensified Smallpox Eradication Programme was estimated by the WHO to be approximately \$200 million (Wickett, 1986). This amount, which represented the direct global cost of eliminating the disease, was borne equally between international and national donors.

In 1968, the United States (US) examined the passive costs associated with smallpox protection by estimating expenses incurred for (1) vaccine administration and treatment of vaccination complications, (2) lost wages due to time off for vaccination and related complications, and (3) international surveillance, traffic clearance, and time lost waiting for traffic clearance (Wickett, 1986). The study concluded that, in 1968, the US spent \$150 million, or 75¢ per person, on smallpox protection. Using the US' per capita cost estimate as a basis, Wickett extrapolated global smallpox protection costs by prorating the amount according to relative Gross National Products (GNP) per capita. He concluded that, in conservative terms, the elimination of the smallpox disease had saved the world \$1 billion in disease prevention expenses each year.

When Wickett (1986) compared this \$1 billion savings to the total cost of the Smallpox Eradication Programme of \$200 million, he determined that the nations of the world had received a 500% return on their investment. While Wickett admitted that his estimates were, at best, generalized approximations, he believed that his dollar amounts provided an indication of the magnitude of potential savings for global disease prevention.

National Savings

The AIDS epidemic is another global disease that seriously threatens the economic growth of many developing nations. AIDS, or acquired immune deficiency syndrome, is a fatal disease caused by the human immunodeficiency virus (HIV), which is transmitted through sexual intercourse, through contact with contaminated blood, or passed from mother to child during the perinatal period or by breast feeding (World Bank, 1991; World Bank, 1993). Generally appearing eight to ten years after HIV infection, AIDS depresses the immune system and increases an individual's susceptibility to other infections, like pneumonia, diarrhea, and tuberculosis (World Bank, 1993).

Statistics reveal that between 1985 and 1997, the global number of persons infected with HIV/AIDS rose from 2.5 million to 30.6 million, with the share of developing country cases

increasing from 50% to 90% (World Bank, 1991; WHO, 1998c). The WHO (1998c) estimated that in 1997 alone, there were 5.8 million people newly infected with HIV (90% adults, 10% children aged 15 years or less) and nearly 2.3 million AIDS deaths (80% adults, 20% children). In several Sub-Saharan countries, in fact, HIV infects more than 10% of the adult population, while in other large African towns, like Kampala, Lusaka, Blantyre, Kigali, and Harare, the rate of adult infection surpasses 25% (Buve, 1997). Since the beginning of the epidemic, it has been estimated that a total of 11.7 million people have died from AIDS and another 8.2 million children have become AIDS orphans (WHO, 1998c).

AIDS' potential to dramatically effect the savings and productivity of lesser developed nations is principally due to the fact that it affects adults in the prime of their productive lives and its resultant infections, including pneumonia and tuberculosis, place a heavy burden on expensive health care (World Bank, 1993). In the worst-affected areas, like Africa, where economies are already burdened and health care is largely inadequate, the epidemic has been described by the World Bank (1991) as "a human and economic disaster of staggering dimensions . . . [that is] likely to have a detectable, and possibly substantial, effect on per capita income growth and welfare for years to come" (p. 63).

Estimating the impact of the AIDS epidemic on ten severely affected Sub-Saharan nations, the World Bank (1993) concluded that per capita income growth, on average, would slow by 0.6 of a percentage point in each of the African countries annually. In Tanzania, an area already experiencing annual per capita income declines of 0.2 of a percentage point during the study period, World Bank simulations indicated further declines ranging from 0.1 to 0.8 of a percentage point per year. In Malawi, a nation showing an annual growth rate of 0.9 of a percentage point, the World Bank estimated that AIDS would reduce such per capita income growth by 0.3 to 0.5 of a percentage point annually.

Studies in Kinshasa, Thailand, and Tanzania (World Bank, 1993), on the other hand, revealed the high proportion of AIDS infection among skilled laborers and the associated costs of replacing such workers. Statistics from one large Kinshasa hospital indicated that over 1% of the health care personnel, including highly trained staff, contracted AIDS through sexual contact every year. A survey of mostly male employees at a Kinshasa textile mill disclosed a higher rate of HIV infection among the most skilled workers, with managers showing the highest rate, foreman the next highest, and workers the lowest. Consequently, the national costs of replacing such skilled labor in the future will be prohibitive. It was estimated, for example, that the cost of replacing all long-haul truckers lost to AIDS in Thailand through the year 2000 would total \$8 million, while the cost of replacing teachers lost to AIDS in Tanzania through 2010 would approach \$40 million (World Bank, 1993). Thus as the AIDS epidemic intensifies, the health of the economy may be threatened by the reduction of skilled labor in key economic sectors, including food and agricultural production, finance, defense, mining, and transportation (UNDP, 1990).

The increased risk of contracting other types of illnesses, and the associated medical costs for treating such illnesses, illustrates yet another economic burden that the AIDS epidemic imposes on developing nations. In a Tanzanian study where clinicians attempted to quantify the number of times an HIV-infected person experienced HIV-related illness prior to death, findings revealed that adults experienced an average of 17 episodes of illness and children experienced 6.5 episodes (World Bank, 1993). Other World Bank (1991) studies have indicated that, depending on the type of treatment provided, the direct costs for treating HIV-related illnesses can be exorbitant. In Zaire, for example, treatment-cost estimates ranged from 78% to 932% of per capita GNP, while in Tanzania, estimates ranged from 36% to 218% of per capita GNP.

In addition to treatment costs, the rise in HIV hospital admissions in several African countries has caused alarm. There are concerns that “[HIV] patients with a very limited life expectancy may be competing for scarce resources for care with non-HIV-infected patients who are likely to benefit more from a hospital stay” (Buve, 1997, p. 138). Reviewing studies conducted in large medical wards in Sub-Saharan Africa, Buve reported that the prevalence of HIV/AIDS infection among hospital admissions ranged from a low of 24% in Bissau to a high of 75% in Kinshasa and 76% in Kigali. The World Bank (1991), likewise, reported that over 50% of hospital admissions in some central African cities were AIDS-related. In two district hospitals in Zambia, Buve found that HIV-infected patients occupied 44% to 47% of all available hospital beds.

Because HIV-related illnesses often require longer hospital visits and more expensive drugs, an influx of HIV patients may deny other patients the essential medical care they need for more treatable ailments (Buve, 1997; World Bank, 1991). Thus, slowing the spread of AIDS could mean substantial savings in medical care costs for lesser developed nations. As the World Bank (1993) reported:

Research in nine developing and seven high-income countries suggests that preventing a case of AIDS saves, on average, about twice GNP per capita in discounted lifetime costs of medical care; in some urban areas the saving may be as much as five times GNP per capita. Calculations for India show that, given prevailing transmission patterns, each currently HIV-positive person infects one previously uninfected person every four years. At this rate, there will be six HIV-positive persons in 2000 for every one today. If the transmission rate could be slowed to one every five years, that number could be reduced to only four infected persons in 2000 for every one today. The corresponding reduction in medical costs, after discounting at 3 percent a year, amounts to \$750 by 2000 for each currently HIV-positive person in India, for a total savings of \$750 million. Similar calculations for Thailand suggest savings of \$1,250 per currently HIV-positive person, for a potential total of \$560 million. (p. 20)

Household Savings

The cost of disease, however, not only affects national and global economies, it also impacts individual and household resources. In developing countries where household budgets are largely inadequate, disease can impose considerable economic hardship on the family (Evans & Jamison, 1994). The death of an adult to AIDS, for example, can force vulnerable households into poverty, as two Tanzanian studies (World Bank, 1993) revealed. In the first study, researchers found that rural Tanzanian households affected by AIDS in 1991 spent approximately \$60, an amount equivalent to the annual regional per capita income, on medical treatment and funeral expenses for AIDS victims; a substantial amount for a country where the government subsidizes a large portion of the cost of health care. In a second study, Tanzanian clinicians estimated that, depending on the type and amount of medical treatment received for HIV-related illnesses prior to death, the total cost per adult AIDS death in a typical developing country could range from 8% to 400% of annual per capita income, averaging at 150%.

Research into the costs of malaria provide similar findings with regard to the economic burden placed on household resources, especially very poor households. Endemic in more than 90 countries, malaria is one of the leading causes of infectious-disease death and poses a health risk to 40% of the world’s population, particularly to peoples in Sub-Saharan Africa where 90% of all cases occur (WHO, 1996b; WHO, 1998b). Every year between 300 to 500 million people are infected with the disease and 1.5 to 2.7 million people die from it.

In 1992, Ettlting, McFarland, Schultz, and Chitsulo (1994) surveyed Malawian households to determine the total costs associated with malaria prevention, treatment, and hospitalization. Surveying 1,531 households revealed that the majority of survey participants earned very moderate incomes, with nearly three-quarters of the households reporting annual incomes of less than \$333. For comparative purposes, the researchers categorized all Malawian households into one of two income groups: (1) 52% of the survey sample was classified as very low-income households earning less than \$167 per year, with an average annual income of \$68, and (2) 48% of the sample was classified as low-to-high-income households earning \$168 or more per year, with an average annual income of \$953.

Examining the costs incurred for malaria prevention (including mosquito coils, insecticidal room sprays, and bed nets), Ettlting et al. (1994) found that household spending on such measures was largely dependent upon household income level. For example, only 4% of very low-income households reported purchasing preventive measures compared to 16% of the low-to-high-income households. The annual expense of such prevention also varied between the two income groups, with very low-income households spending 59¢ per year, or 0.9% of their annual revenue, and low-to-high-income households spending \$4.70, or 0.5% of annual income. The researchers concluded that the low proportion of households using malaria prevention was due to the fact that the cost of such measures was largely prohibitive for the majority of households surveyed.

Examining the costs associated with malaria treatment, however, revealed that household spending did not vary by income level. Treatment costs included out-of-pocket expenses for traditional healers, health centers, hospital admissions, and drugs from non-governmental health centers. Over 40% of all households reported malaria treatment costs, with both income groups incurring similar annual expenses: very low-income households spent \$19.13 per year while low-to-high-income households spent \$19.94 per year. The cost for malaria treatment, therefore, was found to be disproportionately high for the very low-income households, which spent 28% of their annual revenue on malaria treatment versus the 2% spent by the other households (Ettlting et al., 1994).

In addition to malaria prevention and treatment costs, the researchers also examined the indirect expense associated with lost household income due to malaria. Survey findings revealed that very low-income households lost an average of \$2.13 per year to malaria, or 3.1% of their annual earnings, while low-to-high-income households lost approximately \$20.61, or 2.2% of annual income (Ettlting et al., 1994).

Combining the costs of medical treatment and lost household income indicated that the total cost of malaria averaged \$21.85 per year for very low-income households and \$45.25 for low-to-high-income households. Thus, the study revealed that while all Malawian households incurred significant costs for malaria on an annual basis, the economic burden placed on very low-income households was considerable—averaging 32% of annual revenue for very low-income households as compared to 4.7% for other households (Ettlting et al., 1994).

Summary

The literature revealed that health improvements and disease prevention facilitated economic growth and development through the reduction of medical care costs. By decreasing the incidence of disease and thereby avoiding associated health expenditures, financial assets of nations and individuals could be employed much more productively.

The literature indicated that health improvements reduced medical care costs on a global, national and individual level. On a global level, for example, the elimination of just one disease,

smallpox, was associated with the potential worldwide savings of \$1 billion in disease prevention costs per year since its eradication in 1979 (Wickett, 1986). On a national level, a 5% reduction in the transmission rate of AIDS was linked to a possible savings of \$560 million in Thailand and \$750 million in India over a 7-year period (World Bank, 1993). On an individual and household level, reductions in the incidence of malaria could potentially save households as much as 28% of annual income that was previously used for medical treatment (Ettling et al., 1994), while reductions in HIV-related illness could result in significant individual savings, ranging between 8% and 400% of annual per capita income (World Bank, 1993).

The literature, therefore, indicated that reductions in medical care costs through improvements in health and disease prevention could potentially provide tremendous savings to nations and to individuals in the developing world.

Labor Productivity

Improvements in health status promote economic development through labor productivity in several ways: by reducing the number of work days lost to illness, by lengthening worker lifespan and prolonging participation in the labor force, by contributing to worker education and training, by decreasing the amount and severity of disability, and by increasing efficiency and output through improved physical capacity (Ram & Schultz, 1979; Weisbrod, Andreano, Baldwin, Epstein, & Kelley, 1973; World Bank, 1991; World Bank, 1993; WHO, 1997a).

Although good health is generally taken for granted in the First World, at least in terms of labor productivity, in the Third World where there is a high incidence of mortality and morbidity, “health status is among the most important of human resource variables because, regardless of how well a labor force is educated or trained, unhealthy people just don’t feel like working” (Bullock, 1986, p. 256). While developed nations look almost exclusively to education and training for increased productivity, lesser developed nations must consider health status as an additional influence on the productive capacity of their labor force (Bullock, 1986; Johnston & Sasson, 1986; Stockwell & Laidlaw, 1981; World Bank, 1996b).

Time Costs

Health improvements maximize labor productivity by reducing the number of work days lost to illness and by lengthening worker life span. Because the provision of a regular supply of labor is integral to the productive capacity of any nation, health improvements that minimize the disruption caused by frequent worker absence stabilize the labor force and enhance labor performance (Measham, 1986). This increased stability is a benefit that can be enjoyed even by countries with surplus labor, which is reported to be a condition of some frequency in the Third World.

Work Days Lost to Illness. Losses in work time due to illness diminish labor productivity as well as labor supply and cause financial difficulties on both a national and an individual level. As Stockwell and Laidlaw (1981) explained:

Although the evidence is sketchy, it may well be that poor health, by contributing to such things as general physical weakness and higher rates of absenteeism from work, is an important factor underlying the low productivity of the labor force in many underdeveloped areas. (p. 68)

Studies that examine the household costs of time lost to illness demonstrate the potential economic benefit that may be gained through improvements in health. Mills (1993), for example, examined malaria’s effect on the peoples of Nepal to determine, among other things,

the populations most affected by the disease and the average number of working days lost per illness episode. Although malaria is a curable disease with prompt and adequate treatment, it is endemic in more than 90 countries and poses a health risk to 40% of the world's population (WHO, 1996b; WHO, 1998b). As one of the leading causes of global infectious-disease deaths, malaria infects 300 to 500 million people every year and kills 1.5 to 2.7 million people annually.

Mills (1993) used malaria-control-agency workers on their normal monthly rounds to survey households in six Nepali districts over a 12-month period. Once a malaria case was diagnosed and treated, household members were interviewed on the length of time that was lost from work for each specific illness episode. In order to evaluate the disease's impact on all household members (young and old, male and female), work was broadly defined to include paid and unpaid labor performed both inside and outside the home.

Mills' (1993) survey findings indicated that the population most affected by malaria was the adult group over the age of 15. Mean ages for malaria cases ranged from 21.2 years to 29.1 years in the study districts, averaging at 24.9 years. The average number of work days lost to malaria was found to vary considerably among the six districts, ranging from a high of 14.5 days to a low of 6.1 days per illness episode. This average, however, varied little with regard to sex or age, with the only fluctuation being found for those aged 65 and over who experienced a rise in the length of disability period. Although Mills didn't quantify lost work time in monetary terms, she did conclude that the larger-than-expected disability period suggested the possibility of substantial losses in income for wage laborers.

Because her study data was based on patient recall, Mills (1993) cautioned others to interpret her findings as "approximate orders of magnitude rather than precise estimates" (p. 12). Yet she noted that "on the whole, mean days not worked varied in the expected directions in analyses and behaved consistently across the districts" (p. 13). Comparing her results to ten other Southeast Asian malaria studies completed between 1935 and 1988 (including studies in India, Thailand, Indonesia, Pakistan, and Sri Lanka), Mills found corroboration in nine of the ten studies. Collectively, these research findings indicated a 5- to 10-day disability period per malaria episode.

Another study of malaria's impact on working time was conducted in Malawi by Ettling, McFarland, Schultz, and Chitsulo (1994). This study examined the cost of lost productivity by surveying 1,531 households on the annual number of complete and partial working days lost to malaria as a result of being ill, oneself, or as a result of caring for an ill family member.

Survey findings revealed that the majority of survey participants earned very moderate incomes, with nearly three-quarters of the households reporting annual incomes of less than \$333 (Ettling et al., 1994). For comparative purposes, the researchers categorized all Malawian households into one of two income groups: (1) 52% of the survey sample was classified as very low-income households earning less than \$167 per year, with an average annual income of \$68, and (2) 48% of the sample was classified as low-to-high-income households earning \$168 or more per year, with an average annual income of \$953.

Ettling et al. (1994) found little variation between the two income groups with respect to lost work days, with very low-income households averaging a loss of 28 days per year and low-to-high-households averaging 22 days. When viewed in terms of income, however, the increased value of the daily wage for higher income groups resulted in considerable variance. For example, the 28 work days lost to malaria by very low-income households, valued at 7¹/₂¢ per day, represented a loss of \$2.13 per year, while the 22 days lost by low-to-high-income households, valued at 94¢ per day, represented \$20.61. Yet in terms of annual household revenue, the two income groups incurred similar losses, with the very low-income households'

\$2.13 loss representing 3.1% of their annual earnings and the low-to-high-income households' \$20.61 loss representing 2.2% of annual income. Thus, the survey results indicated that the average Malawian household lost 25 work days and 2.6% of their household income to malaria each year.

Another study by Sauerborn et al. (1995) assessed the costs of working time lost to all types of illnesses in Burkina Faso. Surveying 566 households in 25 rural villages, Sauerborn et al. examined (1) the types and frequencies of illness experienced in the preceding month, (2) the number of complete working days lost to illness during the month, both by the sick person and by the caretaker who attended the sick, and (3) the monthly costs incurred for associated health care treatment.

Survey findings indicated that the majority of respondents were subsistence farmers with an average household size of 8.5 family members (Sauerborn et al., 1995). Common chronic and acute illnesses reported in the survey included malaria, diarrhea, respiratory infections, schistosomiasis, goiter, hernias, and night blindness. The frequency of illness per household averaged 1.9 illness episodes per month, with a corresponding loss in working time of 11.78 days per illness episode. The 11.78 work days represented an average of 2.6% of monthly household income and consisted of 6.65 days lost to illness and 5.13 days lost to caregiving. Thus the data indicated that the caretaker lost nearly as much working time as did the person who was actually sick.

The costs of health care treatment were also examined by Sauerborn et al. (1995). While the majority of treatment costs (62%) were spent on drugs or traditional products, other costs included transportation, food, and lodging expenses used in the process of seeking care (21%) and service fees (17%). Total costs for health care treatment represented an average of 1.1% of monthly household income.

Comparing monthly time costs to monthly treatment costs revealed that the expense of lost work days, averaging 2.6% of household income, was more than double that of health care treatment costs, averaging 1.1% of household income (Sauerborn et al., 1995). Survey findings, therefore, indicated that for the study population in rural Burkina Faso, illness exacted a higher cost in terms of time lost from work than it did in terms of health care treatment.

The World Bank (1991) also analyzed the costs of working days lost to illness for wage laborers in eight developing countries: Bolivia, Cote d'Ivoire, Ghana, Indonesia, Jamaica, Mauritania, Peru, and the Philippines. Reviewing household survey data collected between 1985 and 1990, the results collectively indicated that workers lost an average of 12 working days to illness each year, ranging from a low of 6 days in Jamaica to a high of 19.2 days in Mauritania. Projecting these figures into annual income percentages revealed a potential loss of 2.1% to 6.5% of annual worker earnings, with an average annual loss of 4.2% among the eight countries.

The World Bank (1991) noted, however, that this loss in earnings represented only one component of the total household cost of illness. Other variables that had potential economic consequences included "the value of lost nonmarket work (such as child care and food preparation), forgone earnings of other household members, [and] costs of treatment" (p. 54). The World Bank concluded that the total economic impact of illness on household income in developing nations could be substantial.

It must be acknowledged, however, that households often possess the ability to recover some of the earnings lost to illness (Sauerborn et al., 1995; World Bank, 1993). In the developing world where unemployment and disability insurance is rare, healthier household members generally must work longer or work harder to make up for the loss in income of sick family members. The

World Bank (1993) reported, for example, that a study of 250 Sudanese households revealed that the extra work of other family members recovered 68% of the wages that had been lost to malaria. The World Bank further reported that research in Paraguay and Colombia produced similar findings. Therefore, the true economic impact of lost working time, at least in terms of household income, is largely dependent upon the household's ability to compensate for limits in available family labor and reductions in household earnings during times of illness (Sauerborn et al., 1995).

Worker Life Span. Longer life spans enhance labor productivity, as well as labor supply, by providing prolonged worker participation in the labor force and by contributing to the advancement of worker education and training. Over the last half century, the world has witnessed dramatic increases in life expectancy, primarily as a result of communicable disease control and maternal-and-perinatal-mortality reduction (Ram & Schultz, 1979; Stout et al., 1997). Globally, average life expectancy at birth has increased by 42% within the last four decades, from 48 years in 1955 to 68 years in 1998 (WHO, 1998b). Although more than 5 billion people currently live in countries where life expectancy exceeds 60 years, more than 50 million still live in countries where life expectancy is less than 45 years (WHO, 1998b).

In 1997, 21 million deaths occurred globally in individuals under the age of 50, including 10 million deaths among children less than five years of age and 7.4 million deaths among adults in the prime of their working lives, between the ages of 20 and 49 years (WHO, 1998b). The majority of these premature deaths occurred in the least developed nations of the world, where three out of every four people died before they reached the age of 50. While much of the world today enjoys longer life expectancies, developing countries continue to suffer with premature death and life spans comparable to those found in the 1950s.

Increases in worker life span are important to labor productivity because a longer life translates into more years of economic activity per worker (Ram & Schultz, 1979). The production benefit that may be gained through worker longevity can be considerable, as demonstrated by the following two empirical studies. In the first study, Hicks (1979) analyzed the relationship between GNP growth and basic needs attainment in 78 developing countries between 1960 and 1973. Directing his attention to the particular effect that health improvements had on growth and productivity, Hicks found that life expectancy possessed a powerful and significant influence on per capita income growth, similar, in fact, to that found for educational measures. Hick's regression analysis indicated, for instance, that a 10-year increase in life span would add an additional 0.7 to 0.9 of a percentage point to per capita income rates. Such increases would raise the average per capita income growth rate of 2.4 in the study countries to a rate of 3.1 to 3.3.

The second study by Ram and Schultz (1979) also used regression analysis to determine the impact that health improvements had on agricultural output and productivity in India between 1958 and 1965. Attempting to discover the factor most responsible for the residual output that remained unexplained by the conventional inputs of land, labor, capital, and education, the researchers concentrated their investigation on mortality reduction.

Examining data from various Indian states, Ram and Schultz (1979) found that mortality reduction explained approximately 28% of the variation in agricultural output and productivity that occurred between states during the 7-year study period. Stated in economic terms, these findings indicated that a 1% reduction in mortality rate would result in an added 0.3% increase in total agricultural productivity. The potential production benefit that stood to be gained through increased worker longevity was illustrated by the researchers: "If the mortality rate were to fall by 50% (say from 2.5% per year to about 1.25% per year) one might expect the agricultural productivity to increase by about 15%, which is obviously a very substantial increase" (p. 417).

Ram and Schultz (1979) concluded that health improvements, mortality reductions, and increased worker life spans had a positive effect on agricultural output and productivity in Indian states during the late 1950s and early 1960s. Moreover, they asserted that their empirical findings, although based on Indian data alone, were applicable to other low income countries in the developing world.

Worker Education. Increased life expectancy enhances labor productivity not only by providing prolonged participation in the work force, but also by contributing to the advancement of worker education and training (Ram & Schultz, 1979; World Bank, 1991). As life span increases, so do the incentives to acquire additional knowledge and skills because such instruction can be seen as an investment that will provide greater future earnings over an extended period of time. Ram and Schultz explained longevity's favorable effect on education and training:

Increases in life span and vigor and vitality, coupled with the implied increases in earnings, provide incentives to workers to invest more in their training and skills. By "training" and "skills" we do not necessarily mean sophisticated on-the-job training, we simply mean acquisition, out of a vast spectrum, of any sort of training and skill that makes a person a better worker. This aspect of additional human capital formation that results from a decline in mortality and the increases in life span may occur during and after the investment in schooling. (p. 413)

Yet the beneficial relationship between improved health and education is not solely linked to the effects of longevity. Reductions in illness and disease also promote education through improvements in learning capacity (Bullock, 1986; World Bank, 1991), and increases in learning capacity further reinforce labor productivity (Streeten, 1981).

The World Bank (1993) illustrated the negative effect that illness had on childhood learning in a Jamaican study that examined the disparity in test scores found between healthy children and those who suffered from moderate whipworm infection. Whipworm is a parasitic intestinal worm that infects approximately 300 million school-aged children around the world causing a variety of disorders, including malnutrition, diarrhea, anorexia, and general malaise (Rosso & Miller, 1996). Its ability to affect learning capacity results primarily through its malnutrition effect, as heavy infection leads to reductions in appetite and nutrient absorption, eventually resulting in diminished attention and concentration as well as learning potential.

Analysis of the Jamaican children in the World Bank (1993) study group revealed a 15% variance in test scores between healthy and infected children prior to medical treatment. After treatment, a retest was given and the previously infected children scored almost as high on the retest as did the uninfected children.

Another experimental study that assessed illness' effect on mental ability was performed by Kimura et al. (1992) in a primary school in rural Kenya. This study examined the attentiveness and concentration of 49 children, ranging in age from 9 to 19 years, who were lightly infected with *Schistosoma haematobium*.

Schistosoma haematobium is one of five parasitic schistosome worms, known collectively as schistosomiasis, that infect the blood and cause intestinal and urinary disease (WHO, 1996a). Although the primary disorder associated with *Schistosoma haematobium* is urinary disease, including urinary lesions and bladder cancer, people infected with schistosomiasis also suffer from general weakness, lethargy, and diminished mental ability.

Endemic in tropical freshwater areas, schistosomiasis infects more than 200 million people in 74 countries in Africa, Asia, South America and the Caribbean, and places another 600 million

people at risk (WHO, 1996a). Of the 200 million people currently infected, approximately 20 million suffer with severe debility. In highly endemic areas, schistosomiasis may infect a considerable number of children under the age of 15, with estimates approaching three out of every four children (Rosso & Miller, 1996). In terms of socioeconomic and public health impact, schistosomiasis is ranked by the WHO (1996a) as second only to malaria in tropical and subtropical regions.

To assess schistosomiasis' effect on mental ability, Kimura et al. (1992) administered three tests, both before and after medical treatment, that evaluated student attentiveness and concentration. Test performance revealed that (1) test scores worsened as the schistosomiasis infection intensified and (2) medical treatment improved the scores of all three tests for those children who had received high marks on their first test. Study findings, therefore, suggested that even light schistosomiasis infections adversely affected mental activities involving attentiveness and concentration. Other research cited by Rosso and Miller (1996) and World Bank (1991; 1993; 1997) indicate similar impairment in learning ability due to illness.

Additionally, research findings reveal strong links between education and economic growth and productivity. World Bank (1991) research indicated, for example, that a one-year increase in average worker education raised gross domestic product (GDP) by 9% per year for the first three years. Such improvement could result in a total increase of 27% in GDP for three years of worker education. After the initial three years, the return on acquiring additional education fell to an annual increase of 4% in GDP for the next three years, resulting in a potential gain of 12% for three additional years of education.

Schultz (1993) also reported a substantial private and social return on primary and secondary education, ranging from 5% to 40% per year. Citing one study that surveyed empirical data from Africa, Asia, and Latin America, Schultz recounted social returns on educational investments that averaged 27% per year for primary education, 16% for secondary education, and 13% for higher education.

A study by the World Bank (1981), on the other hand, demonstrated the significance of both health and educational investments on national growth. Cross-country comparisons in 1960 indicated that countries which possessed both high life expectancies and high literacy rates grew more rapidly during the next two decades than their counterparts.

Health and education are each vitally important to labor productivity, because without healthy, adequately-nourished and adequately-educated people, countries cannot expect to achieve sustainable economic growth (World Bank, 1997). Good health contributes to intellectual capacity, while education leads to enhancements in information access, reasoning ability, skills and experience, and adaptability to new processes and technologies (Streeten, 1981; UNDP, 1990; World Bank, 1991). Along with land, capital, and technology, health and education are required inputs for production, in fact so much so that Streeten (1981) contended that investments in health and education often contributed more to labor productivity than did other types of investments. Educated workers are more valuable to society because they generally contribute more, both economically and socially (UNDP, 1990).

In a dynamic and technologically-changing world, all nations, including lesser developed nations, require educated, skilled, and adaptable workers (World Bank, 1991). Evang (1973) summed up the importance of health and education to modern-day society:

. . . The vast "man-consuming" sectors of society, industry and war-machines, can no longer use man as he is produced by nature. Unskilled labour belongs to history. To make a man or woman useful in the complicated modern industrial plant, to train a

person to operate sophisticated war equipment, society has to invest large sums in his education and training. As a matter of fact, the more complicated and costly the machine, the higher the degree of selection and the greater the educational investment. For certain very complicated tasks in destruction as well as in production, only the finest specimens of *homo sapiens* are eligible. Mental maturity and balance is priceless; mental health is scarcely to be expected in the absence of reasonable physical health, and of course vice versa. (p. 5)

Summary. The literature indicated that health improvements beneficially impacted labor productivity, as well as labor supply, through reductions in the number of work days lost to illness, through lengthened worker life span, and through the furtherance of worker education. With respect to lost working days, research results varied in the length of time that was generally lost to illness, as duration appeared to be dependent upon the type of illness as well as the type of work that was assessed. Yet in every study that examined the economic costs of lost working time, researchers agreed that illness could have a substantially adverse effect on household income in the developing world.

With respect to life span, statistics confirmed that developing countries continued to suffer with premature death and limited life expectancy. The literature revealed, however, that lengthened life spans could contribute to labor productivity through prolonged participation in the work force and through increased worker education and training. Consequently, the literature demonstrated that along with land, capital, and technology, health and education were vital inputs for sustained economic growth and productivity.

Some scholars, nevertheless, have doubted that health improvements could increase productivity through augmented labor supply in the developing world, at least in the short-term, in view of the excess labor found there (Bullock, 1986; Ram & Schultz, 1979). These critics have contended that because of continued high population growth rates and high levels of unemployment and underemployment, labor productivity in lesser developed nations is not limited by labor supply. They have maintained that where “underemployment is chronic . . . and the marginal value of an additional hour of labor approaches zero, overall production will not necessarily rise as workers become more healthy” (Grosse & Harkavy, 1980, p. 166).

Yet other scholars have challenged the critics’ theory. Stevens (1977), for example, argued that researchers too readily assume that redundant labor supplies exist in all production sectors of the developing world. Instead, Stevens contended that there were certain sectors in which all available supplies of labor were being fully utilized, and he provided two examples to substantiate his claim.

The first example involved the agricultural sector where labor demands are largely dependent upon the season (Stevens, 1977). In this sector, a labor force can remain unemployed for long periods of time, only to be burdened during peak seasons, like the planting or the harvesting season. Illness and disease in this context can have only detrimental effects on labor productivity since there are no remaining reserves of available employee labor during such peak periods. Bullock (1986) and Grosse and Harkavy (1980) agreed with Stevens that improvements in worker health status in these circumstances would undoubtedly contribute to labor productivity.

The second example proffered by Stevens (1977) concerned the nonagricultural, or the industrial, sector. This sector often employs tasks requiring select skills that only a limited number of laborers may possess. In these circumstances, illness and disease again prove detrimental to labor productivity in that “illness contributes significantly to skill bottlenecks which result in decreased output in those activities where skilled manpower is a key complementary input with other manpower and physical capital” (p. 811).

Stevens' (1977) second premise is reinforced by the fact that there is a general lack of education and technical skill in many developing countries (Colletta, Balachander, & Liang, 1996; Grant, 1991; Stockwell & Laidlaw, 1984; World Bank, 1993). Stockwell and Laidlaw (1984), for instance, discussed the large differences in literacy and skill levels found between peoples in the developed and the developing world in the early 1970s. While literacy rates in developed nations averaged around 99% during this period, in the developing world literacy barely averaged 36%, and in the poorest developing nations, literacy only averaged 17%. Wide variances in technical experience were also found between regions in the early 1970s, with 47% of the working males in industrialized countries reporting that they had acquired some type of technical training or skill, while only 20% in developing nations and a mere 6% in the poorest of these nations reported the same.

Recent literacy and educational statistics continue to reveal high illiteracy rates and wide discrepancies among world regions. Grant (1991) reported that in 1990, one out of every four adults in the global population, or nearly one billion adults, were illiterate. Colletta, Balachander, and Liang (1996) disclosed that in that same year, 50% of the adult population over the age of 15 in Sub-Saharan Africa could not read or write a simple statement with comprehension. In terms of childhood education, the World Bank (1993) reported that less than 60% of first-grade students in low-income countries and less than 70% in lower-middle-income countries completed primary school. The World Bank additionally cited that primary school students in the developing world generally received less than 5,000 hours of educational instruction, primarily due to student and teacher illness.

Given the foregoing considerations, Stevens (1977) cautioned against the tendency to automatically "rule out increased aggregate output in the short run in consequence of labor augmenting improvements in health status, on the ground of high levels of underemployment, [because this tendency] may reflect unrealistic assumptions about health status, the labor force, and the labor market" (p. 811). Stevens suggested that even if redundant labor supplies did exist in particular production sectors, there was no assurance that there would be ample numbers of completely healthy workers that could be used to replace the unhealthy ones. He believed that the health status of the labor supply was not optimal and that improvements, therefore, would prove beneficial:

Generally speaking . . . it is more realistic to assume that there are various degrees of health impairment, some of which are (given the customs of the work place) consistent with continued job tenure. It is thus likely that the employed labor force at any time will contain numbers of only more-or-less healthy individuals. These individuals, the "working sick," may not only be producing less than they would if healthy, but may also be pulling down the productivity of other inputs, e.g. capital and the "working well."
(p. 811)

Due to the various factors which act to limit the availability of labor in lesser developed nations, like seasonal labor demands, enhanced skill requirements, and poor levels of general health, Stevens concluded (1977) that improvements in worker health status would effectively contribute to increased productivity despite redundancies in labor.

Disability Costs

Labor productivity is also affected by poor health through worker disability. By reducing the number of workers available in the labor supply pool and by minimizing worker efficiency and output, disabling diseases may place a considerable strain on developing economies.

Global health statistics indicate a higher prevalence of disability among peoples in the developing world. Comparisons made between world regions reveal that Third World inhabitants spend a greater portion of their lifetime living with disability than do their counterparts in the First World, often experiencing disability by as much as 1½ to 2 times longer (Murray & Lopez, 1996). Infants in Sub-Saharan Africa, for instance, can expect to suffer with disability for nearly 15% of their lifetime, as compared to 8% of the lifespan for babies born in the developed world (Murray & Lopez, 1996). Adults aged 60 in Sub-Saharan Africa can anticipate living almost ½ of their remaining years with a disability, while similarly-aged adults in Asia and Latin America will spend approximately ⅓ of their remaining life disabled. These statistics contrast rather sharply with those found in the developed world, where 60 year-olds can expect to be disabled for only ⅕ of their remaining years (Murray & Lopez, 1996).

Although accurate information regarding disability's direct impact on Third World production is somewhat limited, an example of the potential losses in labor supply and labor productivity can be demonstrated by reviewing diseases associated with one of the most serious disabilities experienced by humankind: the loss of one's eyesight.

Global Blindness. Global estimates of visual disability indicate that there are currently 38 million people who are blind and another 112 million people who suffer from serious visual impairments (WHO, 1997e). Of the total number of blind persons, 90% of them, or 34.2 million, live in the developing world (WHO, 1997a).

Every year, about 7 million people become blind, but with the help of medical treatment and technology, over 70% of these people are able to regain their eyesight (WHO, 1997e). The annual increase in global blindness, therefore, is estimated to be approximately 2 million people per year. Although it is reported that ⅔ of all blindness could be avoided through prevention or treatment (WHO, 1997a), experts predict that without intensified international effort, the global number of blind individuals will double by the year 2020. If such predictions are correct, in about 20 years there will be approximately 75 million blind persons worldwide, with the majority living in Third World nations (WHO, 1997e).

Despite the fact that “accurate data on the total economic and social costs of blindness and severe visual impairment are not available” (WHO, 1997d, para. 3), experts agree that blindness currently imposes considerable economic hardship on many economies (WHO, 1997d; WHO, 1997e). Moreover, professionals at the WHO (1997e) warn “that within the next quarter-century blindness and serious visual disability—already a public health problem—will become a major socioeconomic burden worldwide and may even thwart progress in some middle and low income countries” (para. 1). A 1989 study in India, for example, concluded that the aggregate costs of blindness to the Indian economy totaled \$4.6 million per year (WHO, 1997d). This amount, which included a nominal subsistence allowance, was reported to be a conservative estimate of the annual costs incurred for blindness.

Serious visual impairments and blindness are caused by a variety of diseases (WHO, 1997b); the leading causes in lesser developed nations, however, include cataracts, trachoma, glaucoma, xerophthalmia, onchocerciasis, and leprosy (WHO, 1997c; WHO, 1997e). A review of each disease provides a greater understanding of the prevalence of visual disability in the Third World and the economic benefit that may be gained through sight-saving interventions.

Cataracts. Cataracts are a primary cause of blindness, accounting for an estimated 16 million cases worldwide, almost 90% of which are found in rural areas of the developing world (WHO, 1997d). Half of all blindness in most African and Asian countries, in fact, can be attributed to cataracts (WHO, 1997b).

Cataracts develop largely as a result of the aging process, but other origins have also been identified, including infants born with cataracts and eye-injury victims later developing cataracts (WHO, 1997b). Cataracts form when the transparency of the eye lenses change from their normal crystalline state to an opaque condition. As the lens becomes progressively opaque, less and less light is able to penetrate the eye and a gradual loss of vision ensues. If left untreated, the affected person eventually becomes blind (WHO, 1997b).

Age-related cataract blindness, however, is ordinarily treatable. Through a relatively simple operation, the opaque lens is removed, eye glasses prescribed, and vision generally restored (WHO, 1997b). Higher technology options are also available for cataract surgery, including intraocular lens implantation, but these options are substantially more costly than the simple extraction procedures.

Although treatable, cataracts may still impose a significant burden on the economies of developing nations (WHO, 1997d). Currently, the majority of cataract cases are found in individuals over the age of 50 (WHO, 1997b), therefore as life expectancy increases in the developing world, there should be a corresponding rise in the number of persons developing cataracts and in the number of persons becoming blind as a result of cataracts. Demographic trends suggest, in fact, that by the year 2020, there will be approximately 1.2 billion people aged 60 years and older in the world; $\frac{3}{4}$ of them residing in the Third World (WHO, 1997e). During this time, experts predict that, globally, there will be an estimated 54 million blind adults in the 60-and-older age group, with 50 million of them living in developing nations. Thus the future burden of cataract-related blindness on developing economies will undoubtedly be significant.

Yet a study in South Asia showed that the economic benefit derived from cataract treatment can be substantial (WHO, 1997d). The study, which reviewed cataract victims who had regained their eyesight through surgery, found that 85% of the men and 58% of the women with restored eyesight returned to work following surgery. The study also estimated that the financial return on treatment expense was 1500% in the year following the surgery.

Trachoma. The second leading cause of visual disability is trachoma, a disease that is responsible for approximately 15% of all global blindness (WHO, 1997b). Currently, 6 million people have lost their sight as a result of trachoma and another 146 million people are infected with the disease and at risk of becoming blind if medical treatment is not provided.

Endemic in portions of Africa, Asia, the Eastern Mediterranean, and Central and South America, trachoma is principally found in poor rural locations (WHO, 1997b). It is an infectious disease that is caused by a microorganism that resembles both a virus and a bacteria. The infection is transmitted by coming into contact with the discharge of an infected eye, either personally by sharing towels, handkerchiefs, and the like, or by eye-seeking flies. Once infected, the person experiences inflammation in the conjunctiva of the eye. After repeated infections, the eyelid may become so severely scarred that it turns inwards, causing the eyelashes to rub on the eyeball. If this condition is left untreated, blindness will ultimately result (WHO, 1997b).

Glaucoma. The third largest cause of global blindness is glaucoma, currently accounting for approximately 5.2 million cases of blindness, with more than 80% of them located in Third World countries (WHO, 1997b). Estimates of the number of persons suspected of having glaucoma, however, range as high as 105 million people worldwide. Research indicates that persons of African and Asian heritage are more likely to develop and to lose their sight from glaucoma than are Caucasians.

Glaucoma commonly refers to a group of diseases that can cause serious visual impairment, including disorders that are associated with optic nerve atrophy, visual field loss, and increased

intraocular pressure (WHO, 1997b). Although glaucoma cannot be prevented, if detected at an early stage, visual impairment and blindness can generally be avoided through proper medical treatment.

Glaucoma, trachoma, and cataracts are the three leading causes of visual disability; together, they are responsible for more than 70% of all global blindness (WHO, 1997b). They are also prime contributors to Third World disability, specifically accounting for 80% of all blindness in Asian countries (excluding China and India), 75% in Sub-Saharan Africa, 74% in India, and 73% in China. Given the limits in health care and economic resources in developing nations (WHO, 1997d), the disability caused by these three diseases will undoubtedly place considerable strain on future Third World economies if current demographic trends continue.

Xerophthalmia. Xerophthalmia, or vitamin A deficiency, is a preventable disease that primarily affects poor children in the developing world (WHO, 1998h). Currently a health problem in 75 countries, vitamin A deficiency causes a range of health disorders including visual impairment, blindness, depression of the immune system, and even death.

To date, 14 million preschool children have already experienced some type of eye damage due to vitamin A deficiency, and annually, it leads to the partial or total loss of vision for at least 350,000 children, 60% of whom die within a few months of losing their eyesight (WHO, 1997c; WHO, 1998h). Vitamin A deficiency is associated, in fact, with over one million childhood deaths every year.

At any given time, there are approximately 230 million children at risk of vitamin A deficiency (WHO, 1998h). While the WHO reported no specific economic benefit associated with the prevention of xerophthalmia-related blindness, it did state that saving the eyesight of even a few children should provide substantial savings because “blindness occurring in infancy and childhood is a long-lasting drain, both in terms of social dependence and lost productivity” (WHO, 1997d, para. 20). Thus, blindness is an economic burden not only in terms of lost productivity and income, but also in terms of rehabilitative and continuing care costs (WHO, 1997a; WHO, 1997d).

Onchocerciasis. Onchocerciasis, or river blindness, is a painful disease that is transmitted by the bite of an infected blackfly which, left untreated, eventually leads to blindness (World Bank, 1993). Prevalent in 34 countries in Africa, Latin America, and the Arabian Peninsula, nearly 18 million people have been infected with onchocerciasis and another 120 million are seriously at risk (WHO, 1997f). Between 270,000 and 326,000 people have already been blinded by the disease, 99% of them in Africa (WHO, 1997c; WHO, 1997f). In many villages affected by the disease, in fact, the UNDP (1990) reported that up to $\frac{1}{3}$ to $\frac{1}{2}$ of the adult population have already lost their eyesight.

Onchocerciasis is caused by a parasitic worm that can inhabit the human body for up to 14 years (WHO, 1997c). During this time, each adult female worm produces millions of microscopic larvae that travel throughout the body causing various disorders, including severe skin infections, chronic itching, debilitation, serious visual impairment, and blindness (WHO, 1997c; WHO, 1998f).

By treating the disease with a medication that kills the microscopic larvae, substantial economic benefit has been evidenced in West Africa. Through the Onchocerciasis Control Programme, which was instituted in 1974 by the Food and Agriculture Organization, the UNDP, the World Bank, and the WHO, approximately 30 million people have been protected from river blindness, including 9 million children born during the program, and another 1.5 million people have recovered from serious infection (World Bank, 1993; WHO, 1998f). The projected return on

investment for the program, from its inception in 1974 to 2020, is expected to be between 16% and 28% (WHO, 1997d).

Leprosy. Leprosy is a chronic infectious disease primarily found in the poorer regions of the world (WHO, 1998g). To date, it has irreversibly disabled 1 to 2 million people globally, blinding approximately 50,000 to 100,000 of these individuals (WHO, 1997c).

Endemic in 60 countries in Southeast Asia, Africa, and Latin America (WHO, 1997c), there are currently more than 828,000 registered leprosy cases in the world (WHO, 1998g). During 1997, over 685,000 new leprosy cases were discovered, 83% of them originating in Southeast Asia. Currently 85% of all leprosy cases occur in nine developing countries: approximately 518,000 cases in India; 90,000 cases in Brazil; 29,000 in Indonesia; 13,000 each in Myanmar and Bangladesh; 12,000 each in Nigeria and Nepal; and 11,000 each in Mozambique and Madagascar (WHO, 1998g).

Leprosy is an insidious disease caused by a bacteria that principally affects the skin, peripheral nerves, and mucous membranes of the upper respiratory tract and the eyes (WHO, 1997c; WHO, 1998g). The visible symptoms of leprosy, however, may not appear for five to 20 years after infection because the disease develops very slowly (WHO, 1997c). If left untreated, the disease progressively damages the skin, limbs, and eyes. Severe deformity, especially of the feet and hands, occurs in approximately 30% of leprosy cases (World Bank, 1993) and blindness occurs in approximately 5% (WHO, 1997c).

Because leprosy strikes many young adults in their most productive years, it can have a significantly adverse effect on developing economies. One study in India, for example, reported that although leprosy accounted for only a small portion of that country's disease burden (less than 1% in 1990), the elimination of serious deformity associated with the disease would have resulted in an increase of \$130 million to India's 1985 GNP (World Bank, 1993). A second study in Tamil Nadu, India, estimated that the elimination of serious deformity would more than triple the expected annual income of lepers who were employed (World Bank, 1993).

Summary. The literature indicated that poor health affected labor productivity through worker disability. Although accurate information regarding disability's direct impact on Third World production was somewhat limited, a review of the facts surrounding blindness provided an illustration of the potential productivity losses associated with disability.

Global statistics indicated a much higher prevalence of blindness in the Third World, where currently 90% of all cases occur, representing 34.2 million blind individuals (WHO, 1997a). Experts predicted that, without intensified international effort, the incidence of blindness would double by the year 2020, at which time the WHO (1997e) warned that "blindness and serious visual disability . . . will become a major socioeconomic burden worldwide and may even thwart progress in some middle and low income countries" (para. 1). While the literature did not specifically enumerate labor-supply losses associated with blindness, it could reasonably be assumed that the excessive number of visually impaired people in the Third World reduced the availability of labor there, especially in areas heavily affected by blinding diseases.

The economic costs of blindness also appeared quite substantial from the literature review, as indicated by India's estimated aggregate cost of \$4.6 million per year for that disability alone (WHO, 1997d). Yet the literature also revealed significant financial benefit that could potentially be gained through sight-saving interventions. A study of cataract surgery in South Asia, for example, found that 85% of the men and 58% of the women who had regained their eyesight returned to work following surgery (WHO, 1997d). The estimated return on treatment expense was determined to be 1500% one year after surgery. Another study that examined the

effects of the Onchocerciasis Control Programme in West Africa concluded that the program had saved the sight of some 30 million people, including 9 million children, and had provided a projected rate of return ranging from 16% to 28% over the 46-year program period (WHO, 1997d).

Thus, given the limits in health care and economic resources in developing nations (WHO, 1997d) and given the higher prevalence of general disability found there (Murray & Lopez, 1996), the literature indicated that disabling diseases, like blindness, undoubtedly impeded Third World productivity.

Production Costs

Improvements in health further promote labor productivity by increasing worker efficiency and output through improved physical capacity. By enhancing both the quantity and the quality of labor, such improvements stimulate economic growth and development. The following empirical studies demonstrate the considerable production benefit that may be gained from such improvements.

Griffith, Ramana, and Mashaal (1971) analyzed the relationship between health and labor productivity in Ceylon (present-day Sri Lanka) during the 10-year period between 1948 and 1958. At that time, the country was largely a plantation economy specializing in tea, rubber, and palm products, with more than 50% of its labor force engaged in the agricultural sector. Examining the effects that investment capital and health expenditure had on labor productivity, Griffith et al. found that with each additional unit increase in health expenditure, labor productivity increased by an added 0.27.

Further evidence of the importance of health was found by Griffith et al. (1971) in a separate analysis that examined the elasticity between the three study variables. Elasticity refers to the impact that a percentage change in one variable has on the percentage change of another variable. In this instance, the analysis focused on the subsequent change that would occur in labor productivity as a result of a change in either investment capital or health expenditure. Griffith et al. estimated the degree of elasticity to be +0.2 between labor productivity and investment capital, and +0.5 between labor productivity and health expenditures. This finding, which ran contrary to the general assumption that investment played a greater role in productivity than did other factors, indicated that “the productivity of labor . . . at given levels of employment was more sensitive to health expenditures than to the proportion of investment to income” (p. 261). Griffith et al. concluded that the study findings “suggested that in the circumstances of Ceylon during the period, health measures were not only related to the economy but were at the time more important *economically* than capital formation” (p. 261).

In a second study by Griffith et al. (1971), the researchers evaluated the potential impact that the influenza pandemic of 1957 had on the rice production in Thailand. During that year, Thailand reported a lower than average amount of land planted with rice; lower, in fact, than the national average found for the entire 12-year period between 1950 and 1962. This reduction in rice planting subsequently led to a lowered national rice yield for the year. Although economists later claimed that Thailand’s poor rice harvest was the result of a late and inadequate monsoon, Griffith et al. found no evidence of either delayed or deficient rainfall, as the majority of rice-growing areas in the country received reasonable amounts of precipitation during the planting months when compared to prior-year averages.

Given the above findings, additional variables were examined to determine if they had been responsible for the reduction in rice planting, including the price variability in domestic and export rice, the accessibility of imported fertilizer, and the availability and demand in

agricultural labor supply. Griffith et al. (1971) determined that none of these variables factored into the equation, except perhaps, for the demand in labor which remained unusually high during the middle and latter parts of the planting season in 1957 despite the decrease in total area planted that year. As a result of their findings, they proffered the following theory:

Given reasonable prices, reasonable availability of such inputs as fertilizer and adequate conditions for planting, the paddy growing in 1957 was much affected, not by a late or insufficient monsoon, but by a disorganized labor force used in a single-crop system. In the absence of adverse political or other conditions, it could have been that the labor force was mainly affected by some disability that prevented work. (p.263)

Consequently, the researchers focused their attention on the global outbreak of Asian influenza that occurred during the study year of 1957, which affected Thailand sometime between late May and mid-August in the midst of its primary rice planting season (Griffith et al., 1971). While specific information about the details of the flu epidemic in Thailand were not available, the researchers thought it reasonable to look at the effects and patterns of disease that were experienced in nearby countries, like Malaysia, Ceylon (present-day Sri Lanka), and India.

Malaysian statistics revealed that the Asian flu virus had a high rate of transmission because a majority of Malaysians had never encountered that particular viral strain before. In one closed community in northern Malaysia, for example, nearly 88% of the population contracted the flu within a three-week period. The general duration of the infection averaged 6 to 8 days for 95% of those affected, and 10 to 15 days for the remainder. The main symptoms of the virus included “rapid prostration, with fever, cough, and headache” (p. 265).

Ceylon encountered similar viral effects, including “a highly susceptible population . . . [that experienced] an acute, debilitating, but seldom fatal disease” (Griffith et al., 1971, p. 265). The total number of cases reported by Ceylon totaled 4 million, or 43.6% of the country’s population, for the three-month period between June and August of 1957. Studies in India revealed that nearly 80% of all households in Calcutta contracted the Asian flu, and approximately 60% of those affected experienced some form of debility.

To estimate the probable loss in agricultural labor that Thailand likely experienced from the influenza epidemic, Griffith et al. (1971) extrapolated data from national labor statistics as well as viral transmission and duration rates from nearby countries. Assuming a 50% infection rate among the estimated 2 million available rice laborers, Thailand potentially would have experienced a loss of 6,097,000 worker-days over an eight-week period, representing a loss of approximately 122,000 rice workers or 6% of the total rice labor force. This eight-week period, judged to be the most debilitating time of the epidemic, extended from late June to early August and coincided with the primary planting season in Thailand.

To determine the probable output and financial loss that occurred, Griffith et al. (1971) compared rice yields over the 10-year period between 1950 and 1960. They estimated that approximately 1,980 thousand tons of rice were likely lost to the flu epidemic in 1957; a loss that represented 1% of Thailand’s GDP. This amount was regarded by the researchers to be somewhat considerable for an economy that was at that time largely dependent upon agriculture for its economic growth.

Corroboration was found among several other Southeast Asian countries when Griffith et al. (1971) reviewed national statistics regarding the amount of rainfall, the timing of the flu epidemic, and the total rice plantings. These anecdotal findings provided further evidence that there appeared “to be a connection between outbreaks of influenza in various countries and states and the areas planted or harvested” (p. 266). The researchers concluded that the lower than

average rice planting that occurred in Thailand in 1957 was not caused by an inadequate amount of rainfall, but rather was more likely the result of debility associated with the Asian flu; debility that caused the unexpected withdrawal of approximately 6% of the available labor force at a critical time during the planting season.

Ram and Schultz (1979) assessed health's influence on Indian agricultural production during the 1950s, 1960s, and 1970s through two analyses. Their first assessment examined the factors most responsible for the growth in agricultural output during two 10-year periods, from 1951 to 1961 and from 1961 to 1971. National agricultural statistics indicated production increases in both decades, with a 49% growth in crop output during 1951-61 and a 28% growth during 1961-71.

Through the use of regression analysis, the researchers determined that 64% of the growth that occurred in 1951-61 and 81% of the growth in 1961-71 could be attributed to the conventional inputs of land, labor, capital, and schooling (Ram & Schultz, 1979). Yet even after these factors were considered, a significant percentage of each increase still remained unexplained: 36% residual in 1951-61 and 19% residual in 1961-71. Unfortunately, Ram and Schultz were unable to allocate these residual amounts among additional inputs because of data limitations, but they believed that these surpluses could be credited to the effects of technical progress and health improvements in the Indian agricultural sector.

The considerable variance found between residuals, however, puzzled the researchers, as the unexplained growth in the first decade, at 36%, was nearly double that of the latter decade, at 19%. Ram and Schultz (1979) believed it was unlikely that technical progress had been the principal contributor to the unexplained growth in output, because if this were so, then the technical advances that accompanied the Green Revolution in the latter decade would have presumably been reflected in a much larger residual in 1961-71 than in 1951-61. The researchers theorized, instead, that the variance between decades was more likely the result of health improvements in the agricultural labor force, and they provided some national health statistics to illustrate the types of health advances that had been attained during the study period.

The incidence of malaria, for example, declined considerably during the first study decade, from 75 million cases in India in 1952/53 to approximately 1.1 million cases in 1959/60 (Ram & Schultz, 1979). After 1965, however, the malaria eradication program that was responsible for such declines was reported to have suffered a setback, although the malarial incidence did not return to previous levels. A similar campaign against tuberculosis, which began in the 1950s, also provided substantial health benefits during the first decade, with reports of 48 million people receiving vaccinations and 138 million people being tested for possible infection by 1959.

Although their analysis was somewhat conjectural, the researchers determined that:

... the improvement in the health of the agricultural labor force during 1951-61 was larger than that during 1961-71, and health gains contributed much more to the growth of output during 1951-61 than during 1961-71. The fact that a much larger fraction of the increase in output during 1951-61 remains unexplained by the growth of usual inputs which do not include worker health is, in our view, a reflection of the larger contribution made by health to output growth during the period. (Ram & Schultz, 1979, p. 416)

Thus, Ram and Schultz (1979) concluded that health improvements had undoubtedly played a part in the agricultural productivity of India, at least with respect to the 10-year period between 1951 and 1961.

The second assessment performed by Ram and Schultz (1979) examined the effect that reductions in malaria rates had on Indian agricultural production during the 11-year period from

1954 to 1965. To compare the progress made in 98 Indian districts, the researchers divided the study districts into two groups. The first group, referred to as high-incidence districts, included 45 districts that had originally reported a high incidence of malaria in the early 1950s, but through public health interventions had experienced a marked decrease in disease rates by 1965. The second group, referred to as low-incidence districts, consisted of 53 districts that had initially reported a low incidence in malaria and had therefore encountered a smaller health improvement during the study period.

Analyzing output and yield statistics for all major food grains and pulses for both sets of districts, Ram and Schultz (1979) found that high-incidence districts reported greater growth in agricultural production during the study period than did low-incidence districts. In terms of agricultural output, for example, the high-incidence districts experienced a mean increase in food-grain output of 33.6%, while the low-incidence districts reported a mean increase of 30.2%. In terms of agricultural yield, the high-incidence districts indicated an average increase of 28.3% while the low-incidence districts reported a 21.9% increase.

When the researchers examined similar statistics for more labor-intensive crops, however, they found a more pronounced difference in output growth between districts, with the high-incidence districts reporting a mean increase in food-grain output of 45.0% while the low-incidence districts reported only a 38.6% increase. Ram and Schultz (1979) concluded that:

Despite several objections that could be raised in relation to this simple procedure, we believe it provides reasonably good evidence in support of the proposition that the near eradication of malaria during the early part of this period in India contributed significantly to increases in agricultural output and yields. (p. 419)

Other anecdotal studies mentioned by the UNDP (1990) and the World Bank (1993) indicate similar favorable relationships between gains in worker health and gains in productivity. Yet though it would “seem obvious that a healthier labor force will be more productive, empirical findings linking health to productivity have been contradictory” (Bullock, 1986, p. 256). Research results, in fact, have been found to vary substantially, depending upon the type of disease investigated, the group of individuals examined, and the location where the study was performed (Grosse & Harkavy, 1980).

A prime example of contradictory research findings is illustrated in a 1960’s study by Weisbrod et al. (1973) that investigated the effects of parasitic disease on both rural and urban labor productivity in St. Lucia. Beginning in the latter 1960s, Weisbrod et al. surveyed two groups of laborers: (a) 126 rural plantation workers (66 males and 60 females) at one of St. Lucia’s largest banana-growing estates, over an 18-month period, and (b) 114 urban factory workers (all female) who assembled paper advertising materials, over a 14-month period. Worker earnings were employed as the primary measure of labor productivity for both groups of laborers.

Of the five parasitic diseases evaluated, only three (Ascariasis, schistosomiasis, and Strongyloides) were found to have an adverse impact on labor productivity, as measured by employee earnings (Weisbrod et al., 1973). Ascariasis and Strongyloides are two varieties of intestinal parasites. Intestinal parasites currently infect approximately 3.5 billion people globally, causing illness in nearly 450 million people, the majority of which are children (WHO, 1998a). Schistosomiasis, on the other hand, is a parasite that infects the blood of approximately 200 million people worldwide, causing severe debility for 20 million individuals (WHO, 1996a).

With respect to rural labor productivity, Weisbrod et al. (1973) found that the effects of parasitic infection varied according to the gender of the rural worker surveyed. For female plantation workers, for example, the only parasite that singularly acted to reduce productivity was

Strongyloides, as measured by a significant drop in both daily and weekly earnings as well as in the average number of days worked per week. The potential productivity lost to Strongyloides, in terms of daily wage, was estimated to be 31¢ per day, or 15% of the average daily earnings of female agricultural laborers.

For male plantation workers, however, the study found that only schistosomiasis acted alone to reduce daily productivity, as measured by daily wages (Weisbrod et al., 1973). The potential productivity lost to schistosomiasis amounted to approximately 80¢ per day, or 31% of the average daily income of male agricultural laborers. Yet unlike female workers, the loss in daily income for male workers did not translate into lower weekly earnings, as males affected with schistosomiasis tended to work more days per week than other plantation workers, thereby mitigating the loss in daily wage.

With respect to parasitic disease's effect on urban labor productivity, the study findings were even more mixed, as parasites were found to both inhibit and enhance the productive output of female factory workers. Ascariasis infection, for example, was found to significantly lower the physical output of one of three particular tasks assessed, while hookworm infection was found to significantly increase the output of that same task. Furthermore, when Weisbrod et al. (1973) examined the effect of all five parasitic variables on labor productivity, they found that the entire group of diseases, together, exerted a significantly negative influence only on the weekly earnings of rural agricultural laborers, regardless of gender.

Although the literature often reveals contradictory findings between health and labor productivity, Grosse and Harkavy (1980) argued that a great deal of the empirical research found in the literature was problematic, "marred by poor design and insufficient data" (p. 166). One explanation for the inconsistency among results involves the failure of researchers to carefully distinguish between infection and disease in study cases. According to Grosse and Harkavy:

Many infections and parasitic diseases have "gradients of infection" which range from no symptoms through mild to severe disease or disability. The amount of disability associated with diseases such as schistosomiasis or onchocerciasis is related to the worm load in the body, rather than to a state of being infected or not infected. While the relationship of infection to disease may be high, as in measles, it is very low indeed in ailments such as tuberculosis and poliomyelitis, where infection without disease may run well over 90%. (p. 166)

Thus without careful consideration, the presence of infection may be erroneously mistaken for full-blown disease, and study findings expressed accordingly.

A second explanation for conflicting research results involves the high level of underemployment found in many developing nations. If excess labor is abundant in the study area and "the marginal value of an additional hour of labor approaches zero, [then] overall production will not necessarily rise as workers become more healthy" (Grosse & Harkavy, 1980, p. 166).

A third reason for contradictory findings lies in the fact that a majority of productivity studies "examine the immediate effects of improved health conditions on the output of adults in isolated cases, while most of the research on health centers on national infant and child mortality rates" (Bullock, 1986, p. 258). Lastly, the strong alliance that exists between health and other social variables, like education and nutrition, impedes analysts from developing generalizations about health's direct impact on labor productivity (Grosse & Harkavy, 1980). Wheeler (1980) stated that researchers do not deny that a favorable relationship exists between health and productivity; what they question, rather, is the significance of that relationship. According to Bullock (1986),

a thorough review of the literature revealed that:

It seems certain that improving health conditions does enhance economic output through increasing labor productivity, although difficulties with measuring and interpreting the effects of health make it difficult to ascertain the magnitude of their impact. We tentatively conclude that the effects of health on economic productivity and output are positive, lagged, and confounded with other social variables. (p. 260)

Summary

The economic case for health improvement and disease control is strong (World Bank, 1991), as the literature indicated that such efforts contributed to the productive resources of land, labor, and capital in Third World nations. Disease control, for example, stimulated economic growth through the development of underutilized natural resources by opening up vast amounts of previously blighted land for food and cash crop production, as well as for resettlement purposes. Health improvements also encouraged economic development through labor productivity by reducing the number of work days lost to illness, by lengthening worker lifespan and prolonging participation in the labor force, by contributing to worker education and training, by decreasing the amount and severity of disability, and by increasing efficiency and output through improved physical capacity. Disease prevention additionally facilitated economic growth in capital resources by decreasing the incidence of disease and thereby avoiding associated medical care costs. Thus, improvements in health effectively promoted economic development in Third World nations by improving the productivity of land and labor, and by conserving national and individual capital.

But while the economic rationale for health improvement and disease control may be strong, the most compelling case for promoting health in lesser developed nations lies in the fact that it contributes significantly to human welfare, and the ultimate objective behind economic development is the enhancement of human welfare (Castle, 1972; Grosse & Harkavy, 1980; Streeten, 1981; UN, 1963; WHO, 1998d; World Bank, 1991) for “people are the real wealth of a nation” (UNDP, 1990, p. 9). As the WHO (1998e) declared:

The purpose of development is to permit people to lead economically productive and socially satisfying lives. Health—in the sense of complete physical, mental and social well-being, as well as the absence of disease—is a fundamental goal as well as an engine of development. (para. 48)

Investing in health, therefore, makes sense not only in economic terms, but also in human terms.

CHAPTER THREE

Research Methodology

The purpose of this research was to analyze science- and technology-related health assistance provided to lesser developed nations by selected donor agencies from 1985 to 1995. To achieve this purpose, the following methodology was utilized:

1. Review and select science- and technology-related health data.
2. Review and select appropriate development performance indicators related to health, economic, and population variables.
3. Analyze data in terms of numbers and cost, and correlate data from selected countries with development performance indicators.
4. Determine findings and conclusions, and provide recommendations for further research.

Review & Selection of Health Data

This research utilized selected data from the National Science Foundation (NSF) Project #SBR-9510548 (Pytlik, Vasudevan, Bayles, & Spitznogle, 1997), entitled Assessing the Literature on the Benefits of External Science and Technology Aid Assistance to Developing Economies.

The purpose of the NSF Project was to examine the literature to determine the impact that science- and technology-related assistance had on the society and the economy of Third World recipients during the 10-year period from 1985 to 1995. Four major international development agencies served as data sources for the project: the Ford Foundation, the Rockefeller Foundation, the World Bank, and the United States Agency for International Development. Assistance information was gathered from agency and foundation reports, electronic databases, and university, agency, and foundation libraries.

Assistance projects identified by the literature as science- and technology-related were categorized into one of six classifications (agriculture, economic, education, environment, health, and infrastructure) according to the projects' primary goals. Projects were then evaluated in terms of scope, objective, methodology, and outcome, and compiled into a master computer database.

A total of 1,674 science- and technology-related assistance projects in 103 countries, valued at over \$32 billion, were identified during the 18-month literature review. A categorical breakdown of these projects revealed 610 health projects valued at \$1.6 billion, 539 agriculture projects valued at \$6 billion, 167 environment projects valued at \$2.2 billion, 134 education projects valued at \$3.3 billion, 113 economic projects valued at \$4.3 billion, and 111 infrastructure projects valued at \$14.8 billion. All of the 610 health projects included in the NSF database were selected for analysis for this research study.

Review & Selection of Development Performance Indicators

Development performance indicators were utilized in this research study to measure the probable impact that health assistance projects had on the health status and the economic growth of selected Third World countries. The particular indicators employed as diagnostic measures included health and economic variables, as well as other relevant variables that provided additional context to these measures.

Selection Criteria

De Neufville (1982) and Yeung and Mathieson (1998) suggested that the following five criteria were important considerations in the selection of development performance indicators. First, indicators should be both reliable and accurate. Second, they should be generally accepted by development specialists as indicators of progress in a given area. Third, they should be as unbiased as possible, without favoritism to any particular country or group of countries. Fourth, if possible, they should be acquired from a single reputable source to facilitate cross-country comparisons. Lastly, indicators should be readily available for a large percentage of countries.

Final selection of development performance indicators for this research study was guided by the above five criteria.

Source of Indicator Information

World Bank indicators are widely recognized for their comprehensiveness and credibility in the development sector (Bullock, 1986). The World Bank collects its data from a variety of authoritative sources, including specialized international agencies that are noted for their expertise, like the World Health Organization, governmental agencies, bilateral organizations, and from its own files and records (De Neufville, 1982; World Bank, 1996a). Like any compiled data, however, World Bank indicators must be viewed as approximations rather than exact measures (De Neufville, 1982). As the World Bank (1996a) noted:

Despite considerable effort to standardize the data, statistical methods, coverage, practices, and definitions differ widely and the usual warnings about using the figures carefully still apply. In addition, the statistical systems in many developing economies are still weak, thus affecting the availability and reliability of data. Moreover, cross-country and cross-time comparisons always involve complex technical problems, which cannot be fully and unequivocally resolved. The data are drawn from sources thought to be most authoritative, but many of them are subject to considerable margins of error. Readers are urged to take these limitations into account in interpreting the indicators, particularly when making comparisons across countries and economies. (p. 385)

Yet despite the limited precision of some indicators, they continue to be important diagnostic measures for researchers because they “provide concrete information as to where a nation stands in both absolute and relative terms, as well as monitoring progress and achievement over time” (Yeung & Mathieson, 1998, p. 6). Considering the reputation of the World Bank for providing comprehensive and credible data, development performance indicators for this research study were selected from the World Bank’s Social Indicators of Development 1996.

Types of Indicators

Development performance indicators can be classified as either input or output measures. Input measures estimate the amount of resources that are potentially available to achieve certain

development objectives (Hicks & Streeten, 1979; Streeten, 1981). Examples of input measures related to health include immunization rates, government expenditures on health, and percentages of doctors or hospital beds to some unit of population. Thus, input measures provide an indication of the intention and commitment of governments to improve certain objectives. They are, however, only indications of *potential* resources, since such resources can be misdirected or misappropriated by those in power (Streeten, 1981).

Output measures, on the other hand, evaluate the actual success or failure in meeting a desired objective (Hicks & Streeten, 1979; Streeten, 1981). Mortality and morbidity rates as well as life expectancy at birth are examples of output measures related to health. Since these indicators are more closely associated with ultimate objectives, they are better measures of both development performance and general levels of welfare than are input indicators.

Both types of indicators, however, are limited by the fact that they are averaged figures. As such, they have the capacity to conceal significant differences that may occur between income groups or between geographic regions in a given country (Abiaka, 1991; Bullock, 1986; Wheeler, 1980). Therefore, care must be taken when drawing conclusions about national conditions, because differences among population groups are not addressed by these figures.

Health Indicators

To adequately assess health status, Bullock (1986) recommended using both input and output indicators since “input variables help gauge the potential for improving health, while output measures reflect actual health improvement” (p. 301). Consequently, four input and four output indicators were used as measures of health status for this research study, as specified below. These particular health indicators were selected over other World Bank (1996a) measures because they alone provided comparative data for a significant number of Third World countries for the 10-year review period.

The first two input indicators deal with infant vaccination rates: *immunization for measles* and *immunization for diphtheria, pertussis, and tetanus*. Each of these indicators measures the percentage of children under the age of one who have been vaccinated against these specific diseases; diseases which have been targeted by the Expanded Program of Immunization (World Bank, 1996a). Both immunization measures provide an estimate of infant vulnerability to disease, with the measles indicator specifically addressing infant susceptibility to contagious disease (Yeung & Mathieson, 1998).

The second input indicator, *population per physician*, assesses the availability of doctors in a given country (World Bank, 1996a). Although this indicator provides an idea of the quantity and, to a certain extent, the quality of available health care, it suffers from several limitations: (1) the definition of “physician” differs among countries (World Bank, 1996a) and (2) the length of training, the degree of specialization, and the regional distribution of medical practitioners is not explicitly considered by the variable (De Neufville, 1982; Hicks & Streeten, 1979; Morawetz, 1977; Wheeler, 1980). Given the fact that, in some countries, health services and medical personnel are heavily concentrated in urban areas, this indicator may not provide a true representation of general access to health care, especially for poor and rural populations (Grosse & Harkavy, 1980).

Population per hospital bed is an input indicator that measures the availability of hospital facilities in a given country. For purposes of this indicator, hospitals are defined as “establishments permanently staffed by at least one physician” (World Bank, 1996a, p. 389), and include public, private, general, and specialized hospitals as well as rehabilitation centers. This indicator, like the previous indicator, is limited by the fact that it does not consider the

geographic distribution of health facilities within a country. As a result, it may have a tendency to “carry a particularly strong urban bias” (Bullock, 1986, p. 302).

Life expectancy at birth has been widely recognized as one of the best available measures of a population’s general level of health (Wheeler, 1980; Yeung & Mathieson, 1998). This output indicator provides an estimate of how long a newborn child will live, given the prevailing mortality patterns of a particular country (World Bank, 1996a). It examines the quantity rather than the quality of life for a population (Hicks & Streeten, 1979).

Because health is so closely associated with other development variables, however, life expectancy rates also tend to reflect levels of income, employment, nutrition, and housing, as well as environmental conditions (De Neufville, 1982; Hicks & Streeten, 1979). A low life expectancy rate, for example, generally suggests that a considerable portion of the population lives in poverty (De Neufville, 1982). Additionally, life expectancy rates are deeply influenced by infant mortality rates, such that high numbers of infant deaths can reduce life expectancy ratios so substantially that the health conditions of the general populace appear to be considerably worse than they actually are (Bullock, 1986; De Neufville, 1982). As with other indicators, life expectancy is an aggregate figure that can hide significant differences between high and low income groups (Bullock, 1986). Studies from Mexico in the 1980s, for example, revealed a wide disparity in life expectancies with respect to earnings, as the average rate for persons in the lowest income decile was found to be 20 years less than the average in the top income decile (UNDP, 1990).

Another widely used indicator of national health status is the *infant mortality rate* (Yeung & Mathieson, 1998). This output indicator measures the annual number of infant deaths that occur in children under the age of one year, for every 1,000 live births (World Bank, 1996a). The infant mortality rate not only provides independent information on infant health status, it also provides further clarification for national life expectancy measures (De Neufville, 1982).

Because infant health is strongly affected by the quality of life in a household, infant mortality rates reflect nutrition and sanitation conditions as well as the prevalence of infectious disease (De Neufville, 1982). Therefore, high infant mortality rates, like low life expectancy rates, generally indicate that a majority of people are living in extremely poor conditions, where basic needs remain largely unmet. Infant mortality, however, is “a more sensitive indicator than life expectancy and [it often] shows a rapid response to many health policies” (De Neufville, 1982, p. 397).

Like life expectancy rates, infant mortality rates are averaged figures that may potentially conceal vast differences in infant health status between income groups. Research in Colombia, for example, revealed that infant mortality rates were two times higher in poor households than in the richest households (UNDP, 1990). Similarly, studies in rural Punjab showed that infant mortality among landless families was 36% higher than rates for land-owning families (UNDP, 1990).

A third output indicator that assesses women’s health is the *maternal mortality rate* (Yeung & Mathieson, 1998). This indicator measures the number of women who die during childbirth in a given year, for every 100,000 live births (World Bank, 1996a). While this indicator is frequently used, its consistency and reliability is limited by several factors: (1) many maternal deaths that occur in remote rural areas are not reported (World Bank, 1993); (2) many pregnant women die from inadequate health care rather than from the pregnancy, itself; and (3) some countries include female deaths that result from abortion complications as well as deaths that occur after the period of childbirth in this measure (World Bank, 1996a). Therefore, caution should be used when employing this indicator in cross-country comparisons.

Total fertility rate is another other output indicator that measures the “average number of children who would be born alive to a woman during her lifetime, if she were to bear children at each age in accordance with prevailing age-specific fertility rates” (World Bank, 1996a, p. 387). While this indicator actually assesses the quantity of children born per woman in a given country, it is also used as an indirect measure to evaluate the progress made in contraceptive use, since it “is implicitly assumed that women will bear fewer children if they are able to prevent unwanted pregnancies” (Yeung & Mathieson, 1998, p. 33).

Economic Indicators

Gross national product (GNP) per capita was used in this research study as an indicator of the economic performance of selected Third World nations. Other World Bank (1996a) indicators related to the economy were excluded from review because they lacked comparative data for the 10-year study period.

GNP per capita provides an indication of the average amount of economic resources available to each person in a given country (De Neufville, 1982). It is calculated by dividing the total market value of all goods and services, estimated at current market prices in US dollars, by a country’s total population (World Bank, 1993).

Although this indicator simply assesses economic performance, it is thought that such performance may be indicative of future development in social sectors as well. As Yeung and Mathieson (1998) pointed out: “While economic achievement alone is not representative of a country’s development achievements, it is through economic expansion and rising incomes that a country can ultimately afford increasing standards of living and better public services for its citizens” (p. 14).

Like several of the other indicators previously discussed, this economic indicator also suffers from certain limitations. First, GNP per capita is an aggregate figure that does not consider distributional characteristics within a country. Thus, it has the capacity to potentially conceal significant income differences between population groups (Yeung & Mathieson, 1998). Secondly, because countries use various accounting and demographic reporting systems to calculate GNP data and population statistics, cross-country comparability is diminished (World Bank, 1993). Thirdly, the variability of official monetary exchange rates used to convert GNP data to US dollar equivalents, again, limits cross-country comparability (World Bank, 1993).

Background Indicators

In addition to health and economic indicators, this research study also utilized two background indicators to provide further context to the analysis: total population and population growth rate. While each of these measures investigate aspects of population, together they supply supplemental information that can assist in the interpretation of economic and social conditions in a country.

The *total population* statistics of a given country provides an indication of the general need for and demand in economic and social resources, such as requirements for financial capital, health care facilities, education, housing, sanitation, and other public services (Stockwell, 1981).

The *population growth rate* provides an estimate of the average annual growth of a particular country (World Bank, 1996a) and can be used as either an input or an output indicator (Yeung & Mathieson, 1998). As an input measure, it “is a harbinger of current and future needs” (De Neufville, 1982, p. 398), as it reflects the current and potential development demands that will be placed on an economy (Stockwell, 1981; Yeung & Mathieson, 1998). As an output indicator, the

population growth rate is used to measure “overall progress in health and income, because population growth rates level off or even decline as nations achieve higher levels of development” (Yeung & Mathieson, 1998, p. 34). In general, rapid population growth hinders both economic growth and social development in a country, because it “accentuates virtually every problem that is associated with underdevelopment” (Stockwell, 1981, p. 105), including poor health conditions.

Summary

In summary, the following development performance indicators were used as diagnostic measures for health, economic, and population variables in this research study.

1. Immunization for Measles
2. Immunization for Diphtheria, Pertussis, and Tetanus
3. Population per Physician
4. Population per Hospital Bed
5. Life Expectancy at Birth
6. Infant Mortality Rate
7. Maternal Mortality Rate
8. Total Fertility Rate
9. Gross National Product per Capita
10. Total Population
11. Population Growth Rate

As previously stated, all indicator information was obtained from the World Bank’s Social Indicators of Development 1996. This World Bank publication categorized indicator statistics into several different five-year time periods, with each period displaying the most recent single-year estimate of indicator status. Therefore, in order to calculate the changes that occurred in indicator status between 1985 and 1995, data was compiled for each of the above indicators for the following two time periods: 1980-1985 and 1989-1994.

Analysis of Health Data

This research analyzed the number and cost of health assistance projects provided to developing nations in Africa, Asia, and Latin America between 1985 and 1995 using the following analyses: (1) an analysis of the total number and the total value of health assistance projects by region, sub-region, and country; (2) an analysis of the source of health assistance projects by individual donor agency; and (3) an analysis of the types of health projects initiated by donor agencies during the 10-year study period.

In addition, the research measured the probable impact that these health assistance projects potentially had on the health status and the economic growth of Third World recipients by correlating data from selected countries with development performance indicators. Countries were selected for correlation purposes by identifying six recipients within each region (three that received the highest and three that received the lowest amount of health assistance, both in terms of total numbers and total dollar values), and categorized accordingly. In those cases where more than three countries indicated identical quantities or dollar values of health assistance projects, countries were randomly selected from those particular groups for correlation purposes.

Regional comparisons were then made between the two categories (top three countries and bottom three countries) by averaging the changes in each indicator over the 10-year period to determine if any significant differences existed between categories that might be attributed to either the presence or the absence of health assistance programs. The data analysis was

presented in Chapter Four, with supporting documentation exhibited in Appendices A through E.

Determination of Findings, Conclusions, and Recommendations

The data analysis was used to answer the following research questions:

1. How many science- and technology-related health projects were implemented in Third World nations between 1985 and 1995 by the selected donor agencies?
2. What were the total dollar expenditures (by region, by sub-region, and by country) and the per capita expenditures (by country) of such health projects?
3. Of the selected donor agencies, who were the major health funders in Third World countries during the 10-year study period?
4. What types of health projects were initiated by the donor agencies during the study period?
5. Have the health-related indicators of selected Third World countries improved or declined during the study period?
6. Have the economic-related indicators of selected Third World countries improved or declined during the study period?

Based on the above research questions, findings and conclusions were drawn and presented in Chapter Five. Recommendations for further research were adopted following the determination of findings and conclusions, and also discussed in Chapter Five.

CHAPTER FOUR



Analysis of Data

The purpose of this research was to analyze science- and technology-related health assistance provided to lesser developed nations by selected donor agencies during the 10-year period between 1985 and 1995. In accordance with the methodology outlined in Chapter Three, this research study analyzed health assistance projects with respect to (1) the total number and the total value of projects by region, sub-region, and country; (2) the amount of assistance provided by individual donor agencies; (3) the types of projects initiated during the study period; and (4) the probable impact that such projects had on the health and the economic status of selected Third World recipients.

Health data was obtained from the National Science Foundation (NSF) Project #SBR-9510548 (Pytlik, Vasudevan, Bayles, & Spitznogle, 1997), while development performance indicators were gathered from Social Indicators of Development 1996, published by the World Bank.

Number of Health Assistance Projects

The NSF literature review (Pytlik et. al, 1997) identified a total of 610 science- and technology-related health projects implemented in 63 Third World nations between 1985 and 1995 by the Ford Foundation, the Rockefeller Foundation, the World Bank, and the United States Agency for International Development. Because of the time constraints of the NSF study and the limited amount of readily available literature from the donor agencies, it is acknowledged that this number most likely represents only a portion of the total amount of health assistance provided by the four agencies during the 10-year study period.

Distribution of the 610 health projects was summarized by region, by sub-region, and by country in [Tables A1](#) through [A4](#) in Appendix A. These tables display information only on those countries that were identified as having received health assistance from the selected donor agencies between 1985 and 1995. For example, while several countries are located in East Asia, [Table A3](#) in Appendix A presents information on only one country in that sub-region, China, because it was the only country that received health assistance from the four international donor agencies during the study period.

The following summary provides an overview of the information found in [Tables A1](#) through [A4](#) in Appendix A with respect to the distribution of the 610 health assistance projects implemented in Third World nations between 1985 and 1995. Overall, the projects were distributed quite equitably among world regions, but inequitably within the regions and sub-regions. Each of the three world regions, for example, received approximately $\frac{1}{3}$ of the health assistance projects implemented during the study period, as shown in Figure 4.1, with Africa receiving 30.8% of the total number of projects (188 projects), Asia receiving 36.4% (222 projects), and Latin America receiving 32.8% (200 projects).

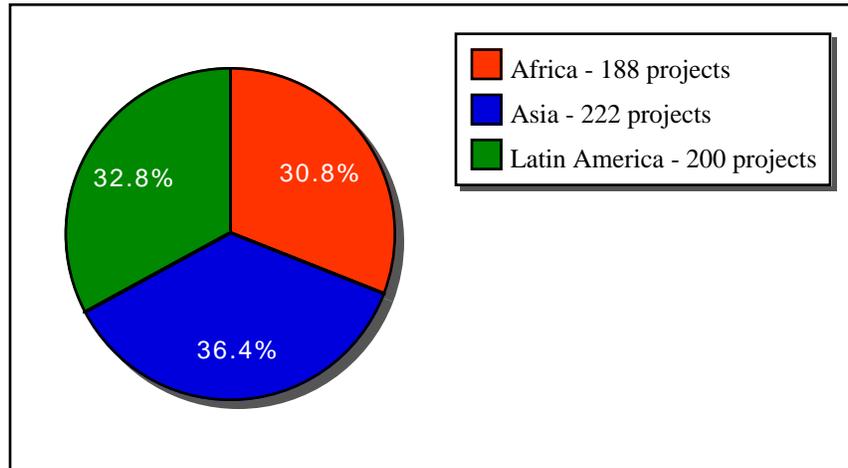


Figure 4.1. Distribution of 610 Health Assistance Projects by Third World Region

Within world regions, however, there was considerable disparity in project allocation (see [Table A1](#), Appendix A). For instance, one sub-region in each of the three world regions of Africa, Asia, and Latin America received more than half of the total number of projects that were implemented in that region: (1) Eastern Africa received 51.1% of the 188 African projects, (2) Southeast Asia received 50.9% of the 222 Asian projects, and (3) South America received 64.0% of the 200 Latin American projects. This unequal allocation in health assistance between sub-regions is depicted in Figures 4.2 through 4.4 on the following pages.

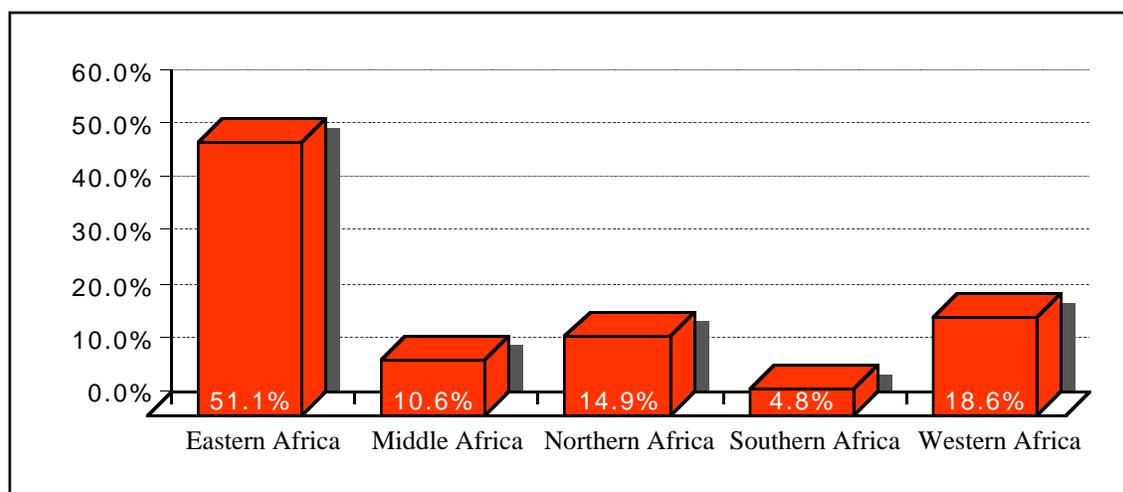


Figure 4.2. Distribution of 188 Health Assistance Projects in Africa by Sub-Region

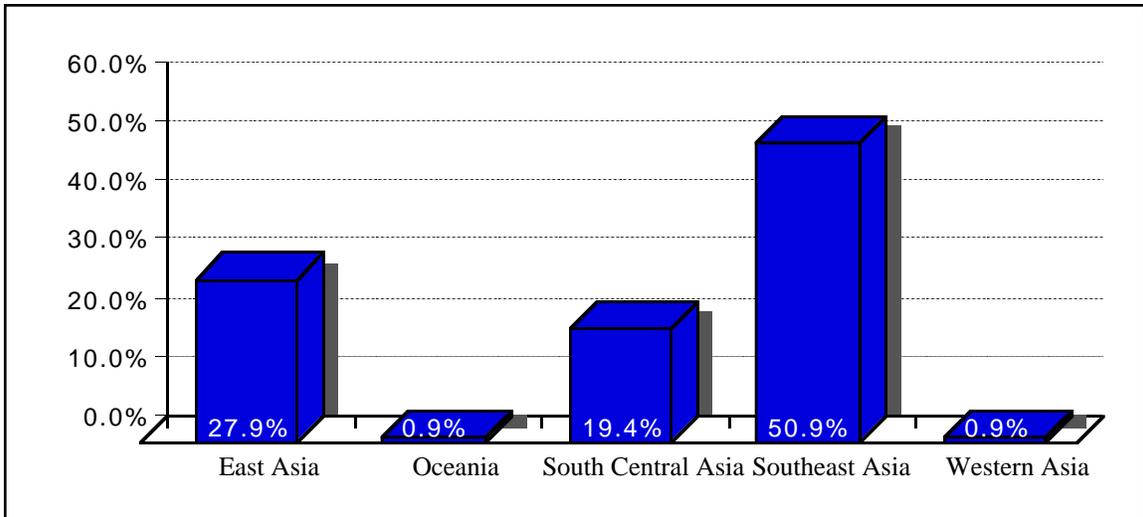


Figure 4.3. Distribution of 222 Health Assistance Projects in Asia by Sub-Region

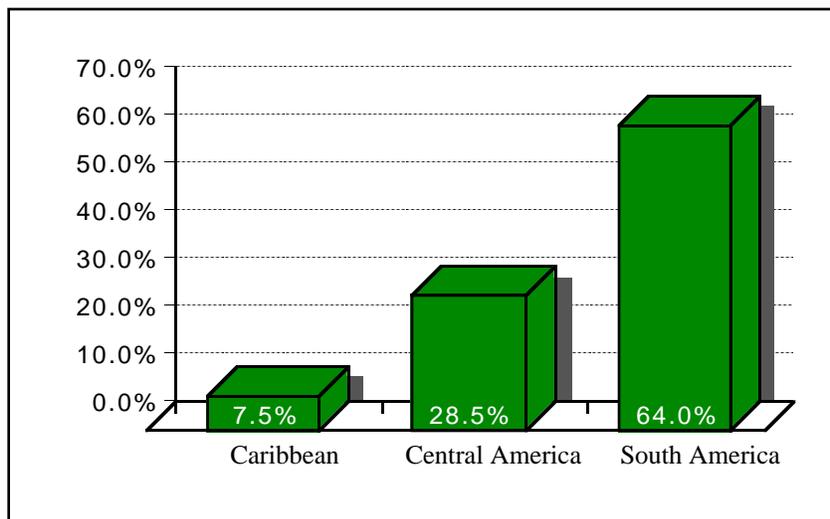


Figure 4.4. Distribution of 200 Health Assistance Projects in Latin America by Sub-Region

Similar disparity in project distribution was found between countries, as summarized below.

Africa

The NSF literature review (Pytlik, et. al, 1997) identified a total of 188 health assistance projects implemented in 29 countries in Africa between 1985 and 1995 (see [Table A2](#), Appendix A). The three African countries that received the highest number of health projects included Kenya (37 projects), Egypt (21 projects), and Nigeria (20 projects), while eleven countries tied for the lowest number, each receiving only one project during the study period (Somalia, Rwanda, Mauritius, Chad, Morocco, Tunisia, Cote d'Ivoire, Mali, Niger, Guinea, and Benin).

Examining country data within African sub-regions revealed the following information.

- Eastern Africa received a total of 96 health projects during the study period. Nearly 70% of these projects were implemented in only three of the 10 countries in Eastern Africa: Kenya (38.5%), Uganda (18.8%), and Zimbabwe (12.5%).
- Middle Africa received a total of 20 health projects during the study period, of which 60% were located in Cameroon, 35% in Zaire, and only 5% in Chad.
- Northern Africa received a total of 28 health projects during the study period, 75% of which were executed in Egypt alone. The remaining 25% of health projects were shared by three other countries in that sub-region: Sudan (17.8%) and Morocco and Tunisia (3.6% each).
- Southern Africa received a total of 9 health projects during the study period. This was the only African sub-region that exhibited equity among countries, with each of its three countries receiving $\frac{1}{3}$ of the total number of health projects.
- Western Africa received a total of 35 health projects during the study period. Over half of these projects (57.1%) were implemented in only one of this sub-region's nine countries, Nigeria.

Asia

The NSF literature review (Pytlik, et. al, 1997) identified a total of 222 health assistance projects implemented in 15 countries in Asia between 1985 and 1995 (see [Table A3](#), Appendix A). The four Asian countries that received the highest number of projects included China (62 projects), Thailand (52 projects), and India and Indonesia (31 projects each). Six countries tied for the lowest amount of projects, each receiving only one project during the study period: Papua New Guinea, Fiji, Myanmar, Malaysia, Yemen, and Lebanon.

Examining country data within Asian sub-regions revealed the following information.

- East Asia received a total of 62 health projects during the study period, all of which were implemented in China.
- Oceania received a total of 2 health projects during the study period, one in Papua New Guinea and one in Fiji.
- South Central Asia received a total of 43 health projects during the study period, of which 72.1% were located in India, 23.2% in Bangladesh, and only 4.7% in Pakistan.

- Southeast Asia received a total of 113 health projects during the study period. Nearly $\frac{3}{4}$ of these projects were executed in only two of the seven countries in Southeast Asia: Thailand (46.0%) and Indonesia (27.4%).
- Western Asia received a total of 2 health projects during the study period, one in Yemen and one in Lebanon.

Latin America

The NSF literature review (Pytlik, et. al, 1997) identified a total of 200 health assistance projects implemented in 19 countries in Latin America between 1985 and 1995 (see [Table A4](#), Appendix A). The three Latin American countries that received the highest number of health projects included Brazil (46 projects), Chile (41 projects) and Mexico (37 projects), while the five countries receiving the lowest amount of projects included Honduras, Nicaragua, and Belize (2 projects each), and Panama and Uruguay (1 project each).

Examining country data within Latin American sub-regions revealed the following information.

- The Caribbean received a total of 15 health projects during the study period that were fairly evenly distributed among the three countries in that sub-region: Dominican Republic (46.7%), Haiti (33.3%), and Jamaica (20%).
- Central America received a total of 57 health projects during the study period, 64.9% of which were executed in Mexico alone. The remaining 35.1% of health projects were distributed among seven other countries in that sub-region.
- South America received a total of 128 health projects during the study period, of which 68% were implemented in two of the eight countries in South America: Brazil (36%) and Chile (32%).

Dollar Value & Per Capita Expenditures of Health Assistance Projects

The NSF literature review (Pytlik, et. al, 1997) of selected donor agencies identified a total of 610 science- and technology-related health projects implemented in Third World nations during the 10-year period between 1985 and 1995. Of these 610 projects, 603 (or 98.9%) provided the necessary financial information to be valued at \$1,576,508,830. Distribution of health assistance dollars was summarized by region, by sub-region, and by country in [Tables A1](#) through [A4](#) in Appendix A. The following information provides an overview of the data displayed in those tables.

Considerable disparity was found in the allocation of health assistance dollars between regions, sub-regions, and countries. As illustrated in Figure 4.5, Asia received the bulk of project dollars, accounting for over 56% of the total dollars spent for health projects (\$884 million) in the Third World during the study period by the selected donor agencies. Latin America was the second highest recipient of health assistance, receiving 26.3% of the total health dollars (almost \$414 million), while Africa came in a distant third with only 17.6% of the total project dollars (\$278 million).

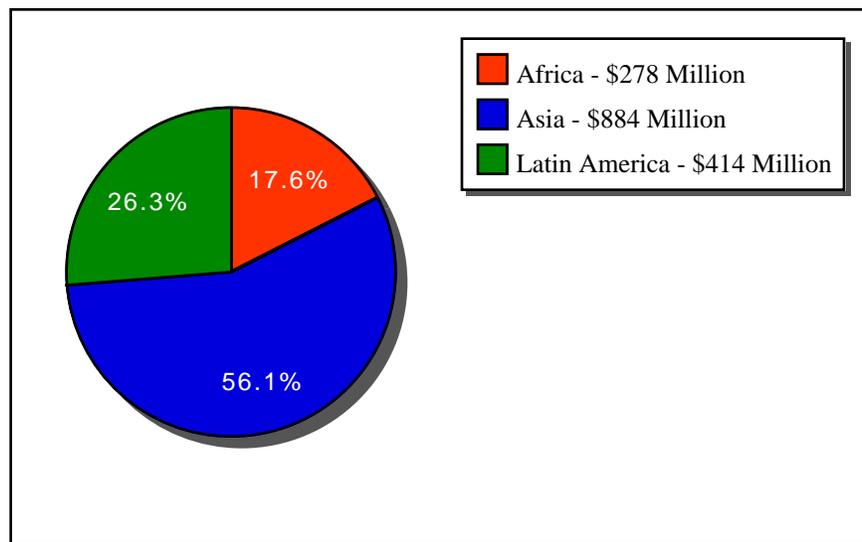


Figure 4.5. Distribution of \$1.577 Billion in Health Assistance by Third World Region

Disparity continued within regions, with one or two sub-regions in each of the three world regions receiving the vast majority of project dollars (see [Table A1](#), Appendix A). In Africa, for example, the Northern and Western sub-regions together received 58% of the health assistance dollars spent in Africa. In Asia, over 56% of its project dollars were spent in South Central Asia, while in Latin America, more than 70% were utilized in Central America. The disparity in dollar distribution between sub-regions is depicted in Figures 4.6 through 4.8 below.

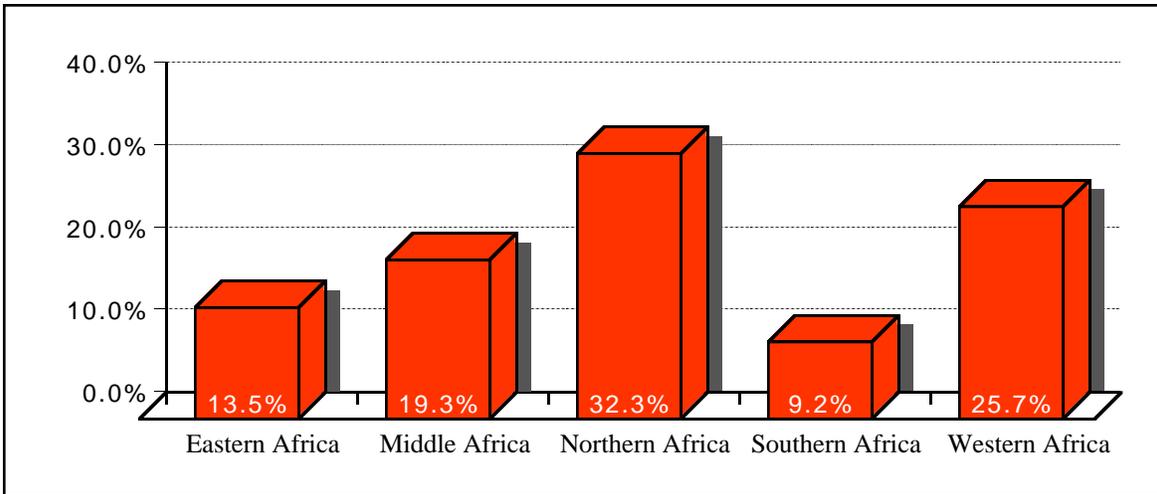


Figure 4.6. Distribution of \$278 Million in Health Assistance in Africa by Sub-Region

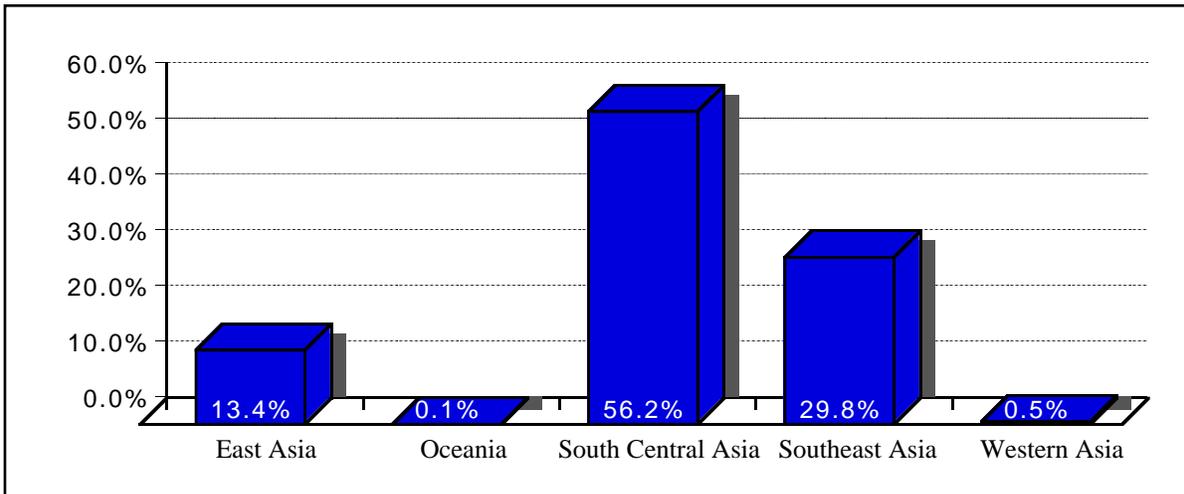


Figure 4.7. Distribution of \$884 Million in Health Assistance in Asia by Sub-Region

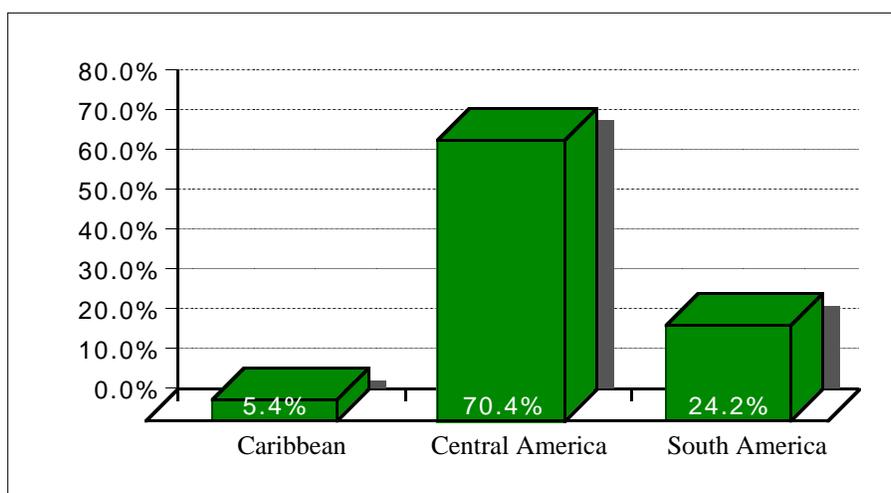


Figure 4.8. Distribution of \$414 Million in Health Assistance in Latin America by Sub-Region

Similar inequality in the distribution of health dollars was found between countries, as summarized below.

Africa

The NSF literature review (Pytlik, et. al, 1997) identified a total of 188 health assistance projects implemented in 29 countries in Africa between 1985 and 1995 (see [Table A2](#), Appendix A). Of these 188 projects, 185 (or 98.4%) provided the necessary financial information to be valued at \$278,364,747.

The three African countries that received the largest amount of health assistance included Egypt (\$60,497,960), Zaire (\$35,452,540), and Guinea (\$27,300,000), while the three countries recording the lowest amount of assistance included Mali (\$30,000), Benin (\$28,000), and Mauritius (\$17,128).

Examining country data within African sub-regions revealed the following information.

- Eastern Africa received a total of 96 health projects during the study period. All but one of these projects provided sufficient financial information to be valued at a total of \$37,736,246. Over 70% of Eastern African project dollars were spent in only two of the 10 countries in that sub-region: Malawi (42%) and Somalia (28.4%). Per capita expenditures within countries in Eastern Africa ranged from a high of \$1.66 in Malawi to a low of less than 1¢ in Ethiopia (\$0.004).
- Middle Africa received a total of 20 health projects during the study period. All but one of the Middle African projects provided sufficient financial information to be valued at a total of \$53,615,570. Project dollars were distributed between the three countries within the sub-region as follows: 66.1% in Zaire, 33.9% in Cameroon, and one unknown budget in Chad. Per capita expenditures within countries in Middle Africa were calculated to be \$1.40 in Cameroon and 83¢ in Zaire.

- Northern Africa received a total of 28 health projects valued at \$89,874,395. The bulk of Northern African health dollars (67.3%) was spent in only one country, Egypt. The remaining project dollars were shared by the three other countries in that sub-region: Morocco (22.9%), Tunisia (9.6%), and Sudan (0.2%). Per capita expenditures within countries in Northern Africa ranged from a high of \$1.07 in Egypt to a low of 1¢ in Sudan.
- Southern Africa received a total of 9 health projects valued at \$25,602,491. Almost 70% of these project dollars were spent in Lesotho, while the two other countries in this sub-region (Botswana and Swaziland) received 29.1% and 1.3% of the health funds, respectively. Per capita expenditures within countries in Southern Africa were calculated to be \$9.18 in Lesotho, \$5.16 in Botswana, and 37¢ in Swaziland.
- Western Africa received a total of 35 health projects during the study period. All but one of these projects provided sufficient financial information to be valued at a total of \$71,536,045. Over 70% of sub-regional project dollars were utilized in two of the nine countries in this sub-region: Guinea (38.2%) and Senegal (32.1%). Per capita expenditures within countries in Western Africa ranged from a high of \$4.25 in Guinea to less than 1¢ in Mali and Cote d'Ivoire (\$0.003 and \$0.004, respectively).

Asia

The NSF literature review (Pytlik, et. al, 1997) identified a total of 222 health assistance projects implemented in 15 countries in Asia between 1985 and 1995 (see [Table A3](#), Appendix A). Of these 222 projects, 220 (or 99.1%) provided the necessary financial information to be valued at \$884,243,303.

The three Asian countries that received the largest amount of health assistance included Bangladesh (\$307,474,612), India (\$189,077,410), and Indonesia (\$155,001,437). The three countries that received the lowest amount of assistance included Vietnam (\$125,500), Yemen (\$29,000), and Malaysia (\$4,000).

Examining country data within Asian sub-regions revealed the following information.

- East Asia received a total of 62 health projects during the study period, valued at \$118,989,665. All of the project dollars were spent in one country in East Asia—China. Per capita expenditures for China were calculated to be 10¢ per person.
- Oceania received a total of 2 health projects valued at \$593,750. This was the only Asian sub-region that exhibited equity among countries receiving health assistance, with each of its two countries reporting \$296,875 in assistance during the study period. Per capita expenditures within the two countries in Oceania included 39¢ in Fiji and 7¢ in Papua New Guinea.
- South Central Asia received a total of 43 health projects during the study period. All but one of these projects provided sufficient financial information to be valued at a total of \$496,848,897. More than 60% of sub-regional health dollars were spent in Bangladesh, while 38% was spent in India, and only 0.1% in Pakistan. Per capita expenditures within the three countries in South Central Asia included \$2.61 in Bangladesh, 21¢ in India, and less than 1¢ in Pakistan (\$0.002).
- Southeast Asia received a total of 113 health projects during the study period. All but one of these projects provided sufficient financial information to be valued at a total of \$263,433,991. Two of the seven countries in Southeast Asia received 97% of sub-regional health dollars: Indonesia (58.8%) and Thailand (38.2%). Per capita expenditures within countries in Southeast

Asia ranged from a high of \$1.73 in Thailand to a low of less than 1¢ in Vietnam and Malaysia (\$0.002 and \$0.0002, respectively).

- Western Asia received a total of 2 health projects valued at \$4,377,000. Over 99% of sub-regional health dollars were spent in Lebanon, while Yemen received the remaining 0.7%. Per capita expenditures within Western Asia included \$1.11 in Lebanon and less than 1¢ in Yemen (\$0.002).

Latin America

The NSF literature review (Pytlik, et. al, 1997) identified a total of 200 health assistance projects implemented in 19 countries in Latin America between 1985 and 1995 (see [Table A4](#), Appendix A). Of these 200 projects, 198 (or 99%) provided the necessary financial information to be valued at \$413,900,780.

The three Latin American countries that received the largest amount of health assistance included El Salvador (\$159,941,888), Guatemala (\$60,639,763) and Nicaragua (\$43,006,888). The three countries that received the lowest amount of assistance included Colombia (\$612,266), Argentina (\$509,680), and Costa Rica (\$352,875).

Examining country data within Latin American sub-regions revealed the following information.

- The Caribbean received a total of 15 health projects during the study period, valued at \$22,317,572. Project dollars were distributed among the three countries in this sub-region as follows: Jamaica received 46.4%; Haiti, 43.3%; and the Dominican Republic, 10.3%. Per capita expenditures in the Caribbean included \$4.15 in Jamaica, \$1.38 in Haiti, and 30¢ in the Dominican Republic.
- Central America received a total of 57 health projects during the study period. All but one of these projects provided sufficient financial information to be valued at a total of \$291,208,243. More than ³/₄ of the project dollars were spent in two of the eight countries in Central America: El Salvador (54.9%) and Guatemala (20.8%). Per capita expenditures within this sub-region showed wide variance, ranging from highs of \$72.37 in Belize, \$28.38 in El Salvador, and \$10.35 in Nicaragua to lows of 35¢ in Honduras, 11¢ in Costa Rica, and 8¢ in Mexico.
- South America received a total of 128 health projects during the study period. All but one of these projects provided sufficient financial information to be valued at a total of \$100,374,965. Two of the eight countries in this sub-region received more than 62% of the project dollars: Peru (35.0%) and Uruguay (27.9%). Per capita expenditures within countries in South America ranged from a high of \$8.85 in Uruguay to a low of 1¢ in Argentina.

Source of Health Assistance Projects

The NSF literature review (Pytlik, et. al, 1997) identified a total of 610 science- and technology-related health projects implemented in 63 Third World nations between 1985 and 1995 by the Ford Foundation, the Rockefeller Foundation, the World Bank, and the United States Agency for International Development (USAID). Of these 610 projects, 603 (or 98.9%) provided the necessary financial information to be valued at \$1,576,508,830. [Tables B1](#) through [B8](#) in [Appendix B](#) analyze the funding source of these projects on a regional and sub-regional basis. The following summary provides an overview of the data found in those tables.

Number of Health Assistance Projects by International Donor Agency

In terms of project numbers, the Rockefeller Foundation was the primary contributor of health assistance during the study period, implementing 465 of the 610 health projects. As indicated in [Table 4.1](#), the Rockefeller Foundation initiated 76.2% of the total number of Third World health projects found in the literature review (Pytlik, et. al, 1997).

The USAID was the next largest sponsor with 77 projects (12.6% of total project numbers), while the Ford Foundation implemented 61 projects (10%) and the World Bank, 7 projects (1.2%).

Table 4.1. Number of Health Assistance Projects by International Donor Agency

International Donor Agency	Number of Health Projects	Percentage of Total Health Projects
THIRD WORLD HEALTH ASSISTANCE		
Rockefeller Foundation	465	76.2%
USAID	77	12.6%
Ford Foundation	61	10.0%
World Bank	7	1.2%
Total Third World Assistance	610	100.0%

Reviewing sources of health assistance within each of the three world regions revealed the following information.

Africa. Africa, as a whole, received a total of 188 health projects between 1985 and 1995 from the selected donor agencies. The Rockefeller Foundation provided 154 of these projects (81.9% of the total number of African projects), followed by the USAID with 23 projects (12.3%), the Ford Foundation with 10 projects (5.3%), and the World Bank with 1 project (0.5%). [Table 4.2](#) depicts the number and percentage of health assistance projects contributed by each of the four international donor agencies in Africa.

Table 4.2. African Health Projects Categorized by International Donor Agency

International Donor Agency	Number of Health Projects	Percentage of Total African Health Projects
AFRICAN HEALTH ASSISTANCE		
Rockefeller Foundation	154	81.9%
USAID	23	12.3%
Ford Foundation	10	5.3%
World Bank	1	0.5%
Total African Assistance	188	100.0%

Examining African health assistance on a sub-regional basis revealed that the Rockefeller Foundation initiated the majority of sub-regional health projects within Africa, as outlined in [Table B2](#) in Appendix B and summarized below.

- Eastern Africa received a total of 96 health projects during the study period, 90.6% of which were sponsored by the Rockefeller Foundation. The remaining 9.4% was shared by the USAID (7.3%) and the Ford Foundation (2.1%).
- Middle Africa received a total of 20 health projects during the study period. The Rockefeller Foundation sponsored 80% of these sub-regional projects and the USAID sponsored 20%.
- Northern Africa received a total of 28 health projects during the study period. The Rockefeller Foundation initiated 67.9% of these projects, while the Ford Foundation initiated 21.4% and the USAID, 10.7%.
- Southern Africa received a total of 9 health projects during the study period, of which the Rockefeller Foundation sponsored 55.6% and the USAID sponsored 44.4%.
- Western Africa received a total of 35 health projects during the study period. This was the only African sub-region to receive health assistance from each of the four international donor agencies, with the Rockefeller Foundation sponsoring 77.1%; the USAID sponsoring 14.3%; the Ford Foundation, 5.7%; and the World Bank, 2.9%.

Asia. Asia received a total of 222 health projects between 1985 and 1995 from the selected donor agencies. The Rockefeller Foundation provided 159 of these projects (71.6% of the total number of Asian projects), followed by the Ford Foundation with 40 projects (18%), the USAID with 20 projects (9%), and the World Bank with 3 projects (1.4%). Table 4.3 depicts the number and percentage of health assistance projects contributed by each of the four international donor agencies in Asia.

Table 4.3. Asian Health Projects Categorized by International Donor Agency

International Donor Agency	Number of Health Projects	Percentage of Total Asian Health Projects
ASIAN HEALTH ASSISTANCE		
Rockefeller Foundation	159	71.6%
Ford Foundation	40	18.0%
USAID	20	9.0%
World Bank	3	1.4%
Total Asian Assistance	222	100.0%

Examining health assistance on a sub-regional basis revealed that a substantial portion of health assistance in Asia was contributed by three of the donor agencies: the Rockefeller Foundation, the USAID, and the Ford Foundation. Sub-regional statistics for Asia are outlined in [Table B3](#) in Appendix B and summarized below.

- East Asia received a total of 62 health projects during the study period, the majority of which were sponsored by the Rockefeller Foundation (79%). The Ford Foundation sponsored another 19.4% and the World Bank sponsored 1.6%.
- Oceania received a total of 2 health projects during the study period, both initiated by the USAID.
- South Central Asia received a total of 43 health projects during the study period. This was the only Asian sub-region to receive health assistance from each of the four international donor agencies, with the Rockefeller Foundation and the Ford Foundation each sponsoring 41.9% of the projects; the USAID sponsoring 11.6%; and the World Bank, 4.6%.
- Southeast Asia received a total of 113 health projects during the study period. The primary contributor in this sub-region was the Rockefeller Foundation, initiating 81.4% of the total number of projects. The USAID initiated another 10.6% and the Ford Foundation implemented the remaining 8%.
- Western Asia received a total of 2 health projects during the study period. One was sponsored by the Ford Foundation and one by the USAID.

Latin America. Latin America received a total of 200 health projects between 1985 and 1995 from the selected donor agencies. The Rockefeller Foundation provided 152 of these projects (76% of the total number of Latin American projects), followed by the USAID with 34 projects (17%), the Ford Foundation with 11 projects (5.5%), and the World Bank with 3 projects (1.5%). Table 4.4 depicts the number and percentage of health assistance projects contributed by each of the four international donor agencies in Latin America.

Table 4.4. Latin American Health Projects Categorized by International Donor Agency

International Donor Agency	Number of Health Projects	Percentage of Total Latin American Health Projects
LATIN AMERICAN HEALTH ASSISTANCE		
Rockefeller Foundation	152	76.0%
USAID	34	17.0%
Ford Foundation	11	5.5%
World Bank	3	1.5%
Total Latin American Assistance	200	100.0%

Examining health assistance on a sub-regional basis revealed that in all but one of the sub-regions, the Rockefeller Foundation was the leading contributor of Latin American health assistance, as outlined in [Table B4](#) in Appendix B and summarized below.

- The Caribbean received a total of 15 health projects during the study period, 46.7% of which were sponsored by the USAID, 40% by the Rockefeller Foundation, and 13.3% by the Ford Foundation. This was the only Latin American sub-region that did not receive assistance from each of the four international donor agencies.
- Central America received a total of 57 health projects during the study period. The Rockefeller Foundation initiated the greatest share of these projects (63.2%), while the USAID sponsored 29.8%; the Ford Foundation, 5.3%; and the World Bank, 1.7%.
- South America received a total of 128 health projects during the study period, 85.9% of which were initiated by the Rockefeller Foundation, 7.8% by the USAID, 4.7% by the Ford Foundation, and 1.6% by the World Bank.

Dollar Value of Health Assistance Projects by International Donor Agency

In terms of project dollars, the USAID provided the bulk of health assistance dollars during the study period, spending approximately \$1.2 billion of the total \$1.6 billion. As indicated in Table 4.5, the USAID funded 75.7% of the total dollars spent on Third World health projects found in the literature review (Pytlik, et. al, 1997).

The second largest contributor was the World Bank with approximately \$351.9 million, representing 22.3% of the total project dollars. Combined, the USAID and the World Bank supplied 98% of all health assistance dollars in Third World regions. In addition, the Rockefeller Foundation contributed \$24.5 million (1.5% of total project dollars) and the Ford Foundation contributed \$6.9 million (0.5%).

Table 4.5. Dollar Value of Health Assistance Projects by International Donor Agency

International Donor Agency	Dollar Value of Health Projects	Percentage of Total Health Dollars
THIRD WORLD HEALTH DOLLARS		
USAID	\$1,193,167,592 *	75.7%
World Bank	\$351,860,000	22.3%
Rockefeller Foundation	\$24,540,937	1.5%
Ford Foundation	\$6,940,301	0.5%
Total Third World Health Dollars	\$1,576,508,830 *	100.0%
* 7 Unknown USAID Budgets: 1 each in Kenya, Chad, Ghana, Pakistan, Philippines, Honduras, and Peru		

Reviewing sources of health assistance within each of the three world regions revealed the following information.

Africa. Africa received a total of approximately \$278.4 million in health assistance between 1985 and 1995 from the selected donor agencies. These moneys were primarily provided by the USAID, which spent approximately \$241.4 million (86.7% of the total African health dollars), followed by the World Bank with \$27.3 million (9.8%), the Rockefeller Foundation with \$8.3 million (3%), and the Ford Foundation with approximately \$1.4 million (0.5%). Table 4.6 depicts the dollar value and percentage of health assistance contributed by each of the four international donor agencies in Africa.

Table 4.6. African Health Dollars Categorized by International Donor Agency

International Donor Agency	Dollar Value of Health Projects	Percentage of Total African Health Dollars
AFRICAN HEALTH DOLLARS		
USAID	\$241,350,975 *	86.7%
World Bank	\$27,300,000	9.8%
Rockefeller Foundation	\$8,339,005	3.0%
Ford Foundation	\$1,374,767	0.5%
Total African Health Dollars	\$278,364,747 *	100.0%
* 3 Unknown USAID Budgets: 1 each in Kenya, Chad, and Ghana		

Examining African health assistance on a sub-regional basis revealed that the USAID funded the vast majority of sub-regional health projects in Africa, as outlined in [Table B2](#) in Appendix B and summarized below.

- Eastern Africa received \$37.7 million in health assistance during the study period. The USAID financed the greatest share of these dollars (84.8%), while the Rockefeller Foundation funded 14.7% and the Ford Foundation, 0.5%.
- Middle Africa received a total of \$53.6 million in health assistance during the study period, of which 98.8% was funded by the USAID and 1.2% by the Rockefeller Foundation.
- Northern Africa received a total of approximately \$89.9 million during the study period, nearly all of which was financed by the USAID (99.3%). The Rockefeller Foundation and the Ford Foundation provided the remaining funding, at 0.5% and 0.2% respectively.
- Southern Africa received a total of \$25.6 million in health assistance during the study period, 99.6% of which was financed by the USAID and 0.4% by the Rockefeller Foundation.
- Western Africa received a total of \$71.5 million in health assistance during the study period. This was the only African sub-region to receive health dollars from each of the four international donor agencies, with the USAID funding 58.2%; the World Bank funding 38.2%; the Rockefeller Foundation, 2.2%; and the Ford Foundation, 1.4%.

Asia. Asia received a total of \$884.2 million in health assistance between 1985 and 1995 from the selected donor agencies. The USAID provided \$581.6 million (65.8% of the total Asian health dollars), followed by the World Bank with approximately \$291.4 million (32.9%), the Rockefeller Foundation with \$6.8 million (0.8%), and the Ford Foundation with \$4.4 million (0.5%). Table 4.7 depicts the dollar value and percentage of health assistance contributed by each of the four international donor agencies in Asia.

Table 4.7. Asian Health Dollars Categorized by International Donor Agency

International Donor Agency	Dollar Value of Health Projects	Percentage of Total Asian Health Dollars
ASIAN HEALTH DOLLARS		
USAID	\$581,632,750 *	65.8%
World Bank	\$291,360,000	32.9%
Rockefeller Foundation	\$6,835,082	0.8%
Ford Foundation	\$4,415,471	0.5%
Total Asian Health Dollars	\$884,243,303 *	100.0%
* 2 Unknown USAID Budgets: 1 each in Pakistan and the Philippines		

Examining health assistance on a sub-regional basis revealed that in all but one of the sub-regions, the USAID was the leading contributor to Asian health assistance, as outlined in [Table B3](#) in Appendix B and summarized below.

- East Asia received a total of approximately \$118.9 million in health assistance during the study period, 96.3% of which was financed by the World Bank. The remaining 3.7% was funded by the Rockefeller Foundation (2.4%) and the Ford Foundation (1.3%).
- Oceania received a total of approximately \$593,750 in health assistance during the study period, all of which was funded by the USAID.
- South Central Asia received a total of \$496.8 million in health assistance during the study period. This was the only Asian sub-region to receive health dollars from each of the four international donor agencies, with the USAID contributing 63.8%; the World Bank contributing 35.6%; the Ford Foundation, 0.4%; and the Rockefeller Foundation, 0.2%.
- Southeast Asia received a total of \$263.4 million in health assistance during the study period. The primary contributor in this sub-region was the USAID, which financed 98.6% of the Southeast Asian health dollars. The remaining dollars were funded by the Rockefeller Foundation (1.1%) and the Ford Foundation (0.3%).
- Western Asia received a total of approximately \$4.4 million in health assistance during the study period, of which 99.3% was funded by the USAID and 0.7% by the Ford Foundation.

Latin America. Latin America received a total of \$413.9 million in health assistance between 1985 and 1995 from the selected donor agencies. The USAID provided approximately \$370.2 million (89.4% of the total Latin American health dollars), followed by the World Bank with \$33.2 million (8%), the Rockefeller Foundation with approximately \$9.4 million (2.3%), and the Ford Foundation with approximately \$1.2 million (0.3%). Table 4.8 depicts the dollar value and percentage of health assistance contributed by each of the four international donor agencies in Latin America.

Table 4.8. Latin American Health Dollars Categorized by International Donor Agency

International Donor Agency	Dollar Value of Health Projects	Percentage of Total Latin American Health Dollars
LATIN AMERICAN HEALTH DOLLARS		
USAID	\$370,183,867 *	89.4%
World Bank	\$33,200,000	8.0%
Rockefeller Foundation	\$9,366,850	2.3%
Ford Foundation	<u>\$1,150,063</u>	0.3%
Total Latin American Health Dollars	\$413,900,780 *	100.0%
* 2 Unknown USAID Budgets: 1 each in Honduras and Peru		

Examining health assistance on a sub-regional basis revealed that the USAID financed the majority of sub-regional health dollars in Latin America, as outlined in [Table B4](#) in Appendix B and summarized below.

- The Caribbean received a total of \$22.3 million in health assistance during the study period, 98.2% of which was financed by the USAID, 1.3% by the Rockefeller Foundation, and 0.5% by the Ford Foundation. This was the only Latin American sub-region that did not receive health assistance from each of the four international donor agencies.
- Central America received a total of \$291.2 million in health assistance during the study period. The USAID funded nearly all of these health dollars (97.6%), while the World Bank financed 1.4%; the Rockefeller Foundation, 0.9%; and the Ford Foundation, 0.1%.
- South America received a total of approximately \$100.4 million in health assistance during the study period, of which 63.9% was financed by the USAID, 29.1% by the World Bank, 6.4% by the Rockefeller Foundation, and 0.6% by the Ford Foundation.

Funding Agency Summaries

To better understand the particular regions, sub-regions, and countries that received the greatest benefit from each of the four donor agencies, a review of project allocation by funding agency was developed. [Tables B5](#) through [B8](#) in Appendix B analyze the distribution of health projects by donor agency on a regional and sub-regional basis. The following summary provides an overview of the information found in those tables.

Ford Foundation. In terms of project numbers, the Ford Foundation implemented over 65% of its 61 health projects in Asia, particularly in the South Central, East, and Southeast sub-regions (see [Table B5](#), Appendix B). South Central Asia received 18 health projects, 10 of which were executed in India and eight in Bangladesh. East Asia received 12 health projects, all of which were implemented in China, and Southeast Asia received 9 health projects, six in Indonesia and three in Thailand.

In terms of project dollars, the Ford Foundation spent the majority (63.6%) of its \$6.9 million in the same three Asian sub-regions. India and Bangladesh in South Central Asia received a total of \$1.9 million, China in East Asia received \$1.5 million, and Indonesia and Thailand in Southeast Asia received a total of \$892,034.

Rockefeller Foundation. As indicated in [Table B6](#) in Appendix B, the Rockefeller Foundation distributed its 465 health assistance projects fairly equitably among the three world regions, with Asia receiving 159 projects (34.2%), Africa receiving 154 projects (33.1%), and Latin America receiving 152 projects (32.7%). The three sub-regions that received the largest number of health assistance projects were South America with 110 projects, Southeast Asia with 92 projects, and Eastern Africa with 87 projects. The countries within each of these sub-regions that received the majority of sub-regional projects included:

- Brazil (44 projects) and Chile (38 projects) in South America
- Thailand (48 projects), Indonesia (18 projects), and the Philippines (18 projects) in Southeast Asia
- Kenya (34 projects) and Uganda (18 projects) in Eastern Africa

In terms of project dollars, the Rockefeller Foundation again equitably divided its \$24.5 million among the three regions, spending approximately \$9.4 million in Latin America (38.2%), \$8.3 million in Africa (34%), and \$6.8 million in Asia (27.8%). The two sub-regions that

received nearly half of all Rockefeller funds included South America, with \$6.4 million, and Eastern Africa, with approximately \$5.6 million. In South America, Brazil and Chile were the primary recipients of Rockefeller dollars, receiving \$3.5 million and \$1.9 million, respectively. In Eastern Africa, Kenya and Uganda received the largest portion of sub-regional health dollars, with \$1.7 million and \$1.8 million, respectively.

United States Agency for International Development (USAID). In terms of project numbers, almost half (44.1%) of all 77 USAID projects were implemented in Latin America, followed by Africa with 29.9% and Asia with 26% (see [Table B7](#), Appendix B). The three sub-regions that received the majority of USAID health projects were Central America with 17 projects, Southeast Asia with 12 projects, and South America with 10 projects. The countries within each of these sub-regions that received the majority of sub-regional health projects included:

- Guatemala (5 projects) and El Salvador (4 projects) in Central America
- Indonesia (7 projects) in Southeast Asia
- Bolivia (4 projects) and Peru (3 projects) in South America

In terms of project dollars, the USAID concentrated most of its funding in Asia (48.9% of \$1.2 billion), followed by Latin America (31%) and Africa (20.1%). The three sub-regions that received the largest share of USAID dollars were South Central Asia with \$317 million, Central America with \$284.2 million, and Southeast Asia with \$259.6 million. The countries within each of these sub-regions that received the bulk of sub-regional health dollars included:

- Bangladesh in South Central Asia, with \$306.6 million
- El Salvador in Central America, with \$159.9 million
- Indonesia in Southeast Asia, with \$153.9 million

World Bank. The literature review only identified a total of seven health projects sponsored by the World Bank (see [Table B8](#), Appendix B). As previously noted, due to the time constraints of the study and the limited amount of readily available literature, this number most likely represents only a portion of the total amount of health assistance provided by the World Bank during the study period.

In terms of project numbers, each of the three Third World regions received from one to three projects, with Africa receiving one project, and Asia and Latin America receiving three projects each. The African project was implemented in Guinea in Western Africa. One of the Asian projects was implemented in China in East Asia, while the other two were initiated in India in South Central Asia. In Latin America, one project was implemented in the Central sub-region in Mexico, while two projects were implemented in the Southern sub-region, one in Brazil and one in Uruguay.

Although the World Bank contributed little in the way of project numbers, in terms of project dollars, it funded a considerable portion of health assistance in Third World regions, spending approximately \$351.9 million. These funds, however, were almost totally concentrated in Asia, which received 82.8% of total World Bank dollars. The countries and sub-regions which received the bulk of this funding included India in South Central Asia, with \$176.8 million, and China in East Asia, with \$114.6 million.

Types of Health Assistance Projects

Examining the types of health projects identified in the NSF literature review (Pytlik et al., 1997) revealed that, during the study period, nine general types of health assistance were initiated by the selected donor agencies in Third World countries. These included projects focusing on public health, epidemiology surveillance, immunization, reproductive biology and fertility regulation, maternal and child health, injuries, prosthetic and orthotic services, communicable diseases, and noncommunicable diseases, as described below.

1. *Public health initiatives* included those projects that sought to develop, enhance, or support general physical and mental health through the promotion and provision of basic or primary health care, medical facilities, equipment, supplies, nutrition, safe water, sanitation, health sector reform, or through research and investigation of community health issues. Public health initiatives were found in both single-objective projects, like those targeting public health alone, as well as in multiple-objective projects, like those concerned with both public health and agricultural development.
2. *Epidemiology surveillance* programs included those projects that were primarily concerned with “the study of the occurrence, distribution, and causes of disease in humankind” (Anderson, Anderson, & Glanze, 1994, p. 560).
3. *Immunization* programs included those health projects that sought to build up a specific population’s resistance to infectious disease.
4. *Reproductive biology and fertility regulation* programs included those projects that targeted reproductive health, fertility, family planning, and contraception issues.
5. *Maternal and child health* programs included those projects that were primarily focused on the health and survival of women and children.
6. *Injury* initiatives included those health projects that were involved in the research and prevention of injuries.
7. *Prosthetic and orthotic services* incorporated those projects that provided either artificial limbs or devices to replace missing body parts, or external appliances to promote motion in paralyzed muscles or improve musculoskeletal deformities.
8. *Communicable disease* programs included those health projects that targeted diseases that could be communicated or “transmitted from one person or animal to another directly, by contact with excreta or other discharges from the body; or indirectly, via substances or inanimate objects, such as contaminated drinking glasses, toys, or water; or via vectors, as flies, mosquitoes, ticks, or other insects” (Anderson et al., 1994, p. 367).
9. *Noncommunicable disease* programs included those projects that were concerned with diseases that were not communicable.

In addition to project type, projects were also evaluated in terms of the primary method used to accomplish the general objective. Four project methodologies were identified:

- A. *Program development and support* involved the actual origination or the continued support of a particular health initiative.

B. *Research and investigation* involved either the experimental research of illness and disease or the investigation of public health issues.

C. *Education and training* involved formal medical training of health care professionals as well as informal public health training.

D. *Equipment and supplies* involved the purchase of equipment and supplies in support of health initiatives.

Table C1 in Appendix C analyzes the 610 health assistance projects valued at \$1.577 billion by project type and project methodology. The following summary provides an overview of the information found in Table C1.

Number of Health Assistance Projects by Project Type and Project Deliverable

In terms of project numbers, over $\frac{1}{3}$ of all health assistance projects were initiated in support of reproductive biology and fertility regulation, with a total of 225 projects or 36.9% of the total number of Third World health projects, as indicated in Table C1 in Appendix C. The primary focus of these reproduction and fertility initiatives involved experimental research in reproductive health, fertility, and contraception methods with 159 projects, followed by education and training in reproduction and fertility issues with 51 projects, program development and support with 12 projects, and the purchase of appropriate equipment and supplies with 3 projects.

The second largest number of projects (106 projects or 17.4% of total Third World projects) were those related to communicable disease research. More than 64% of these projects were implemented in two of the 13 communicable disease categories: sexually transmitted diseases (STDs) and diarrheal infections. STD initiatives received a total of 46 projects or 7.4% of all Third World projects, the majority of which involved research of STDs (31 projects). Further analysis of these research projects revealed a total of 24 projects involving research of the human immunodeficiency virus (HIV), 5 projects examining STDs and HIV, and 2 projects concentrating on STDs other than HIV. The remaining projects in the STD category included 5 projects that promoted the development and support of HIV programs, and 10 projects that provided HIV education and training.

Diarrheal infection initiatives received another 22 projects within the communicable disease category, or 3.6% of all Third World projects. Research, once again, received the largest number of projects within this sub-category (19 projects), followed by education and training (2 projects), and program development and support (1 project).

The third largest number of projects focused on epidemiology surveillance, with a total of 99 projects representing 16.2% of Third World assistance. The majority of these projects (96 projects) were initiated in support of the International Clinical Epidemiology Network; a network that linked clinical epidemiology units in developing countries with similar resource and training centers in the developed world.

Thus, nearly $\frac{3}{4}$ of the total number of health assistance projects sponsored by the international donor agencies involved initiatives in reproductive biology and fertility regulation, communicable disease, and epidemiology surveillance. The remaining $\frac{1}{4}$ included projects that promoted public health (62 projects or 10.1% of Third World projects), maternal and child health (44 projects or 7.2%), noncommunicable disease research (33 projects or 5.4%), immunization (19 projects or 3.1%), multiple-objective projects targeting public health as well as agricultural and economic development (17 projects or 2.8%), injury research (4 projects or 0.7%), and

prosthetic and orthotic services (1 project or 0.2%).

Dollar Value of Health Assistance Projects by Project Type and Project Deliverable

In terms of project dollars, nearly 80% of all Third World health assistance dollars were spent among three project categories: reproductive biology and fertility regulation, public health, and noncommunicable disease initiatives. As indicated in [Table C1](#) in Appendix C, the largest amount of project dollars were allocated to the project type that also received the highest number of projects, reproductive biology and fertility regulation. These reproduction and fertility initiatives received a total of \$495 million or 31.4% of all Third World project dollars, the majority of which was concentrated in the development and support of such programs (\$358.6 million). The remaining moneys in this category were allocated to education and training (\$119.5 million), experimental research (\$9.8 million), and the purchase of appropriate equipment and supplies (\$7.2 million).

The second largest amount of health dollars was spent on single-objective public health initiatives, which received \$403.4 million or 25.6% of total Third World assistance. Again, program development and support for these initiatives received the majority of funds in this category (\$381.1 million), followed by education and training (\$21 million), equipment and supplies (\$843,800), and research and investigation into public health issues (\$428,490).

The third largest amount of project dollars was allocated to noncommunicable disease research, which received \$357.5 million or 22.7% of total Third World health dollars. Aside from a minimal amount of money being spent on nine other noncommunicable diseases, the vast majority of noncommunicable health funds (\$350.5 million) were expended on micronutrient deficiencies and anemia initiatives. This category focused on problems involving nutritional deficiencies of such key micronutrients as vitamin A, iron, iodine, and the underconsumption of protein and energy as well as problems with anemia. In the micronutrient category, program development once again received the bulk of funds, receiving \$297.4 million, while experimental research received \$53.1 million.

The remaining 20% of Third World health dollars were spent on immunization (\$154.5 million or 9.8% of Third World assistance), maternal and child health (\$73.7 million or 4.6%), communicable disease control (\$55.7 million or 3.4%), multiple-objective projects targeting public health as well as agricultural and economic development (\$19.8 million or 1.3%), epidemiology surveillance (\$12.6 million or 0.8%), prosthetic and orthotic services (\$4.3 million or 0.3%), and injury initiatives (\$25,000 or less than 0.1%).

Change in Health Status in Selected Countries

To determine the change in health status during the study period, information was gathered from the World Bank's Social Indicators of Development 1996 for selected Third World countries regarding the following health-related indicators:

- Life Expectancy at Birth
- Infant Mortality Rate
- Maternal Mortality Rate
- Total Fertility Rate
- Immunization for Measles
- Immunization for Diphtheria, Pertussis, and Tetanus (DPT)
- Population per Physician
- Population per Hospital Bed

Twelve countries from each world region were selected for comparative purposes by identifying the three countries that received the highest and the three that received the lowest number of regional health projects, as well as the three countries that received the largest and the three that received the smallest amount of regional health assistance dollars. The average change in each indicator was then compared between high and low recipient countries, both in terms of project numbers and project dollars, to determine if any improvements in health status had occurred and if any significant differences existed between the two country groups that might be attributed to the presence of health assistance projects.

Individual country statistics and multi-country averages are presented in Appendices D and E, with [Appendix D](#) displaying information based on the number of projects received and [Appendix E](#) presenting information based on the amount of project dollars received. The first three tables in each Appendix (Tables D1-D3 and E1-E3) present a regional overview of average health indicators for both high and low recipient countries, as well as the mathematical differences between the two country groups. The remaining tables in each Appendix provide supporting data for the individual countries used in the group comparisons.

The following information summarizes the data found in Appendices D and E with respect to the improvement in health status during the study period.

African Health Indicators Based on Project Numbers

In terms of project numbers, the three African countries that received the highest number of health assistance projects included Kenya (37 projects valued at \$2.1 million), Egypt (21 projects at \$60.5 million), and Nigeria (20 projects at \$1.3 million), as indicated in [Table D4](#) in Appendix D. The three countries that were randomly selected to represent the countries receiving the lowest number of projects included Somalia (1 project at \$10.7 million), Cote d'Ivoire (1 project at \$50,000), and Mauritius (1 project at \$17,128), as referenced in [Table D5](#).

Analyzing the average percentage change that occurred in the health indicators of these African countries revealed that the majority of indicators improved between 1985 and 1994, in both high and low recipient countries (see [Table D1](#)). Even with these improvements, however, nearly all of the health indicators remained at substandard levels when compared to First World norms.

Comparing the difference in change between average indicators revealed that high recipient countries saw substantially greater improvements in maternal mortality and measles immunization rates during the study period than did low recipient countries (see [Table D1](#)). The change in maternal mortality rates, for example, differed by 59.2 percentage points between the

two groups, with the high recipient countries recording an average decrease in mortality of 2.4% while the low recipient countries reported a 56.8% increase during the same period. Likewise, the difference in the average change in measles immunization was determined to be 66 percentage points, with high recipient countries reporting an average immunization increase of 85.1% as opposed to only a 19.1% increase in low recipient countries.

The largest variance in Africa, however, was found in the area of population per physician, which recorded a difference of 104.1 percentage points between the two country groups. Yet unlike the former improvements which favored high recipient countries, the change in this indicator provided more benefit to low recipient countries, as they reported an average decrease of 38.5% in population per physician during the study period as opposed to an average increase of 65.6% in high recipient countries.

No significant difference was found between high and low recipient countries with respect to changes in life expectancy, infant mortality, DPT immunization, and fertility rates, as each group experienced similar rates of improvement during the period that fell within a 20 percentage point range of each other. No conclusion could be made with respect to population per hospital bed due to the fact that comparative data from low recipient countries was unavailable.

African Health Indicators Based on Project Dollars

In terms of project dollars, the three African countries that received the largest amount of health assistance dollars included Egypt (\$60.5 million for 21 projects), Zaire (\$35.5 million for 7 projects), and Guinea (\$27.3 million for 1 project), while the three countries that received the lowest amount of project dollars included Mali (\$30,000 for 1 project), Benin (\$28,000 for 1 project), and Mauritius (\$17,128 for 1 project), as referenced in [Tables E4](#) and [E5](#) in Appendix E.

An examination of the average percentage change that occurred in the health indicators of these African countries revealed that except for two of the eight health indicators (maternal mortality and population per hospital bed), African countries generally experienced improvements in health status between 1985 and 1994, in both high and low recipient countries (see [Table E1](#)). Even with these improvements, however, nearly all of the health indicators remained at substandard levels when compared to First World norms.

Comparing the difference in change between average indicators revealed that high recipient countries saw substantially greater improvements in DPT immunization and population per physician ratios than did low recipient countries (see [Table E1](#)). The change in population per physician, for instance, differed by 4,129.1 percentage points between the two groups, with the high recipient countries recording a 4,115.1% average decrease in population per physician while the low recipient countries reported a 14% increase during the same period. Likewise, the difference in the average change in DPT immunization was determined to be 173.3 percentage points, with high recipient countries reporting an average immunization increase of 367.6% as opposed to a 194.3% increase for low recipient countries.

A notable difference of 45.9 percentage points was also found between the two country groups regarding the average change in population per hospital bed. Although the change in this indicator favored neither country group, since both groups reported increases during the study period, high recipient countries did show a smaller increase in population per bed (7%) than low recipient countries (52.9%).

Two other significant variances were found in [Table E1](#), but the average change that occurred in these two indicators provided more benefit to low recipient countries than to high. The first variance of 226.8 percentage points concerned measles immunization, with low recipient countries reporting an average increase of 234% in immunization during the study period as opposed to an average increase of only 7.2% reported by high recipient countries. The second variance of 28.1 percentage points involved maternal mortality rates. Although changes in this indicator were unfavorable to both country groups, low recipient countries did report a smaller average mortality increase (47.1%) than high recipient countries (75.2%).

No significant difference was found between country groups with respect to life expectancy, infant mortality, and fertility rates, as each group experienced similar rates of improvement during the period that fell within a 7 percentage point range of each other.

Asian Health Indicators Based on Project Numbers

In terms of project numbers, the three countries that received the highest number of health assistance projects in Asia included China (62 projects valued at \$118.9 million), Thailand (52 projects at \$100.6 million), and Indonesia (31 projects at \$155 million), as indicated in [Table D6](#) in Appendix D. The three countries that were randomly selected to represent the countries receiving the lowest number of projects in Asia included Lebanon (1 project at \$4.3 million), and Papua New Guinea and Myanmar (1 project each at \$296,875 each), as referenced in [Table D7](#).

Analyzing the average percentage change that occurred in the health indicators of these Asian countries revealed that the majority of indicators improved between 1985 and 1994, in both high and low recipient countries (see [Table D2](#)). Even with these improvements, however, many of the health indicators, like infant and maternal mortality, and populations per physician and per hospital bed, remained at substandard levels when compared to First World norms.

Comparing the difference in change between average indicators revealed that high recipient countries saw substantially greater improvements in five of the eight health indicators (maternal mortality, measles immunization, DPT immunization, population per physician, and population per hospital bed) than did low recipient countries (see [Table D2](#)). The change in population per physician, for example, differed by 133.4 percentage points between the two groups, with the high recipient countries recording an average decrease of 15.1% while the low recipient countries reported an average increase of 118.3% during the same period. Likewise, the difference in the change in measles immunization was determined to be 107 percentage points, with high recipient countries reporting an average increase in immunization of 210.6% as opposed to a 103.6% increase for low recipient countries. The variance between country groups for population per hospital bed, DPT immunization, and maternal mortality was calculated to be 39.6 percentage points, 39.1 percentage points, and 37.8 percentage points, respectively.

No significant difference was found between high and low recipient countries with respect to life expectancy, infant mortality, and fertility rates, as each group experienced similar rates of improvement during the period that fell within a 10 percentage point range of each other.

Asian Health Indicators Based on Project Dollars

In terms of project dollars, the three Asian countries that received the largest amount of health assistance dollars included Bangladesh (\$307.5 million for 10 projects), India (\$189.1 million for 31 projects), and Indonesia (\$155 million for 31 projects), while the three countries that received the lowest amount of project dollars included Vietnam (\$125,500 for 4 projects), Yemen (\$29,000 for 1 project), and Malaysia (\$4,000 for 1 project), as referenced in [Tables E6](#) and [E7](#) in Appendix E.

An examination of the average percentage change that occurred in the health indicators of these Asian countries revealed that the majority of indicators improved between 1985 and 1994, in both high and low recipient countries (see [Table E2](#)). Even with these improvements, however, many of the health indicators, like infant and maternal mortality, and populations per physician and per hospital bed, remained at substandard levels when compared to First World norms.

Comparing the difference in change between average indicators revealed that high recipient countries saw substantially greater changes in measles immunization, DPT immunization, and maternal mortality rates than did low recipient countries (see [Table E2](#)). The change in measles immunization, for instance, differed by 3,540.5 percentage points between the two groups, with high recipient countries recording an average immunization increase of 3,861.7% while low recipient countries reported a 321.2% increase during the same period. Likewise, the difference in the change in DPT immunization was determined to be 1,272.7 percentage points, with high recipient countries reporting an average increase of 1,349.4% in immunization as opposed to a 76.7% increase for low recipient countries. The variance between country groups for maternal mortality was calculated at 27.9 percentage points, with high recipient countries disclosing a 37.7% decrease in mortality and low recipient countries reporting only a 9.8% decrease.

No significant difference was found between country groups with respect to the five other health indicators (life expectancy, infant mortality, fertility rates, population per physician, and population per hospital bed), as each group experienced similar rates of improvement during the period that fell within a 14 percentage point range of each other.

Latin American Health Indicators Based on Project Numbers

In terms of project numbers, the three Latin American countries that received the highest number of health assistance projects included Brazil (46 projects valued at \$4.7 million), Chile (41 projects at \$3.6 million), and Mexico (37 projects at \$6.9 million), while the three countries that received the lowest number of projects included Honduras (2 projects at \$2 million), Uruguay (1 project at \$28 million), and Panama (1 project at \$3 million), as referenced in [Tables D8](#) and [D9](#) in Appendix D.

Analyzing the average percentage change that occurred in the health indicators of these Latin American countries revealed that except for three of the eight health indicators (maternal mortality, population per physician, and population per hospital bed), Latin American countries generally experienced improvements in health status between 1985 and 1994, in both high and low recipient countries (see [Table D3](#)). Even with these improvements, however, many of the health indicators, like infant mortality and DPT immunization, remained at substandard levels when compared to First World norms.

Comparing the difference in change between average indicators revealed substantially greater improvements in maternal mortality and measles immunization rates, but for low recipient countries (see [Table D3](#)). The change in measles immunization, for instance, differed by 101.3 percentage points between the two groups, with low recipient countries recording an average increase in immunization of 162.8% and high recipient countries reporting a 61.5% increase. Likewise, the difference in maternal mortality rates was determined to be 64.3 percentage points, with low recipient countries recording an average mortality decrease of 31% during the study period as opposed to a 33.3% increase reported by high recipient countries.

No significant difference was found between high and low recipient countries with respect to the other six health indicators (life expectancy, infant mortality, fertility rates, DPT immunization, population per physician, population per hospital bed), as each group experienced similar rates of improvement during the period that fell within a 14 percentage point range of each other.

Latin American Health Indicators Based on Project Dollars

In terms of project dollars, the three Latin American countries that received the largest amount of health assistance dollars included El Salvador (\$159.9 million for 4 projects), Guatemala (\$60.6 million for 5 projects), and Nicaragua (\$43 million for 2 projects), while the three countries that received the lowest amount of project dollars included Colombia (\$612,266 for 12 projects), Argentina (\$509,680 for 15 projects), and Costa Rica (\$352,875 for 4 projects), as referenced in [Tables E8](#) and [E9](#) in Appendix E.

An examination of the average percentage change that occurred in the health indicators of these Latin American countries revealed that except for two of the eight health indicators (maternal mortality and population per hospital bed), Latin American countries generally experienced improvements in health status between 1985 and 1994, in both high and low recipient countries (see [Table E3](#)). Even with these improvements, however, some of the health indicators, like immunization and infant mortality rates, remained at substandard levels when compared to First World norms.

Comparing the difference in change between average indicators revealed that high recipient countries saw substantially greater improvements in measles and DPT immunization rates than did low recipient countries (see [Table E3](#)). The change in measles immunization, for instance, differed by 41.5 percentage points between the two groups, with the high recipient countries recording an average increase in immunization of 62.4% while the low recipient countries reported a 20.9% increase during the same period. Likewise, the difference in DPT immunization was determined to be 30.6 percentage points, with high recipient countries recording an average increase of 58.3% as opposed to a 27.7% increase for low recipient countries.

A notable variance of 29.9 percentage points was also found between the two country groups regarding the average change in maternal mortality rates. Although the change in this indicator favored neither country group, since both groups reported mortality increases during the study period, low recipient countries reported a smaller increase in mortality (24.8%) than high recipient countries (54.7%).

No significant difference was found between country groups with respect to life expectancy, infant mortality, fertility rates, and population per hospital bed, as each group experienced similar rates of improvement during the period that fell within a 20 percentage point range of each other. No conclusion could be made regarding population per physician due to the fact that comparative data from low recipient countries was unavailable.

Change in Economic Status in Selected Countries

To determine the change in economic status during the study period, information on the gross national product (GNP) per capita of selected Third World countries was obtained from the World Bank's Social Indicators of Development 1996. Twelve countries from each world region were selected for comparative purposes by identifying the three countries that received the highest and the three that received the lowest number of regional health projects, as well as the three countries that received the largest and the three that received the smallest amount of regional health assistance dollars.

The average change in GNP per capita was then compared between high and low recipient countries, both in terms of project numbers and project dollars, to determine if any improvements in economic status had occurred and if any significant differences existed between the two country groups that might be attributed to the presence of health assistance projects.

Individual country statistics and multi-country averages are presented in Appendices D and E, with [Appendix D](#) displaying information based on the number of projects received and [Appendix E](#) presenting information based on the amount of project dollars received. The first three tables in each Appendix (Tables D1-D3 and E1-E3) present a regional overview of average GNP and average health indicators for both high and low recipient countries, as well as the mathematical differences between the two country groups. The remaining tables in each Appendix provide supporting data for the individual countries used in the group comparisons.

The following information summarizes the data found in Appendices D and E with respect to economic performance during the study period.

African Economic Performance Based on Health Project Numbers

In terms of project numbers, the three African countries that received the highest number of health assistance projects included Kenya (37 projects valued at \$2.1 million), Egypt (21 projects at \$60.5 million), and Nigeria (20 projects at \$1.3 million), as indicated in [Table D4](#) in Appendix D. The three countries that were randomly selected to represent the countries receiving the lowest number of projects included Somalia (1 project at \$10.7 million), Cote d'Ivoire (1 project at \$50,000), and Mauritius (1 project at \$17,128), as referenced in [Table D5](#).

An examination of the average change in GNP in these African countries revealed that only low recipient countries saw average improvements in GNP per capita between 1985 and 1994 (see [Table D1](#)). A significant difference of 85.5 percentage points was found between the two country groups, with low recipient countries recording an average GNP growth of 59.4% during the study period as opposed to an average loss of 26.1% reported by high recipient countries.

African Economic Performance Based on Health Project Dollars

In terms of project dollars, the three African countries that received the largest amount of health assistance dollars included Egypt (\$60.5 million for 21 projects), Zaire (\$35.5 million for 7 projects), and Guinea (\$27.3 million for 1 project), while the three countries that received the lowest amount of project dollars included Mali (\$30,000 for 1 project), Benin (\$28,000 for 1 project), and Mauritius (\$17,128 for 1 project), as referenced in [Tables E4](#) and [E5](#) in Appendix E.

Analyzing the average change in GNP in these African countries revealed that both high and low recipient countries reported average gains in GNP per capita between 1985 and 1994 (see [Table E1](#)). Yet the difference between these improvements was substantial (97.1 percentage points),

with low recipient countries receiving a much more favorable increase in GNP per capita (102.6%) than high recipient countries (5.5%).

Asian Economic Performance Based on Health Project Numbers

In terms of project numbers, the three countries that received the highest number of health assistance projects in Asia included China (62 projects valued at \$118.9 million), Thailand (52 projects at \$100.6 million), and Indonesia (31 projects at \$155 million), as indicated in [Table D6](#) in Appendix D. The three countries that were randomly selected to represent the countries receiving the lowest number of projects included Lebanon (1 project at \$4.3 million), and Papua New Guinea and Myanmar (1 project each at \$296,875 each), as referenced in [Table D7](#).

An examination of the average change in GNP in these Asian countries revealed that although both country groups recorded average GNP improvements between 1985 and 1994 (see [Table D2](#)), those countries receiving the highest number of health projects reported a larger average increase in GNP per capita (96.4%) than did low recipient countries (61.1%).

Asian Economic Performance Based on Health Project Dollars

In terms of project dollars, the three Asian countries that received the largest amount of health assistance dollars included Bangladesh (\$307.5 million for 10 projects), India (\$189.1 million for 31 projects), and Indonesia (\$155 million for 31 projects), while the three countries that received the lowest amount of project dollars included Vietnam (\$125,500 for 4 projects), Yemen (\$29,000 for 1 project), and Malaysia (\$4,000 for 1 project), as referenced in [Tables E6](#) and [E7](#) in Appendix E.

Analyzing the change in GNP in these Asian countries revealed that both high and low recipient countries saw average gains in GNP per capita between 1985 and 1994 (see [Table E2](#)). Low recipient countries, however, reported a larger growth in GNP (84.3%) than did high recipient countries (44.4%).

Latin American Economic Performance Based on Health Project Numbers

In terms of project numbers, the three Latin American countries that received the highest number of health assistance projects included Brazil (46 projects valued at \$4.7 million), Chile (41 projects at \$3.6 million), and Mexico (37 projects at \$6.9 million), while the three countries that received the lowest number of projects included Honduras (2 projects at \$2 million), Uruguay (1 project at \$28 million), and Panama (1 project at \$3 million), as referenced in [Tables D8](#) and [D9](#) in Appendix D.

An examination of the average change in GNP in these Latin American countries revealed that although both country groups disclosed average GNP increases between 1985 and 1994 (see [Table D3](#)), high recipient countries reported a larger growth in GNP per capita (116.6%) than did low recipient countries (66.7%), resulting in a 49.9 percentage point difference between country groups.

Latin American Economic Performance Based on Health Project Dollars

In terms of project dollars, the three Latin American countries that received the largest amount of health assistance dollars included El Salvador (\$159.9 million for 4 projects), Guatemala (\$60.6 million for 5 projects), and Nicaragua (\$43 million for 2 projects), while the three countries that received the lowest amount of project dollars included Colombia (\$612,266 for 12 projects), Argentina (\$509,680 for 15 projects), and Costa Rica (\$352,875 for 4 projects), as referenced in

[Tables E8](#) and [E9](#) in Appendix E.

Analyzing the average change in GNP in these Latin American countries revealed that both country groups reported average gains in GNP per capita between 1985 and 1994 (see [Table E3](#)). The difference between these improvements, however, was substantial (84.6 percentage points), with low recipient countries recording an average gain of 94.5% as compared to only a 9.9% gain in high recipient countries.



CHAPTER FIVE

Findings, Conclusions and Recommendations

The problem of this research was to analyze science- and technology-related health assistance provided to lesser developed nations by selected donor agencies during the 10-year period between 1985 and 1995. The purpose of this research was two-fold: (1) to provide evaluative information on past health assistance to donor agencies and (2) to determine if a relationship existed between science- and technology-related health assistance and changes in quality of life.

In accordance with the methodology outlined in Chapter Three, this research study analyzed health assistance projects with respect to (a) the total number and the total value of projects by region, sub-region, and country; (b) the total assistance dollars provided by each individual donor agency; (c) the types of projects initiated during the study period; and (d) the probable impact that such projects had on the health and the economic status of selected Third World recipients.

Health data was obtained from the National Science Foundation Project #SBR-9510548 (Pytlík, Vasudevan, Bayles, & Spitznogle, 1997), while development performance indicators were gathered from Social Indicators of Development 1996, published by the World Bank.

Findings & Conclusions

An analysis of the health data led to the following findings and conclusions.

Question 1: How many science- and technology-related health projects were implemented in Third World nations between 1985 and 1995 by the selected donor agencies?

The literature review identified a total of 610 science- and technology-related health projects implemented in 63 Third World nations between 1985 and 1995 by the Ford Foundation, the Rockefeller Foundation, the World Bank, and the United States Agency for International Development. Because of the limited amount of readily available literature from the donor agencies, it is acknowledged that this number most likely represents only a portion of the total amount of health assistance provided by the four international agencies during the 10-year study period.

Overall, it was found that the projects were distributed quite equitably among world regions, but inequitably within the regions and sub-regions (see [Tables A1](#) through [A4](#) in Appendix A). Each of the three world regions, for example, received approximately $\frac{1}{3}$ of the health assistance projects implemented during the study period, with Africa receiving 30.8% of the total number of projects (188 projects), Asia receiving 36.4% (222 projects), and Latin America receiving 32.8% (200 projects).

Yet within regions, considerable disparity in project allocation was found. In Africa, for instance, the percentage of projects implemented in any one sub-region ranged from a high of 51.1% in Eastern Africa (representing 96 projects) to a low of 4.8% in Southern Africa (9

projects). The range in Asia varied from 50.9% in Southeast Asia (113 projects) to 0.9% in both Oceania and Western Asia (2 projects each). In Latin America, 64% of the projects were implemented in South America (128 projects) while only 7.5% were executed in the Caribbean (15 projects). Thus, one sub-region in each world region received more than half of the projects implemented there.

A comparison of sub-regional project numbers to population statistics, in terms of percentages, revealed a strong correlation between these two variables in Latin American, as project distribution mirrored population rates in each of the three sub-regions as follows. South America, with 67.7% of the population, received 64% of the total number of projects; Central America, with 28.3% of the population, received 28.5% of the projects; and the Caribbean, with 4% of the population, received 7.5% of the projects. Additionally, some correlation was found between project numbers and population in Africa, as the higher populated regions received the largest number of health projects, but no such correlation was identified in Asia.

Inequitable distribution of project numbers was also discovered among countries. Of the 29 countries that received health assistance in Africa, three countries (Kenya, Egypt and Nigeria) collectively received 41.5% of the total number of African projects, while eleven countries (Somalia, Rwanda, Mauritius, Chad, Morocco, Tunisia, Cote d'Ivoire, Mali, Niger, Guinea, and Benin) jointly received only 5.9%. In Asia, four of the 15 countries (China, Thailand, India, and Indonesia) together received 79.3% of Asian project numbers, while six countries (Papau New Guinea, Fiji, Myanmar, Malaysia, Yemen, and Lebanon) collectively received only 2.7%. In Latin America, three of the 19 countries (Brazil, Chile, and Mexico) jointly received a total of 62% of Latin American projects, while five countries (Honduras, Nicaragua, Belize, Panama, and Uruguay) collectively received only 4%.

Only in Caribbean countries was a correlation found between project numbers and population statistics. There, project distribution paralleled population ranking order as the higher populated countries received the largest number of health projects.

Therefore, it was concluded that health project distribution was equitable among Third World regions, but no so within most regions or sub-regions.

Question 2: What were the total dollar expenditures (by region, by sub-region, and by country) and the per capita expenditures (by country) of such health projects?

Of the 610 health projects identified in the literature review, 603 (or 98.9%) provided the necessary financial information to be valued at \$1,576,508,830. Unlike project numbers, however, considerable disparity was found in the regional distribution of project dollars, as Asia received the bulk of health assistance with \$884 million (56.1% of total health dollars), followed by Latin America with almost \$414 million (26.3%), and Africa with \$278 million (17.6%).

Distribution disparity was also found within each of the world regions (see [Tables A1 through A4](#) in Appendix A). In Africa, for example, the Northern and Western sub-regions together received 58% of all African health dollars. In Asia, over 56% of its project dollars were spent in South Central Asia, while in Latin America, more than 70% was utilized solely in Central America. Thus, one to two sub-regions within each world region received well over half of the project dollars spent there.

Similar inequality in project-dollar distribution was found among countries. Comparing the three countries from each region that received the highest and the three countries that received

the lowest amount of health assistance revealed that (a) Egypt, Zaire, and Guinea jointly collected 44.2% of all African project dollars while Mali, Benin, and Mauritius together amassed less than 0.1%; (b) Bangladesh, India, and Indonesia received 73.7% of all Asian dollars while Vietnam, Yemen, and Malaysia received less than 0.1%; and (c) El Salvador, Guatemala, and Nicaragua collectively received 63.7% of all Latin American dollars while Colombia, Argentina, and Costa Rica received a total of only 0.4%.

Comparing project dollars to population, in terms of percentages, revealed no correlation between these two variables on either a sub-regional or a country-wide basis.

Therefore, it was concluded that, in terms of dollars spent on Third World health assistance, there was significant inequity at the regional, sub-regional, and country levels.

Per Capita Expenditures. Per capita expenditures also exhibited wide disparity among countries. The range of such expenditures in Africa varied from a high of \$9.18 in Lesotho to a low of less than 1¢ in Ethiopia, Cote d'Ivoire, and Mali. Additionally, 19 of the 29 countries in Africa disclosed expenditures of less than \$1 per person. In Asia, per capita expenditures ranged from \$2.61 in Bangladesh to less than 1¢ in Pakistan, Vietnam, Malaysia, and Yemen, with 12 of the 15 countries reporting per capita expenditures of less than \$1. In Latin America, Belize recorded an incredible per capita expenditure of \$72.37 as compared to Argentina's 1¢ per capita. Eight of the 19 Latin American countries reported expenditures of less than \$1 per person. Thus, it was concluded that there was no correlation between population and health assistance dollars spent on the population in Third World countries.

Comparison of Project Dollars to Project Numbers. Comparing project dollars to project numbers revealed that Asia was given more favorable support by the international donor agencies, at least in financial terms, than Africa or Latin America (see Figure 5.1).

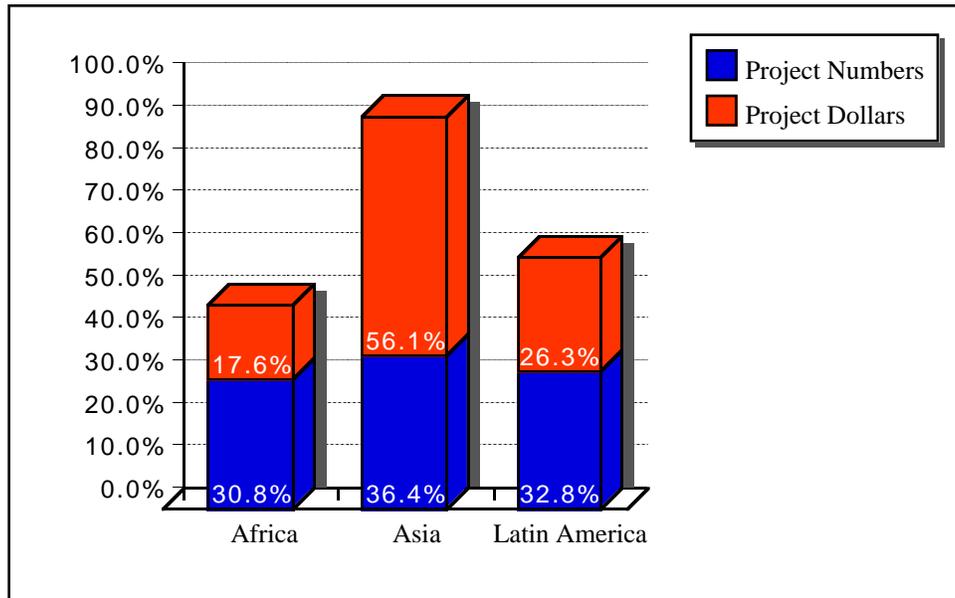


Figure 5.1. Comparison of Project Numbers to Project Dollars by Third World Region

Although each of the three world regions received approximately $\frac{1}{3}$ of the total number of health projects during the study period, disproportionate shares of project dollars were found among the regions, ranging from a high of 56.1% in Asia to a low of 17.6% in Africa. Thus, it was found that Asia received two to three times more health assistance funding for essentially the same number of projects than did the other two regions.

Similar inconsistencies between project dollars and project numbers were found among sub-regions and countries. In fact, the only equitable ratio discovered between countries was in Oceania, where both of the two countries receiving health assistance reported one project each, valued at \$296,875.

It was therefore concluded that the amount of money spent on Third World health assistance projects was not equitably distributed.

Question 3: Of the selected donor agencies, who were the major health funders in Third World countries during the 10-year study period?

The Rockefeller Foundation was the primary contributor of health assistance in Third World nations, at least in terms of project numbers, implementing 465 of the 610 health projects (or 76.2%) identified in the literature review. The United States Agency for International Development (USAID) was the second largest sponsor with 77 projects (12.6%), while the Ford Foundation sponsored 61 projects (10%) and the World Bank, 7 projects (1.2%).

Examining Third World health assistance in terms of project dollars, however, revealed a somewhat different ranking order, with the USAID providing the bulk of project dollars, \$1.2 billion of the \$1.6 billion (or 75.7%). The second largest financial contributor was the World Bank with approximately \$351.9 million, representing 22.3% of total Third World dollars. Collectively, the USAID and the World Bank supplied 98% of all health assistance dollars during the study period.

The remaining two international donor agencies, the Rockefeller Foundation and the Ford Foundation, contributed \$24.5 million (1.5%) and \$6.9 million (0.5%), respectively (see [Tables B1 through B8](#) in Appendix B).

Analyzing the regional distribution of health projects by donor agency revealed that the Rockefeller Foundation distributed its 465 health projects, valued at \$24.5 million, fairly equitably among the three world regions. Africa received 33.1% of Rockefeller projects and 34% of Rockefeller dollars, Asia received 34.2% and 27.8%, respectively, and Latin America received 32.7% and 38.2%, respectively.

The USAID implemented almost half (44.1%) of its 77 projects in Latin America, spending about a third (31%) of its \$1.2 billion there. Asia received 26% of USAID projects, but almost half of its dollars (48.9%). The agency placed the remaining 29.9% of its projects in Africa, where it spent 20.1% of its dollars.

The Ford Foundation appeared to favor Asia with its health assistance, implementing 65.6% of its 61 health projects and spending 63.6% of its \$6.9 million there. Its remaining projects were distributed evenly between Latin America and Africa, with Latin America receiving 18% of the agency's projects and 16.5% of its dollars, and Africa receiving 16.4% of its projects and 19.9% of its dollars.

The World Bank's seven health projects were distributed among world regions as follows: Africa received one project (14.3%) while Asia and Latin America received three projects each (42.9%). Although it contributed little in the way of project numbers, the World Bank funded a considerable portion of health assistance in Third World regions, spending approximately \$351.9 million for its seven projects. These funds, however, were almost totally concentrated in Asia, which received 82.8% of total World Bank dollars. Latin America and Africa received 9.4% and 7.8% of World Bank dollars, respectively.

Thus, it was found that the Rockefeller Foundation provided the majority of Third World health assistance projects (76.2%), in terms of numbers, while the USAID provided the majority of health assistance dollars (75.7%). Furthermore, while the Rockefeller Foundation distributed its health projects equitably among the three world regions, the other three donor agencies appeared to favor the Asian region, as each allocated either more projects (65.6% of Ford projects) or more dollars there (63.6% of Ford dollars, 48.9% of USAID dollars, and 82.8% of World Bank dollars). From this data, it was concluded that the Rockefeller Foundation was the agency most involved with health assistance programs in the Third World, while the USAID contributed the largest amount of health assistance dollars.

Question 4: What types of health projects were initiated by the donor agencies during the study period?

The research found that nine general types of health assistance were initiated by the international donor agencies in Third World nations during the study period. These included projects focusing on public health, epidemiology surveillance, immunization, reproductive biology and fertility regulation, maternal and child health, injuries, prosthetic and orthotic services, communicable diseases, and noncommunicable diseases (see [Table C1](#) in Appendix C).

In terms of project numbers, nearly 75% of all health assistance projects were initiated in support of reproductive biology and fertility regulation, communicable disease, and epidemiology surveillance. The largest number of projects found were reproductive biology and fertility regulation initiatives, with a total of 225 projects representing 36.9% of the total number of Third World health initiatives. The second largest number of projects (106 projects or 17.4%) were those related to communicable disease research, the majority of which focused on sexually transmitted diseases (46 projects) and diarrheal infections (22 projects). Third were the projects that focused on epidemiology surveillance, with a total of 99 projects representing 16.2% of total project numbers.

The remaining 25% of health projects included initiatives that promoted public health (62 projects or 10.1% of total project numbers), maternal and child health (44 projects or 7.2%), noncommunicable disease research (33 projects or 5.4%), immunization (19 projects or 3.1%), multiple-objective projects targeting public health as well as agricultural and economic development (17 projects or 2.8%), injury research (4 projects or 0.7%), and prosthetic and orthotic services (1 project or 0.2%).

In terms of project dollars, nearly 80% of Third World health assistance was spent in three of the project categories: reproductive biology and fertility regulation, public health, and noncommunicable disease initiatives. The largest amount of project dollars (\$495 million or 31.4% of Third World dollars) was allocated to the project type that also received the highest number of projects, reproductive biology and fertility regulation. The second largest amount was spent on single-objective public health initiatives, which received \$403.4 million or 25.6% of total project dollars. The third largest amount was allocated to noncommunicable disease research, which received \$357.5 million or 22.7% of total project dollars, nearly all of which was

used in support of micronutrient deficiencies and anemia initiatives.

The remaining 20% of health assistance was spent on immunization (\$154.5 million or 9.8% of total project dollars), maternal and child health (\$73.7 million or 4.6%), communicable disease control (\$55.7 million or 3.4%), multiple-objective projects targeting public health as well as agricultural and economic development (\$19.8 million or 1.3%), epidemiology surveillance (\$12.6 million or 0.8%), prosthetic and orthotic services (\$4.3 million or 0.3%), and injury initiatives (\$25,000 or less than 0.1%).

Thus, research findings revealed that reproductive biology and fertility regulation received the largest amount of support by international donor agencies during the study period, both in terms of project numbers and project dollars. Additionally, this support was relatively equal in terms of numbers and dollars, as 36.9% of total project numbers and 31.4% of total projects dollars were found in this category.

Comparing numbers to dollars in the remaining categories revealed a reasonably equitable ratio between these two variables, in terms of percentages, for six of the project types: maternal and child health initiatives, immunization, injury research, prosthetic and orthotic services, and both single- and multiple-objective projects targeting public health. Substantial differences were found, however, in three project categories: noncommunicable disease research, epidemiology surveillance, and communicable disease control. Noncommunicable disease initiatives, for example, received a significantly higher percentage of total project dollars compared to total project numbers, at 22.7% and 5.4%, respectively. Epidemiology surveillance and communicable disease initiatives, on the other hand, reported the opposite, as both of these categories reported disproportionately smaller shares of health funding compared to project numbers (0.8% compared to 16.2% and 3.4% compared to 17.4%, respectively). Thus, noncommunicable disease research appeared to be exceptionally well funded when measured against the other project categories, while communicable disease control and epidemiology surveillance initiatives appeared to be extremely underfunded.

The research also found that the majority of projects, in terms of numbers, were used for the research and investigation of health issues, while the majority of project dollars were devoted to program development and support.

It was concluded, then, that the greatest emphasis in international health assistance during the study period, both in terms of numbers of projects and total dollars spent, was directed toward reproductive biology and fertility regulation.

Question 5: Have the health-related indicators of selected Third World countries improved or declined during the study period?

To evaluate progress in health status during the study period, a comparison of the change in eight health-related indicators was made between Third World countries receiving the highest and the lowest amount of health assistance (see [Appendices D and E](#)). Twelve countries from each world region were selected for comparative purposes by identifying the three countries that received the highest and the three that received the lowest number of regional health projects, as well as the three countries that received the largest and the three that received the smallest amount of regional health assistance dollars. The average change in each indicator was then compared between high and low recipient countries, both in terms of project numbers and project dollars, to determine if any improvements in health status had occurred and if any significant differences existed between the two country groups that might be attributed to the presence of health assistance projects.

Indicator Improvement During Study Period. The research found improvements, between 1985 and 1994, in each of the 12 country groups for five of the health indicators:

- *Life expectancy* increased, on average, from 6.4% to 7.6% in Africa, 5.6% to 13.1% in Asia, and 3.8% to 13.8% in Latin America.
- *Infant mortality* decreased, on average, from 21.2% to 35.1% in Africa, 19.3% to 35.2% in Asia, and 29.9% to 41.1% in Latin America.
- *Total fertility rates* decreased, on average, from 6.7% to 28.9% in Africa, 18.2% to 32.7% in Asia, and 16.5% to 22.3% in Latin America.
- *Measles immunization* increased, on average, from 7.2% to 234% in Africa, 103.6% to 3,861.7% in Asia, and 20.9% to 162.8% in Latin America.
- *Diphtheria, pertussis, and tetanus (DPT) immunization* increased, on average, from 36.9% to 367.6% in Africa, 76.7% to 1,349.4% in Asia, and 27.7% to 58.3% in Latin America.

Even with these improvements, however, many of the regional health indicators, like life expectancy, infant mortality, and immunization rates, remained at substandard levels when compared to First World norms.

The three remaining health indicators (maternal mortality, population per physician, and population per hospital bed) saw improvement in approximately half of the 12 country groups during the study period. *Maternal mortality*, for example, declined, on average, in all four country groups in Asia, as well as in one country group in both Africa and Latin America. The decreases in Asia ranged from 4.8% to 42.6%, while the decreases in Africa and Latin America averaged 2.4% and 31%, respectively.

Increases in this indicator, on the other hand, were found in the six remaining country groups, varying from 47.1% to 75.2% in the three African groups and from 24.8% to 54.7% in the three Latin American groups. Despite average improvements in half of the country groups, however, Third World maternal mortality rates remained deplorable, averaging as much as 188 times higher in Africa, 66 times higher in Asia, and 46 times higher in Latin America than those in the developed world.

Population per physician ratios also saw some improvement between 1985 and 1994 in five of the 12 country groups. Two African groups reported average declines of 38.5% and 4,115.1%, and three Asian groups recorded average decreases ranging from 15.1% to 33.4%. Yet in six of the country groups, population per physician ratios increased during the study period, with three Latin American groups recording average increases ranging from 0.1% to 74.8%, two African groups showing average increases of 14% and 65.6%, and one Asian group reporting an average increase of 118.3%. The remaining Latin American group provided no comparative data for the study period.

Comparing First and Third World averages in population per physician ratios revealed substantially higher rates in the developing world—rates up to 25 times higher in Africa, 18 times higher in Asia, and 5 times higher in Latin America.

Similar improvements were also found in *population per hospital bed* ratios in four of the 12 country groups during the study period. In Asia, two country groups reported average declines of 0.2% and 6.1%, while one group in Africa and one group in Latin America recorded average declines of 13% and 2.1%, respectively.

Seven country groups, however, reported increases in this ratio during the same period. Three of these groups were in Latin America, with average increases varying from 8.8% to 36.5%; two were in Africa, with average increases of 7% and 52.9%; and two were in Asia, with average increases of 4.1% and 39.4%. The remaining country group in Africa provided no comparative data for this indicator.

Like the previous health indicators, population per hospital bed ratios remained substantially higher in Third World nations than in First World nations, varying as much as 30 times higher in Africa, 14 times higher in Asia, and 4 times higher in Latin America.

Correlation between Indicator Changes and Health Assistance. Comparing the difference in change between average indicators in high and low recipient countries revealed similar improvements in both country groups for three of the health indicators during the study period: *life expectancy*, *infant mortality*, and *fertility rates*. In all six regional comparisons, both country groups reported average improvements in each of these indicators that fell within a 20 percentage point range of one another, regardless of the number or the dollar amount of health assistance received. Thus no correlation was demonstrated between health assistance and changes in life expectancy, infant mortality, or fertility rates, as both high and low recipient countries reported comparable improvements in each of these indicators between 1985 and 1994.

Substantial differences in changes were found, however, for the remaining health indicators: maternal mortality, population per physician, population per hospital bed, measles immunization, and DPT immunization. Yet with respect to *maternal mortality*, *population per physician*, and *population per hospital bed*, no correlation was established between health assistance and indicator change, as half of the high recipient countries actually reported deterioration in each of these indicators during the study period.

Significant differences were found in each of the six regional comparisons for *measles immunization*. Four of the comparisons showed a variance ranging from 41.5 to 3,540.5 percentage points, all of which favored high recipient countries as they reported substantially greater increases in immunization rates than low recipient countries. In two of the comparisons, however, low recipient countries were favored by a margin of 101.3 and 226.8 percentage points. Consequently, no strong correlation was found between health assistance and changes in measles immunization rates.

An examination of the difference in change between high and low recipient countries for *DPT immunization* appeared to reveal a potential correlation to health assistance. Substantial differences were found in four of the six regional comparisons, all of which favored high recipient countries by a margin of 30.6 to 1,272.7 percentage points. And in the two regional comparisons where no significant differences were found between the groups, one comparison favored high recipient countries by a margin of 17.8 percentage points, while the other favored low recipient countries by a margin of only 2.6 percentage points. These findings, therefore, indicated a potential correlation between health assistance and changes in DPT immunization, as those countries receiving the largest amount of health assistance during the study period generally showed greater average improvements in immunization rates than low recipient countries.

Thus, it was concluded that despite significant positive changes in health-related indicators over the 10-year period, if Third World countries are to reach the health levels enjoyed in the more developed world, then both the number and the dollar value of health assistance projects must be increased significantly and distributed more equitably.

Question 6: Have the economic-related indicators of selected Third World countries improved or declined during the study period?

A comparison of the change in gross national product (GNP) per capita between Third World countries receiving the highest and the lowest amount of health assistance was used to evaluate economic progress during the study period (see [Appendices D and E](#)). Twelve countries from each world region were selected for comparative purposes by identifying the three countries that received the highest and the three that received the lowest number of regional health projects, as well as the three countries that received the largest and the three that received the smallest amount of regional health assistance dollars. The average change in GNP per capita was then compared between high and low recipient countries, both in terms of project numbers and project dollars, to determine if any improvements in economic status had occurred and if any significant differences existed between the two country groups that might be attributed to the presence of health assistance projects.

The research found that all but one of the country groups in Africa, Asia, and Latin America reported average gains in GNP per capita between 1985 and 1994, regardless of the number or the dollar amount of health assistance received during that period. The range of GNP per capita growth within country groups varied from an average of 5.5% to 102.6% in Africa, 44.4% to 96.4% in Asia, and 9.9% to 116.6% in Latin America. Even with this growth, however, more than half of the countries remained classified as low-income economies, as defined by the World Bank (1996a) as those countries reporting \$725 or less in GNP per capita.

In four of the six regional comparisons, countries receiving the least amount of health assistance, either in terms of project numbers or project dollars, showed the greatest average improvement in GNP per capita, as well as substantially higher, average GNP rates. Therefore, no correlation was found between health assistance and GNP growth in the selected Third World countries, as the economies of low recipient countries repeatedly outperformed high recipient countries during the study period.

Thus, it was concluded that there was no apparent relationship between the economic development of a country and the number of health-related projects or the amount of dollars spent on those projects during the 10-year period.

Recommendations

It is recommended that research be conducted in the following related areas:

- A follow-up study be conducted for the period 1995 to 2005 and data comparisons made.
- Similar analyses be conducted for the other science- and technology-related sectors included in the Pytlik et al. (1997) study.
- An analysis of the international-health-assistance allocation process, particularly focusing on why certain Third World nations receive more favorable support from international donor agencies than others.
- An analysis of health project budgeting practices, particularly focusing on why certain types of health projects receive disproportionately higher shares of funding than other project types.

Observations

While the following observations were not proven in this research study, they were, nevertheless, considered to be important because they provided clarification for three of the research findings.

Inequitable Project Distribution

This research study repeatedly found that health projects were inequitably distributed between regions, sub-regions, and countries, both in terms of project numbers and project dollars. Two potential explanations for such variance include (1) the differing health needs in the Third World and (2) the motivation behind the allocation process.

The most plausible explanation for this inequity lies in the fact that health needs differ substantially between regions, sub-regions, and countries. Thus, inequity in project distribution should be expected, with the assumption that the neediest areas will receive the greatest share of assistance. A review of regional health indicators between 1985 and 1994, however, indicated that Africa appeared to be the neediest of the three world regions, as its health indicators were generally much poorer than the other areas. Yet the research found that although Africa received a third of the total number of health projects, it received less than 20% of all health dollars. Thus, generally speaking, it appeared that the health projects identified in this research study were not allocated on the basis of need alone.

A second explanation for the inequitable distribution of projects deals with the motivation behind the allocation process, including political and financial motivations. One possibility is that project allocation may be more politically motivated than needs-oriented. This view is substantiated in part by a study performed by Muyia (1986) who examined the voting patterns of the World Health Organization (WHO) between the late 1940s and early 1970s when 24 newly independent African nations became members of the WHO. Examining project allocation in Africa, Muyia concluded that need had little effect on the allocation of WHO aid, as the more developed African economies with higher per capita incomes received more than their fair share of African WHO aid.

Another possibility is that project allocation may be more financially-motivated than needs-oriented, whereby donor agencies potentially view the poorest and neediest regions as much riskier investments than more highly developed areas. Thus, donor agencies might tend to place more of their projects in locations where they can reap the greatest return on investment.

Lack of Correlation between Health Assistance and Health Improvement

While the research study found improvement in the majority of health indicators during the 10-year period, most of the regional indicators remained at considerably substandard levels when compared to First World norms. Africa, for instance, reported regional maternal mortality rates that were 188 times higher, population per hospital bed ratios that were 30 times higher, and population per physician rates that were 25 times higher than those in the developed world. Additionally, little correlation was found between the presence of health assistance and improvement in health status during the study period. Three possible explanations for this lack of correlation are presented below.

The first explanation assumes that many of the Third World countries identified in this research study simply didn't receive enough health assistance to produce significant improvement. To generate recognizable results, massive support and assistance is often required. The research findings appear to substantiate this assumption as the per capita equivalence of health

assistance for 69% of the recipient countries (39 of the 63 countries) totaled less than \$1 per person. It is acknowledged, however, that the health projects identified in this research study most likely represent only a portion of the total amount of health assistance provided by the four donor agencies during the study period.

A second explanation for the lack of correlation involves the interrelationship between health and other variables. Improved health and longer life are not only dependent on disease prevention and better health facilities, they are also highly dependent on income, nutrition, sanitation, clean water, housing, and education (De Neufville, 1982; Hicks & Streeten, 1979). Thus, the lack of correlation found between health assistance and health improvement may have been partially due to the fact that a majority of Third World people continued to live in extremely poor conditions where basic needs remained largely unmet.

A third explanation for the lack of correlation deals with the impact that high population growth rates have on development. Many Third World countries report annual population growth rates that either equal or exceed 2.0%. Research findings in this study, for example, indicated average annual population growth rates of 2.5% in Africa, 2.0% in Latin America, and 1.9% in Asia.

An annual population growth rate of 2.0% will result in a 22% increase in population in a 10-year period and a doubling of population in only a 35-year period. To understand the impact of a 22% increase over a 10-year period, a look at India's population growth between 1985 and 1994 is helpful. During this period, India grew by 19.5% from 765 million to approximately 914 million people (World Bank, 1996a). This resulted in an increase of approximately 150 million people in India over a 10-year period; an increase that was equivalent to one-half of the United States' population at that time.

Thus, high population growth rates have an enormous potential to dilute any developmental gains derived from health assistance in a given period. The lack of correlation found between health assistance and health improvement, therefore, may have simply been the result of high population growth rates outpacing any progress made during the study period. As Stockwell and Laidlaw (1981) aptly surmised: "As long as birth rates remain high and population continues to grow rapidly, many of the underdeveloped economies will find themselves in a situation where they will have to run as fast as they can just to stay in the same place" (p. 105).

Hence, this research study concluded that, even though no strong correlation was found between health assistance and health improvement during the study period, both the number and dollar value of health projects should be increased significantly and distributed more equitably if Third World countries hope to reach the health levels enjoyed in the more developed world. This statement was based on the assumption that other factors, like those mentioned above, were more responsible for the lack of correlation between these two variables than was the failure of health assistance alone.

In conclusion, while project numbers or project dollars didn't appear to have much impact on the health or economic indicators of selected Third World countries, think what those same indicators would look like today without those health assistance projects.

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APPENDIX A

Health Assistance Projects
Categorized by
Region, Sub-Region, & Country

Table A1. Health Assistance Projects Categorized by Region & Sub-Region

Region/ Sub-Region	Total Population (millions)	Percentage of Regional Population	Number of Health Projects	Percentage of Regional Health Projects	Dollar Value of Health Projects	Percentage of Regional Health Dollars
Africa						
Eastern Africa	175.474	32.6%	96	51.1%	\$37,736,246 *	13.5%
Middle Africa	61.814	11.5%	20	10.6%	\$53,615,570 *	19.3%
Northern Africa	119.313	22.1%	28	14.9%	\$89,874,395	32.3%
Southern Africa	4.291	0.8%	9	4.8%	\$25,602,491	9.2%
Western Africa	<u>177.840</u>	<u>33.0%</u>	<u>35</u>	<u>18.6%</u>	<u>\$71,536,045</u> *	<u>25.7%</u>
African Total	538.732	100.0%	188	100.0%	\$278,364,747 *	100.0%
Asia						
East Asia	1,190.918	42.1%	62	27.9%	\$118,989,665	13.4%
Oceania	4.964	0.2%	2	0.9%	\$593,750	0.1%
South Central Asia	1,157.825	40.9%	43	19.4%	\$496,848,897 *	56.2%
Southeast Asia	457.488	16.1%	113	50.9%	\$263,433,991 *	29.8%
Western Asia	<u>18.715</u>	<u>0.7%</u>	<u>2</u>	<u>0.9%</u>	<u>\$4,377,000</u>	<u>0.5%</u>
Asian Total	2,829.910	100.0%	222	100.0%	\$884,243,303 *	100.0%
Latin America						
Caribbean	17.127	4.0%	15	7.5%	\$22,317,572	5.4%
Central America	120.533	28.3%	57	28.5%	\$291,208,243 *	70.4%
South America	<u>288.511</u>	<u>67.7%</u>	<u>128</u>	<u>64.0%</u>	<u>\$100,374,965</u> *	<u>24.2%</u>
Latin American Total	426.171	100.0%	200	100.0%	\$413,900,780 *	100.0%
Total for Third World Regions	3,794.813		610		\$1,576,508,830 *	
* 7 unknown project budgets: 1 each in Kenya, Chad, Ghana, Pakistan, Philippines, Honduras, and Peru						

Table A2. Health Assistance Projects in Africa

Sub-Region/ Country	Total Population (millions)	Percentage of Sub- Regional Population	Number of Health Projects	Percentage of Sub- Regional Health Projects	Dollar Value of Health Projects	Percentage of Sub- Regional Health Dollars	Health Project Dollars per Capita
AFRICAN HEALTH ASSISTANCE							
Eastern Africa							
Ethiopia	54.890	31.3%	7	7.3%	\$245,830	0.65%	\$0.004
Tanzania	28.817	16.4%	6	6.3%	\$524,460	1.4%	\$0.02
Kenya	26.017	14.8%	37	38.5%	\$2,078,423	* 5.5%	\$0.08
Uganda	18.592	10.6%	18	18.8%	\$1,803,895	4.8%	\$0.10
Zimbabwe	10.778	6.1%	12	12.5%	\$613,782	1.6%	\$0.06
Malawi	9.532	5.4%	6	6.3%	\$15,843,338	42.0%	\$1.66
Zambia	9.203	5.3%	7	7.3%	\$499,390	1.3%	\$0.05
Somalia	8.775	5.0%	1	1.0%	\$10,710,000	28.4%	\$1.22
Rwanda	7.755	4.5%	1	1.0%	\$5,400,000	14.3%	\$0.70
Mauritius	1.115	0.6%	1	1.0%	\$17,128	0.05%	\$0.02
Sub-Regional Total	175.474	100.0%	96	100.0%	\$37,736,246	* 100.0%	
Middle Africa							
Zaire	42.540	68.8%	7	35.0%	\$35,452,540	66.1%	\$0.83
Cameroon	12.986	21.0%	12	60.0%	\$18,163,030	33.9%	\$1.40
Chad	6.288	10.2%	1	5.0%	unknown	* unknown	unknown
Sub-Regional Total	61.814	100.0%	20	100.0%	\$53,615,570	* 100.0%	
Northern Africa							
Egypt	56.767	47.6%	21	75.0%	\$60,497,960	67.3%	\$1.07
Sudan	27.364	22.9%	5	17.8%	\$174,435	0.2%	\$0.01
Morocco	26.367	22.1%	1	3.6%	\$20,600,000	22.9%	\$0.78
Tunisia	8.815	7.4%	1	3.6%	\$8,602,000	9.6%	\$0.98
Sub-Regional Total	119.313	100.0%	28	100.0%	\$89,874,395	100.0%	
Southern Africa							
Lesotho	1.942	45.3%	3	33.3%	\$17,821,488	69.6%	\$9.18
Botswana	1.443	33.6%	3	33.3%	\$7,447,000	29.1%	\$5.16
Swaziland	0.906	21.1%	3	33.3%	\$334,003	1.3%	\$0.37
Sub-Regional Total	4.291	100.0%	9	99.9%	\$25,602,491	100.0%	
Table A2 continued on next page							

Table A2 continued. Health Assistance Projects in Africa

Sub-Region/ Country	Total Population (millions)	Percentage of Sub- Regional Population	Number of Health Projects	Percentage of Sub- Regional Health Projects	Dollar Value of Health Projects	Percentage of Sub- Regional Health Dollars	Health Project Dollars per Capita
Western Africa							
Nigeria	108.014	60.7%	20	57.1%	\$1,346,880	1.9%	\$0.01
Ghana	16.639	9.4%	4	11.4%	\$7,331,665 *	10.25%	\$0.44
Cote d'Ivoire	13.841	7.8%	1	2.9%	\$50,000	0.07%	\$0.004
Mali	9.524	5.4%	1	2.9%	\$30,000	0.04%	\$0.003
Niger	8.730	4.9%	1	2.9%	\$12,300,000	17.2%	\$1.41
Senegal	8.263	4.6%	3	8.5%	\$22,999,500	32.1%	\$2.78
Guinea	6.425	3.6%	1	2.9%	\$27,300,000	38.2%	\$4.25
Benin	5.325	3.0%	1	2.9%	\$28,000	0.04%	\$0.01
Gambia	1.079	0.6%	3	8.5%	\$150,000	0.2%	\$0.14
Sub-Regional Total	177.840	100.0%	35	100.0%	\$71,536,045 *	100.0%	
Total for Africa	538.732		188		\$278,364,747 *		
* 3 unknown project budgets in Africa: 1 each in Kenya, Chad, and Ghana							

Table A3. Health Assistance Projects in Asia

Sub-Region/ Country	Total Population (millions)	Percentage of Sub- Regional Population	Number of Health Projects	Percentage of Sub- Regional Health Projects	Dollar Value of Health Projects	Percentage of Sub- Regional Health Dollars	Health Project Dollars per Capita
ASIAN HEALTH ASSISTANCE							
East Asia							
China	1,190.918	100.0%	62	100.0%	\$118,989,665	100.0%	\$0.10
Sub-Regional Total	1,190.918	100.0%	62	100.0%	\$118,989,665	100.0%	
Oceania							
Papau New Guinea	4.197	84.5%	1	50.0%	\$296,875	50.0%	\$0.07
Fiji	0.767	15.5%	1	50.0%	\$296,875	50.0%	\$0.39
Sub-Regional Total	4.964	100.0%	2	100.0%	\$593,750	100.0%	
South Central Asia							
India	913.600	78.9%	31	72.1%	\$189,077,410	38.0%	\$0.21
Pakistan	126.284	10.9%	2	4.7%	\$296,875 *	0.1%	\$0.002
Bangladesh	117.941	10.2%	10	23.2%	\$307,474,612	61.9%	\$2.61
Sub-Regional Total	1,157.825	100.0%	43	100.0%	\$496,848,897 *	100.0%	
Southeast Asia							
Indonesia	190.389	41.6%	31	27.4%	\$155,001,437	58.8%	\$0.81
Vietnam	72.039	15.7%	4	3.5%	\$125,500	0.048%	\$0.002
Philippines	67.038	14.7%	21	18.6%	\$7,228,445 *	2.8%	\$0.11
Thailand	58.024	12.7%	52	46.0%	\$100,635,234	38.2%	\$1.73
Myanmar (Burma)	45.581	10.0%	1	0.9%	\$296,875	0.1%	\$0.01
Malaysia	19.669	4.3%	1	0.9%	\$4,000	0.002%	\$0.0002
Laos	4.748	1.0%	3	2.7%	\$142,500	0.05%	\$0.03
Sub-Regional Total	457.488	100.0%	113	100.0%	\$263,433,991 *	100.0%	
Western Asia							
Yemen	14.785	79.0%	1	50.0%	\$29,000	0.7%	\$0.002
Lebanon	3.930	21.0%	1	50.0%	\$4,348,000	99.3%	\$1.11
Sub-Regional Total	18.715	100.0%	2	100.0%	\$4,377,000	100.0%	
Total for Asia	2,829.910		222		\$884,243,303 *		
* 2 unknown project budgets in Asia: 1 each in Pakistan and the Philippines							

Table A4. Health Assistance Projects in Latin America

Sub-Region/ Country	Total Population (millions)	Percentage of Sub- Regional Population	Number of Health Projects	Percentage of Sub- Regional Health Projects	Dollar Value of Health Projects	Percentage of Sub- Regional Health Dollars	Health Project Dollars per Capita
LATIN AMERICAN HEALTH ASSISTANCE							
Caribbean							
Dominican Republic	7.622	44.5%	7	46.7%	\$2,298,538	10.3%	\$0.30
Haiti	7.008	40.9%	5	33.3%	\$9,653,493	43.3%	\$1.38
Jamaica	2.497	14.6%	3	20.0%	\$10,365,541	46.4%	\$4.15
Sub-Regional Total	17.127	100.0%	15	100.0%	\$22,317,572	100.0%	
Central America							
Mexico	88.543	73.4%	37	64.9%	\$6,989,941	2.4%	\$0.08
Guatemala	10.322	8.6%	5	8.8%	\$60,639,763	20.8%	\$5.87
Honduras	5.750	4.8%	2	3.5%	\$2,006,888 *	0.7%	\$0.35
El Salvador	5.635	4.7%	4	7.0%	\$159,941,888	54.9%	\$28.38
Nicaragua	4.156	3.4%	2	3.5%	\$43,006,888	14.8%	\$10.35
Costa Rica	3.304	2.7%	4	7.0%	\$352,875	0.1%	\$0.11
Panama	2.612	2.2%	1	1.8%	\$3,000,000	1.0%	\$1.15
Belize	0.211	0.2%	2	3.5%	\$15,270,000	5.3%	\$72.37
Sub-Regional Total	120.533	100.0%	57	100.0%	\$291,208,243 *	100.0%	
South America							
Brazil	159.128	55.1%	46	36.0%	\$4,692,220	4.7%	\$0.03
Colombia	36.330	12.6%	12	9.4%	\$612,266	0.6%	\$0.02
Argentina	34.194	11.9%	15	11.7%	\$509,680	0.5%	\$0.01
Peru	23.238	8.0%	5	3.9%	\$35,166,388 *	35.0%	\$1.51
Chile	13.994	4.9%	41	32.0%	\$3,639,930	3.6%	\$0.26
Ecuador	11.227	3.9%	4	3.1%	\$16,931,218	16.9%	\$1.51
Bolivia	7.237	2.5%	4	3.1%	\$10,823,263	10.8%	\$1.50
Uruguay	3.163	1.1%	1	0.8%	\$28,000,000	27.9%	\$8.85
Sub-Regional Total	288.511	100.0%	128	100.0%	\$100,374,965 *	100.0%	
Total for Latin America	426.171		200		\$413,900,780 *		
* 2 unknown project budgets in Latin America: 1 each in Honduras and Peru							

APPENDIX B

Source of Health Assistance
Categorized by
International Donor Agency

Table B1. Source of Health Assistance Categorized by Agency & Region

International Donor Agency	Number of Health Projects	Percentage of Total Health Projects	Dollar Value of Health Projects	Percentage of Total Health Dollars
Ford Foundation				
Africa	10	1.6%	\$1,374,767	0.1%
Asia	40	6.6%	\$4,415,471	0.3%
Latin America	<u>11</u>	<u>1.8%</u>	<u>\$1,150,063</u>	<u>0.1%</u>
Total Ford Assistance	61	10.0%	\$6,940,301	0.5%
Rockefeller Foundation				
Africa	154	25.2%	\$8,339,005	0.5%
Asia	159	26.1%	\$6,835,082	0.4%
Latin America	<u>152</u>	<u>24.9%</u>	<u>\$9,366,850</u>	<u>0.6%</u>
Total Rockefeller Assistance	465	76.2%	\$24,540,937	1.5%
USAID				
Africa	23	3.7%	\$241,350,975	* 15.3%
Asia	20	3.3%	\$581,632,750	* 36.9%
Latin America	<u>34</u>	<u>5.6%</u>	<u>\$370,183,867</u>	* <u>23.5%</u>
Total USAID Assistance	77	12.6%	\$1,193,167,592	* 75.7%
World Bank				
Africa	1	0.2%	\$27,300,000	1.7%
Asia	3	0.5%	\$291,360,000	18.5%
Latin America	<u>3</u>	<u>0.5%</u>	<u>\$33,200,000</u>	<u>2.1%</u>
Total World Bank Assistance	7	1.2%	\$351,860,000	22.3%
Total Third World Assistance	610	100.0%	\$1,576,508,830	* 100.0%
* 7 unknown USAID budgets: 1 each in Kenya, Chad, Ghana, Pakistan, Philippines, Honduras, and Peru				

Table B2. Source of Health Assistance in Africa

Sub-Region/ Country	Number of Health Projects	Percentage of Sub-Regional Health Projects	Dollar Value of Health Projects	Percentage of Sub-Regional Health Dollars
AFRICAN HEALTH ASSISTANCE				
Eastern Africa				
Ford Foundation	2	2.1%	\$178,667	0.5%
Rockefeller Foundation	87	90.6%	\$5,556,954	14.7%
USAID	7	7.3%	\$32,000,625 *	84.8%
World Bank	0	0.0%	\$0	0.0%
Sub-Regional Total	96	100.0%	\$37,736,246 *	100.0%
Middle Africa				
Ford Foundation	0	0.0%	\$0	0.0%
Rockefeller Foundation	16	80.0%	\$636,770	1.2%
USAID	4	20.0%	\$52,978,800 *	98.8%
World Bank	0	0.0%	\$0	0.0%
Sub-Regional Total	20	100.0%	\$53,615,570 *	100.0%
Northern Africa				
Ford Foundation	6	21.4%	\$179,100	0.2%
Rockefeller Foundation	19	67.9%	\$493,295	0.5%
USAID	3	10.7%	\$89,202,000	99.3%
World Bank	0	0.0%	\$0	0.0%
Sub-Regional Total	28	100.0%	\$89,874,395	100.0%
Southern Africa				
Ford Foundation	0	0.0%	\$0	0.0%
Rockefeller Foundation	5	55.6%	\$99,816	0.4%
USAID	4	44.4%	\$25,502,675	99.6%
World Bank	0	0.0%	\$0	0.0%
Sub-Regional Total	9	100.0%	\$25,602,491	100.0%
Western Africa				
Ford Foundation	2	5.7%	\$1,017,000	1.4%
Rockefeller Foundation	27	77.1%	\$1,552,170	2.2%
USAID	5	14.3%	\$41,666,875 *	58.2%
World Bank	1	2.9%	\$27,300,000	38.2%
Sub-Regional Total	35	100.0%	\$71,536,045 *	100.0%
Total for Africa	188		\$278,364,747 *	
* 3 unknown USAID budgets: 1 each in Kenya, Chad, and Ghana				

Table B3. Source of Health Assistance in Asia

Sub-Region/ Country	Number of Health Projects	Percentage of Sub-Regional Health Projects	Dollar Value of Health Projects	Percentage of Sub-Regional Health Dollars
ASIAN HEALTH ASSISTANCE				
East Asia				
Ford Foundation	12	19.4%	\$1,539,100	1.3%
Rockefeller Foundation	49	79.0%	\$2,890,565	2.4%
USAID	0	0.0%	\$0	0.0%
World Bank	1	1.6%	\$114,560,000	96.3%
Sub-Regional Total	62	100.0%	\$118,989,665	100.0%
Oceania				
Ford Foundation	0	0.0%	\$0	0.0%
Rockefeller Foundation	0	0.0%	\$0	0.0%
USAID	2	100.0%	\$593,750	100.0%
World Bank	0	0.0%	\$0	0.0%
Sub-Regional Total	2	100.0%	\$593,750	100.0%
South Central Asia				
Ford Foundation	18	41.9%	\$1,955,337	0.4%
Rockefeller Foundation	18	41.9%	\$1,041,810	0.2%
USAID	5	11.6%	\$317,051,750 *	63.8%
World Bank	2	4.6%	\$176,800,000	35.6%
Sub-Regional Total	43	100.0%	\$496,848,897 *	100.0%
Southeast Asia				
Ford Foundation	9	8.0%	\$892,034	0.3%
Rockefeller Foundation	92	81.4%	\$2,902,707	1.1%
USAID	12	10.6%	\$259,639,250 *	98.6%
World Bank	0	0.0%	\$0	0.0%
Sub-Regional Total	113	100.0%	\$263,433,991 *	100.0%
Western Asia				
Ford Foundation	1	50.0%	\$29,000	0.7%
Rockefeller Foundation	0	0.0%	\$0	0.0%
USAID	1	50.0%	\$4,348,000	99.3%
World Bank	0	0.0%	\$0	0.0%
Sub-Regional Total	2	100.0%	\$4,377,000	100.0%
Total for Asia	222		\$884,243,303 *	
* 2 unknown USAID budgets: 1 each in Pakistan and the Philippines				

Table B4. Source of Health Assistance in Latin America

Sub-Region/ Country	Number of Health Projects	Percentage of Sub-Regional Health Projects	Dollar Value of Health Projects	Percentage of Sub-Regional Health Dollars
LATIN AMERICAN HEALTH ASSISTANCE				
Caribbean				
Ford Foundation	2	13.3%	\$118,396	0.5%
Rockefeller Foundation	6	40.0%	\$291,650	1.3%
USAID	7	46.7%	\$21,907,526	98.2%
World Bank	0	0.0%	\$0	0.0%
Sub-Regional Total	15	100.0%	\$22,317,572	100.0%
Central America				
Ford Foundation	3	5.3%	\$385,167	0.1%
Rockefeller Foundation	36	63.2%	\$2,660,774	0.9%
USAID	17	29.8%	\$284,162,302 *	97.6%
World Bank	1	1.7%	\$4,000,000	1.4%
Sub-Regional Total	57	100.0%	\$291,208,243 *	100.0%
South America				
Ford Foundation	6	4.7%	\$646,500	0.6%
Rockefeller Foundation	110	85.9%	\$6,414,426	6.4%
USAID	10	7.8%	\$64,114,039 *	63.9%
World Bank	2	1.6%	\$29,200,000	29.1%
Sub-Regional Total	128	100.0%	\$100,374,965 *	100.0%
Total for Latin America	200		\$413,900,780 *	
* 2 unknown USAID budgets: 1 each in Honduras and Peru				

Table B5. Ford Foundation Health Assistance by Region & Sub-Region

Region/ Sub-Region	Number of Health Projects	Percentage of Total Ford Foundation Projects	Dollar Value of Health Projects	Percentage of Total Ford Foundation Dollars
FORD FOUNDATION ASSISTANCE				
Africa				
Eastern Africa	2	3.3%	\$178,667	2.6%
Middle Africa	0	0.0%	\$0	0.0%
Northern Africa	6	9.8%	\$179,100	2.6%
Southern Africa	0	0.0%	\$0	0.0%
Western Africa	<u>2</u>	<u>3.3%</u>	<u>\$1,017,000</u>	<u>14.7%</u>
African Total	10	16.4%	\$1,374,767	19.9%
Asia				
East Asia	12	19.7%	\$1,539,100	22.2%
Oceania	0	0.0%	\$0	0.0%
South Central Asia	18	29.5%	\$1,955,337	28.2%
Southeast Asia	9	14.8%	\$892,034	12.8%
Western Asia	<u>1</u>	<u>1.6%</u>	<u>\$29,000</u>	<u>0.4%</u>
Asian Total	40	65.6%	\$4,415,471	63.6%
Latin America				
Caribbean	2	3.3%	\$118,396	1.7%
Central America	3	4.9%	\$385,167	5.5%
South America	<u>6</u>	<u>9.8%</u>	<u>\$646,500</u>	<u>9.3%</u>
Latin American Total	11	18.0%	\$1,150,063	16.5%
Total Ford Foundation Assistance	61	100.0%	\$6,940,301	100.0%

Table B6. Rockefeller Foundation Health Assistance by Region & Sub-Region

Region/ Sub-Region	Number of Health Projects	Percentage of Total Rockefeller Foundation Projects	Dollar Value of Health Projects	Percentage of Total Rockefeller Foundation Dollars
ROCKEFELLER FOUNDATION ASSISTANCE				
Africa				
Eastern Africa	87	18.7%	\$5,556,954	22.7%
Middle Africa	16	3.4%	\$636,770	2.6%
Northern Africa	19	4.1%	\$493,295	2.0%
Southern Africa	5	1.1%	\$99,816	0.4%
Western Africa	<u>27</u>	<u>5.8%</u>	<u>\$1,552,170</u>	<u>6.3%</u>
African Total	154	33.1%	\$8,339,005	34.0%
Asia				
East Asia	49	10.5%	\$2,890,565	11.8%
Oceania	0	0.0%	\$0	0.0%
South Central Asia	18	3.9%	\$1,041,810	4.2%
Southeast Asia	92	19.8%	\$2,902,707	11.8%
Western Asia	<u>0</u>	<u>0.0%</u>	<u>\$0</u>	<u>0.0%</u>
Asian Total	159	34.2%	\$6,835,082	27.8%
Latin America				
Caribbean	6	1.3%	\$291,650	1.2%
Central America	36	7.7%	\$2,660,774	10.9%
South America	<u>110</u>	<u>23.7%</u>	<u>\$6,414,426</u>	<u>26.1%</u>
Latin American Total	152	32.7%	\$9,366,850	38.2%
Total Rockefeller Foundation Assistance	465	100.0%	\$24,540,937	100.0%

Table B7. USAID Health Assistance by Region & Sub-Region

Region/ Sub-Region	Number of Health Projects	Percentage of Total USAID Projects	Dollar Value of Health Projects	Percentage of Total USAID Dollars
UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT (USAID) ASSISTANCE				
Africa				
Eastern Africa	7	9.1%	\$32,000,625 *	2.7%
Middle Africa	4	5.2%	\$52,978,800 *	4.45%
Northern Africa	3	3.9%	\$89,202,000	7.4%
Southern Africa	4	5.2%	\$25,502,675	2.1%
Western Africa	5	6.5%	\$41,666,875 *	3.5%
African Total	23	29.9%	\$241,350,975 *	20.15%
Asia				
East Asia	0	0.0%	\$0	0.0%
Oceania	2	2.6%	\$593,750	0.05%
South Central Asia	5	6.5%	\$317,051,750 *	26.6%
Southeast Asia	12	15.6%	\$259,639,250 *	21.8%
Western Asia	1	1.3%	\$4,348,000	0.4%
Asian Total	20	26.0%	\$581,632,750 *	48.85%
Latin America				
Caribbean	7	9.1%	\$21,907,526	1.8%
Central America	17	22.0%	\$284,162,302 *	23.8%
South America	10	13.0%	\$64,114,039 *	5.4%
Latin American Total	34	44.1%	\$370,183,867 *	31.0%
Total USAID Assistance	77	100.0%	\$1,193,167,592 *	100.0%
* 7 unknown USAID budgets: 1 each in Kenya, Chad, Ghana, Pakistan, Philippines, Honduras, and Peru				

Table B8. World Bank Health Assistance by Region & Sub-Region

Region/ Sub-Region	Number of Health Projects	Percentage of Total World Bank Projects	Dollar Value of Health Projects	Percentage of Total World Bank Dollars
WORLD BANK ASSISTANCE				
Africa				
Eastern Africa	0	0.0%	\$0	0.0%
Middle Africa	0	0.0%	\$0	0.0%
Northern Africa	0	0.0%	\$0	0.0%
Southern Africa	0	0.0%	\$0	0.0%
Western Africa	<u>1</u>	<u>14.3%</u>	<u>\$27,300,000</u>	<u>7.8%</u>
African Total	1	14.3%	\$27,300,000	7.8%
Asia				
East Asia	1	14.3%	\$114,560,000	32.6%
Oceania	0	0.0%	\$0	0.0%
South Central Asia	2	28.55%	\$176,800,000	50.2%
Southeast Asia	0	0.0%	\$0	0.0%
Western Asia	<u>0</u>	<u>0.0%</u>	<u>\$0</u>	<u>0.0%</u>
Asian Total	3	42.85%	\$291,360,000	82.8%
Latin America				
Caribbean	0	0.0%	\$0	0.0%
Central America	1	14.3%	\$4,000,000	1.1%
South America	<u>2</u>	<u>28.55%</u>	<u>\$29,200,000</u>	<u>8.3%</u>
Latin American Total	3	42.85%	\$33,200,000	9.4%
Total World Bank Assistance	7	100.0%	\$351,860,000	100.0%

APPENDIX C

Health Assistance Projects
Categorized by
Project Type & Project Methodology

Table C1. Health Assistance Projects Categorized by Type & Methodology

Project Type / Project Methodology	Number of Health Projects	Percentage of Total Health Projects	Dollar Value of Health Projects	Percentage of Total Health Dollars
PROJECTS WITH MULTIPLE OBJECTIVES				
Public Health & Agricultural Development	16	2.6%	\$4,750,000	0.3%
Public Health, Agriculture, & Economic Dev.	1	0.2%	\$15,000,000	1.0%
Total Multiple Objective Projects	17	2.8%	\$19,750,000	1.3%
PROJECTS WITH SINGLE OBJECTIVES				
Public Health Initiatives				
program development & support	21	3.4%	\$381,119,630 *	24.2%
research & investigation	11	1.8%	\$428,490	**
education & training	20	3.3%	\$21,036,300	1.3%
equipment & supplies	10	1.6%	\$843,800	0.1%
Total Public Health Initiatives	62	10.1%	\$403,428,220 *	25.6%
Epidemiology Surveillance				
program development & support	96	15.7%	\$12,525,200	0.8%
education & training	3	0.5%	\$46,700	**
Total Epidemiology Surveillance	99	16.2%	\$12,571,900	0.8%
Immunization				
program development & support	12	2.0%	\$55,097,992	3.5%
research & investigation	2	0.3%	\$98,651,800	6.3%
education & training	2	0.3%	\$140,000	**
equipment & supplies	3	0.5%	\$585,000	**
Total Immunization	19	3.1%	\$154,474,792	9.8%
Reproductive Biology & Fertility Regulation				
program development & support	12	2.0%	\$358,563,300	22.7%
research & investigation	159	26.0%	\$9,768,342 *	0.6%
education & training	51	8.4%	\$119,533,420	7.6%
equipment & supplies	3	0.5%	\$7,153,470	0.5%
Total Reproduction & Fertility	225	36.9%	\$495,018,532 *	31.4%
Maternal & Child Health				
program development & support	4	0.7%	\$71,087,600	4.5%
research & investigation	29	4.7%	\$2,088,170	0.1%
education & training	11	1.8%	\$498,000	**
Total Maternal & Child Health	44	7.2%	\$73,673,770	4.6%
Injuries				
research & investigation	4	0.7%	\$25,000	**
Prosthetic & Orthotic Services				
program development & support	1	0.2%	\$4,348,000	0.3%

Table C1 continued on next page

Table C1 continued. Health Assistance Projects Categorized by Type & Methodology

Project Type / Project Methodology	Number of Health Projects	Percentage of Total Health Projects	Dollar Value of Health Projects	Percentage of Total Health Dollars
Communicable Diseases				
Ascariasis - research	1	0.2%	\$40,000	**
Dengue - research	7	1.2%	\$562,770	**
Diarrheal Infections				
program development & support	1	0.2%	\$19,000,000	1.2%
research & investigation	19	3.1%	\$1,510,659	0.1%
education & training	2	0.3%	\$1,039,000	0.1%
Total Diarrheal Infections	22	3.6%	\$21,549,659	1.4%
Encephalitis - research	1	0.2%	\$100,000	**
Filariasis - research	2	0.3%	\$94,000	**
Hepatitis - research	2	0.3%	\$55,000	**
Malaria				
program development & support	1	0.2%	\$14,877,000	0.9%
research & investigation	8	1.3%	\$283,200	**
Total Malaria	9	1.5%	\$15,160,200	0.9%
Measles - research	2	0.3%	\$10,000	**
Meningitis - research	1	0.2%	\$5,000	**
Respiratory Infections - research	3	0.5%	\$55,700	**
Schistosomiasis - research	7	1.2%	\$358,200	**
Sexually Transmitted Diseases (STDs), including Human Immunodeficiency Virus (HIV)				
program development & support (HIV only)	5	0.8%	\$14,706,000	0.9%
research & investigation (HIV only)	24	3.9%	\$1,465,470	0.1%
research & investigation (STDs & HIV)	5	0.8%	\$183,798	**
research & investigation (excluding HIV)	2	0.3%	\$30,000	**
education & training (HIV only)	10	1.6%	\$1,117,164	0.1%
Total STDs & HIV	46	7.4%	\$17,502,432	1.1%
Visceral Leishmaniasis - research	3	0.5%	\$220,000	**
Total Communicable Diseases	106	17.4%	\$55,712,961	3.4%
Table C1 continued on next page				

Table C1 continued. Health Assistance Projects Categorized by Type & Methodology

Project Type / Project Methodology	Number of Health Projects	Percentage of Total Health Projects	Dollar Value of Health Projects	Percentage of Total Health Dollars
Noncommunicable Diseases				
Alcohol & Drug Abuse				
program development & support	2	0.3%	\$6,800,000	0.4%
research & investigation	1	0.2%	\$5,000	**
Total Alcohol & Drug Abuse	3	0.5%	\$6,805,000	0.4%
Cancer - research	4	0.7%	\$37,970	**
Cardiovascular Disease - research	6	1.0%	\$54,640	**
Diabetes - research	2	0.3%	\$40,050	**
Epilepsy - research	1	0.2%	\$5,000	**
Guillian-Barre Syndrome - research	1	0.2%	\$22,410	**
Mental Disorders - research	2	0.3%	\$11,100	**
Micronutrient Deficiencies				
program development & support	5	0.8%	\$297,360,000	18.9%
research & investigation	5	0.8%	\$53,149,485	3.4%
Total Micronutrient Deficiencies	10	1.6%	\$350,509,485	22.3%
Renal (Kidney) Disease - research	2	0.3%	\$10,000	**
Rheumatoid Arthritis - research	2	0.3%	\$10,000	**
Total Noncommunicable Diseases	33	5.4%	\$357,505,655	22.7%
Total Health Assistance	610	100.0%	\$1,576,508,830	99.9%
* 7 unknown project budgets: 2 in Public Health and 5 in Reproduction & Fertility				
** Less than 0.1%				

APPENDIX D

Development Performance Indicators for Selected Third World Countries Receiving the Highest & Lowest Number of Regional Health Projects

Table D1. Average Indicators for African Countries with High & Low Project Numbers

AVERAGE INDICATORS FOR AFRICAN COUNTRIES WITH HIGH & LOW NUMBERS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the average of the most recent estimate during the period 1989 to 1994			
- changes in indicators reflect the average percentage change that occurred between 1985 and 1994			
Development Performance Indicators	3 Countries with Highest Project Numbers	3 Countries with Lowest Project Numbers	Difference between Country Groups
Total Population (millions)	190.798	23.731	167.067
Total Percentage of African Study Population	35.3%	4.4%	30.9
Average Percentage Change in Population	27.3%	26.6%	0.7
Average Population Growth Rate (annual percentage)	2.4%	2.6%	0.2
Total Number of Health Projects	78	3	75
Total Percentage of African Health Projects	41.5%	1.5%	40.0
Total Value of Health Projects (US \$)	\$63,923,263 *	\$10,777,128	53,146,135
Total Percentage of African Health Dollars	22.9%	3.8%	19.1
Average Health Dollars per Capita	\$0.39	\$0.41	0.02
Average Life Expectancy at Birth (years)	58	58	0
Average Percentage Change in Life Expectancy at Birth	6.8%	6.4%	0.4
Average Infant Mortality Rate (per 1,000 live births)	64	79	15
Average Percentage Change in Infant Mortality Rate	(26.6%)	(21.2%)	5.4
Average Maternal Mortality Rate (per 100,000 live births)	837	1,274	437
Average Percentage Change in Maternal Mortality Rate	(2.4%)	56.8% †	59.2
Average Total Fertility Rate (live births per woman)	4.7	5.1	0.4
Average Percentage Change in Fertility Rate	(28.9%)	(10.7%)	18.2
Average Immunization for Measles (% of children < 1 year)	53.0%	36.0%	17.0
Average Percentage Change in Immunization for Measles	85.1%	19.1%	66.0
Average Immunization for DPT (% of children < 1 year)	50.3%	33.0%	17.3
Average Percentage Change in Immunization for DPT	54.7%	36.9%	17.8
Average Population per Physician (persons)	5,584	1,167 †	4,417
Average Percentage Change in Pop per Physician	65.6%	(38.5%) †	104.1
Average Population per Hospital Bed (persons)	573	1,301	728
Average Percentage Change in Pop per Hospital Bed	(13.0%)	unknown	unknown
Average Gross National Product (GNP) per Capita (US \$)	\$413	\$1,270	857
Average Percentage Change in GNP per Capita	(26.1%)	59.4%	85.5
* 1 unknown project budget in Kenya			
† Only 1 of the 3 countries reported information on this indicator			

Table D2. Average Indicators for Asian Countries with High & Low Project Numbers

AVERAGE INDICATORS FOR ASIAN COUNTRIES WITH HIGH & LOW NUMBERS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the average of the most recent estimate during the period 1989 to 1994			
- changes in indicators reflect the average percentage change that occurred between 1985 and 1994			
Development Performance Indicators	3 Countries with Highest Project Numbers	3 Countries with Lowest Project Numbers	Difference between Country Groups
Total Population (millions)	1,439.331	53.708	1,385.623
Total Percentage of Asian Study Population	50.9%	1.8%	49.1
Average Percentage Change in Population	14.5%	21.9%	7.4
Average Population Growth Rate (annual percentage)	1.3%	2.1%	0.8
Total Number of Health Projects	145	3	142
Total Percentage of Asian Health Projects	65.3%	1.5%	63.8
Total Value of Health Projects (US \$)	\$374,626,336	\$4,941,750	369,684,586
Total Percentage of Asian Health Dollars	42.4%	0.6%	41.8
Average Health Dollars per Capita	\$0.88	\$0.40	0.48
Average Life Expectancy at Birth (years)	67	61	6
Average Percentage Change in Life Expectancy at Birth	6.7%	8.4%	1.7
Average Infant Mortality Rate (per 1,000 live births)	40	59	19
Average Percentage Change in Infant Mortality Rate	(23.6%)	(19.3%)	4.3
Average Maternal Mortality Rate (per 100,000 live births)	135	495	360
Average Percentage Change in Maternal Mortality Rate	(42.6%) †	(4.8%)	37.8
Average Total Fertility Rate (live births per woman)	2.2	3.9	1.7
Average Percentage Change in Fertility Rate	(28.3%)	(18.2%)	10.1
Average Immunization for Measles (% of children < 1 year)	77.7%	58.7%	19.0
Average Percentage Change in Immunization for Measles	210.6%	103.6%	107.0
Average Immunization for DPT (% of children < 1 year)	83.3%	71.0%	12.3
Average Percentage Change in Immunization for DPT	180.6%	141.5%	39.1
Average Population per Physician (persons)	4,173	8,802	4,629
Average Percentage Change in Pop per Physician	(15.1%)	118.3%	133.4
Average Population per Hospital Bed (persons)	910	944	34
Average Percentage Change in Pop per Hospital Bed	(0.2%)	39.4%	39.6
Average Gross National Product (GNP) per Capita (US \$)	\$1,207	\$1,160 †	47
Average Percentage Change in GNP per Capita	96.4%	61.1% †	35.3
† Only 1 of the 3 countries reported information on this indicator			

Table D3. Average Indicators for Latin American Countries with High & Low Project Numbers

AVERAGE INDICATORS FOR LATIN AMERICAN COUNTRIES WITH HIGH & LOW NUMBERS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the average of the most recent estimate during the period 1989 to 1994			
- changes in indicators reflect the average percentage change that occurred between 1985 and 1994			
Development Performance Indicators	3 Countries with Highest Project Numbers	3 Countries with Lowest Project Numbers	Difference between Country Groups
Total Population (millions)	261.665	11.525	250.140
Total Percentage of Latin American Study Population	61.4%	2.6%	58.8
Average Percentage Change in Population	17.2%	18.7%	1.5
Average Population Growth Rate (annual percentage)	1.7%	1.8%	0.1
Total Number of Health Projects	124	4	120
Total Percentage of Latin American Health Projects	62.0%	2.0%	60.0
Total Value of Health Projects (US \$)	\$15,319,091	\$33,006,888 *	17,687,797
Total Percentage of Latin American Health Dollars	3.7%	8.0%	4.3
Average Health Dollars per Capita	\$0.12	\$3.45	3.33
Average Life Expectancy at Birth (years)	70	71	1
Average Percentage Change in Life Expectancy at Birth	4.1%	4.0%	0.1
Average Infant Mortality Rate (per 1,000 live births)	34	29	5
Average Percentage Change in Infant Mortality Rate	(33.2%)	(29.9%)	3.3
Average Maternal Mortality Rate (per 100,000 live births)	200 †	129	71
Average Percentage Change in Maternal Mortality Rate	33.3% †	(31.0%)	64.3
Average Total Fertility Rate (live births per woman)	2.8	3.2	0.4
Average Percentage Change in Fertility Rate	(19.6%)	(20.8%)	1.2
Average Immunization for Measles (% of children < 1 year)	84.7%	89.0%	4.3
Average Percentage Change in Immunization for Measles	61.5%	162.8%	101.3
Average Immunization for DPT (% of children < 1 year)	76.3%	89.3%	13.0
Average Percentage Change in Immunization for DPT	55.1%	57.7%	2.6
Average Population per Physician (persons)	2,152 †	2,435 †	283
Average Percentage Change in Pop per Physician	74.8% †	60.9% †	13.9
Average Population per Hospital Bed (persons)	474	607	133
Average Percentage Change in Pop per Hospital Bed	8.8% †	(2.1%)	10.9
Average Gross National Product (GNP) per Capita (US \$)	\$3,647	\$2,633	1,014
Average Percentage Change in GNP per Capita	116.6%	66.7%	49.9
* 1 unknown project budget in Honduras			
† Only 1 of the 3 countries reported information on this indicator			

Table D4. Performance Indicators for African Countries with Highest Project Numbers

AFRICAN COUNTRIES WITH HIGHEST PROJECT NUMBERS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Kenya	Egypt	Nigeria
Total Population (millions)	26.017	56.767	108.014
Percentage of African Study Population	4.8%	10.5%	20.0%
Percentage Change in Population (1985-1994)	30.1%	22.1%	29.8%
Population Growth Rate (annual percentage)	2.6%	1.8%	2.9%
Number of Health Projects	37	21	20
Percentage of African Health Projects	19.7%	11.2%	10.6%
Value of Health Projects (US dollars)	\$2,078,423 *	\$60,497,960	\$1,346,880
Percentage of African Health Dollars	0.7%	21.7%	0.5%
Health Dollars per Capita (within country)	\$0.08	\$1.07	\$0.01
Life Expectancy at Birth (years)	59	62	52
Percentage Change in Life Expectancy at Birth (1985-1994)	5.4%	8.8%	6.1%
Infant Mortality Rate (per 1,000 live births)	59	52	81
Percentage Change in Infant Mortality Rate (1985-1994)	(10.6%)	(53.6%)	(15.6%)
Maternal Mortality Rate (per 100,000 live births)	646	unknown	1,027
Percentage Change in Maternal Mortality Rate (1985-1994)	26.7%	unknown	(31.5%)
Total Fertility Rate (live births per woman)	4.9	3.5	5.6
Percentage Change in Fertility Rate (1985-1994)	(36.4%)	(31.4%)	(18.8%)
Immunization for Measles (% of children under 1 year of age)	36.0%	89.0%	34.0%
Percentage Change in Immunization for Measles (1985-1994)	(42.9%)	20.3%	277.8%
Immunization for DPT (% of children under 1 year of age)	36.0%	86.0%	29.0%
Percentage Change in Immunization for DPT (1985-1994)	(48.6%)	(9.5%)	222.2%
Population per Physician (persons)	9,851	1,316	unknown
Percentage Change in Pop per Physician (1985-1994)	51.3%	79.8%	unknown
Population per Hospital Bed (persons)	602	517	599
Percentage Change in Pop per Hospital Bed (1985-1994)	2.0%	7.0%	(48.1%)
Gross National Product (GNP) per Capita (US dollars)	\$250	\$710	\$280
Percentage Change in GNP per Capita (1985-1994)	(16.7%)	10.9%	(72.5%)
* 1 unknown project budget in Kenya			

Table D5. Performance Indicators for African Countries with Lowest Project Numbers

AFRICAN COUNTRIES WITH LOWEST PROJECT NUMBERS**			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Somalia	Mauritius	Cote d'Ivoire
Total Population (millions)	8.775	1.115	13.841
Percentage of African Study Population	1.6%	0.2%	2.6%
Percentage Change in Population (1985-1994)	31.2%	9.3%	39.3%
Population Growth Rate (annual percentage)	2.7%	1.6%	3.6%
Number of Health Projects	1	1	1
Percentage of African Health Projects	0.5%	0.5%	0.5%
Value of Health Projects (US dollars)	\$10,710,000	\$17,128	\$50,000
Percentage of African Health Dollars	3.8%	0.01%	0.02%
Health Dollars per Capita (within country)	\$1.22	\$0.02	\$0.004
Life Expectancy at Birth (years)	49	70	56
Percentage Change in Life Expectancy at Birth (1985-1994)	8.9%	4.5%	5.7%
Infant Mortality Rate (per 1,000 live births)	130	17	90
Percentage Change in Infant Mortality Rate (1985-1994)	(9.1%)	(39.3%)	(15.1%)
Maternal Mortality Rate (per 100,000 live births)	1,725	unknown	822
Percentage Change in Maternal Mortality Rate (1985-1994)	56.8%	unknown	unknown
Total Fertility Rate (live births per woman)	6.8	2.0	6.5
Percentage Change in Fertility Rate (1985-1994)	0%	(20.0%)	(12.2%)
Immunization for Measles (% of children under 1 year of age)	30.0%	unknown	42.0%
Percentage Change in Immunization for Measles (1985-1994)	(11.8%)	unknown	50.0%
Immunization for DPT (% of children under 1 year of age)	18.0%	unknown	48.0%
Percentage Change in Immunization for DPT (1985-1994)	(18.2%)	unknown	92.0%
Population per Physician (persons)	unknown	1,167	unknown
Percentage Change in Pop per Physician (1985-1994)	unknown	(38.5%)	unknown
Population per Hospital Bed (persons)	1,333	unknown	1,268
Percentage Change in Pop per Hospital Bed (1985-1994)	unknown	unknown	unknown
Gross National Product (GNP) per Capita (US dollars)	\$120	\$3,180	\$510
Percentage Change in GNP per Capita (1985-1994)	0%	197.2%	(19.0%)
** These 3 countries were randomly selected from a pool of 11 African countries reporting 1 project each			

Table D6. Performance Indicators for Asian Countries with Highest Project Numbers

ASIAN COUNTRIES WITH HIGHEST PROJECT NUMBERS**			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	China	Thailand	Indonesia
Total Population (millions)	1,190.918	58.024	190.389
Percentage of Asian Study Population	42.1%	2.1%	6.7%
Percentage Change in Population (1985-1994)	13.3%	13.5%	16.8%
Population Growth Rate (annual percentage)	1.1%	1.2%	1.6%
Number of Health Projects	62	52	31
Percentage of Asian Health Projects	27.9%	23.4%	14.0%
Value of Health Projects (US dollars)	\$118,989,665	\$100,635,234	\$155,001,437
Percentage of Asian Health Dollars	13.5%	11.4%	17.5%
Health Dollars per Capita (within country)	\$0.10	\$1.73	\$0.81
Life Expectancy at Birth (years)	69	69	63
Percentage Change in Life Expectancy at Birth (1985-1994)	1.5%	6.2%	12.5%
Infant Mortality Rate (per 1,000 live births)	30	36	53
Percentage Change in Infant Mortality Rate (1985-1994)	(18.9%)	(18.2%)	(33.8%)
Maternal Mortality Rate (per 100,000 live births)	115	155	unknown
Percentage Change in Maternal Mortality Rate (1985-1994)	unknown	(42.6%)	unknown
Total Fertility Rate (live births per woman)	1.9	2.0	2.7
Percentage Change in Fertility Rate (1985-1994)	(17.4%)	(33.3%)	(34.1%)
Immunization for Measles (% of children under 1 year of age)	93.0%	60.0%	80.0%
Percentage Change in Immunization for Measles (1985-1994)	25.7%	172.7%	433.3%
Immunization for DPT (% of children under 1 year of age)	95.0%	69.0%	86.0%
Percentage Change in Immunization for DPT (1985-1994)	21.8%	46.8%	473.3%
Population per Physician (persons)	1,063	4,427	7,028
Percentage Change in Pop per Physician (1985-1994)	5.1%	(25.1%)	(25.3%)
Population per Hospital Bed (persons)	612	615	1,503
Percentage Change in Pop per Hospital Bed (1985-1994)	21.2%	(5.5%)	(16.3%)
Gross National Product (GNP) per Capita (US dollars)	\$530	\$2,210	\$880
Percentage Change in GNP per Capita (1985-1994)	47.2%	172.8%	69.2%
** Indonesia was randomly selected from a pool of 2 Asian countries reporting 31 projects each			

Table D7. Performance Indicators for Asian Countries with Lowest Project Numbers

ASIAN COUNTRIES WITH LOWEST PROJECT NUMBERS**			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Papau New Guinea	Myanmar (Burma)	Lebanon
Total Population (millions)	4.197	45.581	3.930
Percentage of Asian Study Population	0.1%	1.6%	0.1%
Percentage Change in Population (1985-1994)	21.3%	21.4%	23.0%
Population Growth Rate (annual percentage)	2.3%	2.1%	1.9%
Number of Health Projects	1	1	1
Percentage of Asian Health Projects	0.5%	0.5%	0.5%
Value of Health Projects (US dollars)	\$296,875	\$296,875	\$4,348,000
Percentage of Asian Health Dollars	0.03%	0.03%	0.5%
Health Dollars per Capita (within country)	\$0.07	\$0.01	\$1.11
Life Expectancy at Birth (years)	57	58	69
Percentage Change in Life Expectancy at Birth (1985-1994)	9.6%	9.4%	6.2%
Infant Mortality Rate (per 1,000 live births)	65	80	32
Percentage Change in Infant Mortality Rate (1985-1994)	0%	(24.5%)	(33.3%)
Maternal Mortality Rate (per 100,000 live births)	700	518	266
Percentage Change in Maternal Mortality Rate (1985-1994)	(22.2%)	12.6%	unknown
Total Fertility Rate (live births per woman)	4.9	4.0	2.9
Percentage Change in Fertility Rate (1985-1994)	(12.5%)	(18.4%)	(23.7%)
Immunization for Measles (% of children under 1 year of age)	63.0%	73.0%	40.0%
Percentage Change in Immunization for Measles (1985-1994)	133.3%	unknown	73.9%
Immunization for DPT (% of children under 1 year of age)	64.0%	69.0%	80.0%
Percentage Change in Immunization for DPT (1985-1994)	60.0%	331.3%	33.3%
Population per Physician (persons)	12,754	12,897	754
Percentage Change in Pop per Physician (1985-1994)	110.1%	244.6%	0.3%
Population per Hospital Bed (persons)	297	1,590	unknown
Percentage Change in Pop per Hospital Bed (1985-1994)	42.8%	35.9%	unknown
Gross National Product (GNP) per Capita (US dollars)	\$1,160	unknown	unknown
Percentage Change in GNP per Capita (1985-1994)	61.1%	unknown	unknown
** These 3 countries were randomly selected from a pool of 6 Asian countries reporting 1 project each			

Table D8. Performance Indicators for Latin American Countries with Highest Project Numbers

LATIN AMERICAN COUNTRIES WITH HIGHEST PROJECT NUMBERS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Brazil	Chile	Mexico
Total Population (millions)	159.128	13.994	88.543
Percentage of Latin American Study Population	37.3%	3.3%	20.8%
Percentage Change in Population (1985-1994)	17.8%	15.4%	18.4%
Population Growth Rate (annual percentage)	1.7%	1.4%	2.1%
Number of Health Projects	46	41	37
Percentage of Latin American Health Projects	23.0%	20.5%	18.5%
Value of Health Projects (US dollars)	\$4,692,220	\$3,639,930	\$6,986,941
Percentage of Latin American Health Dollars	1.1%	0.9%	1.7%
Health Dollars per Capita (within country)	\$0.03	\$0.26	\$0.08
Life Expectancy at Birth (years)	67	72	70
Percentage Change in Life Expectancy at Birth (1985-1994)	6.3%	1.4%	4.5%
Infant Mortality Rate (per 1,000 live births)	56	12	35
Percentage Change in Infant Mortality Rate (1985-1994)	(21.1%)	(50.0%)	(28.6%)
Maternal Mortality Rate (per 100,000 live births)	200	unknown	unknown
Percentage Change in Maternal Mortality Rate (1985-1994)	33.3%	unknown	unknown
Total Fertility Rate (live births per woman)	2.8	2.5	3.2
Percentage Change in Fertility Rate (1985-1994)	(24.3%)	(10.7%)	(23.8%)
Immunization for Measles (% of children under 1 year of age)	83.0%	93.0%	78.0%
Percentage Change in Immunization for Measles (1985-1994)	3.8%	20.8%	160.0%
Immunization for DPT (% of children under 1 year of age)	75.0%	90.0%	64.0%
Percentage Change in Immunization for DPT (1985-1994)	11.9%	7.1%	146.2%
Population per Physician (persons)	unknown	2,152	unknown
Percentage Change in Pop per Physician (1985-1994)	unknown	74.8%	unknown
Population per Hospital Bed (persons)	300	320	801
Percentage Change in Pop per Hospital Bed (1985-1994)	unknown	8.8%	unknown
Gross National Product (GNP) per Capita (US dollars)	\$3,370	\$3,560	\$4,010
Percentage Change in GNP per Capita (1985-1994)	113.3%	152.5%	83.9%

Table D9. Performance Indicators for Latin American Countries with Lowest Project Numbers

LATIN AMERICAN COUNTRIES WITH LOWEST PROJECT NUMBERS**			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Honduras	Panama	Uruguay
Total Population (millions)	5.750	2.612	3.163
Percentage of Latin American Study Population	1.3%	0.6%	0.7%
Percentage Change in Population (1985-1994)	31.2%	19.8%	5.2%
Population Growth Rate (annual percentage)	3.0%	1.9%	0.5%
Number of Health Projects	2	1	1
Percentage of Latin American Health Projects	1.0%	0.5%	0.5%
Value of Health Projects (US dollars)	\$2,006,888 *	\$3,000,000	\$28,000,000
Percentage of Latin American Health Dollars	0.5%	0.7%	6.8%
Health Dollars per Capita (within country)	\$0.35	\$1.15	\$8.85
Life Expectancy at Birth (years)	66	73	73
Percentage Change in Life Expectancy at Birth (1985-1994)	6.5%	2.8%	2.8%
Infant Mortality Rate (per 1,000 live births)	47	20	19
Percentage Change in Infant Mortality Rate (1985-1994)	(24.2%)	(23.1%)	(42.4%)
Maternal Mortality Rate (per 100,000 live births)	221	unknown	36
Percentage Change in Maternal Mortality Rate (1985-1994)	(26.3%)	unknown	(35.7%)
Total Fertility Rate (live births per woman)	4.7	2.7	2.2
Percentage Change in Fertility Rate (1985-1994)	(24.2%)	(22.9%)	(15.4%)
Immunization for Measles (% of children under 1 year of age)	86.0%	99.0%	82.0%
Percentage Change in Immunization for Measles (1985-1994)	68.6%	37.5%	382.4%
Immunization for DPT (% of children under 1 year of age)	94.0%	86.0%	88.0%
Percentage Change in Immunization for DPT (1985-1994)	95.8%	22.9%	54.4%
Population per Physician (persons)	2,435	unknown	unknown
Percentage Change in Pop per Physician (1985-1994)	60.9%	unknown	unknown
Population per Hospital Bed (persons)	993	unknown	221
Percentage Change in Pop per Hospital Bed (1985-1994)	24.1%	unknown	(28.2%)
Gross National Product (GNP) per Capita (US dollars)	\$580	\$2,670	\$4,650
Percentage Change in GNP per Capita (1985-1994)	(26.6%)	16.6%	210.0%
* 1 unknown project budget in Honduras			
** Honduras was randomly selected from a pool of 3 Latin American countries reporting 2 projects each			

APPENDIX E

Development Performance Indicators
for Selected Third World Countries
Receiving the Highest & Lowest Amount of Regional Health Dollars

Table E1. Average Indicators for African Countries with High & Low Project Dollars

AVERAGE INDICATORS FOR AFRICAN COUNTRIES WITH HIGH & LOW DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the average of the most recent estimate during the period 1989 to 1994			
- changes in indicators reflect the average percentage change that occurred between 1985 and 1994			
Development Performance Indicators	3 Countries with Highest Project Dollars	3 Countries with Lowest Project Dollars	Difference between Country Groups
Total Population (millions)	105.732	15.964	89.768
Total Percentage of African Study Population	19.6%	3.0%	16.6
Average Percentage Change in Population	28.4%	23.3%	5.1
Average Population Growth Rate (annual percentage)	2.5%	2.5%	0
Total Number of Health Projects	29	3	26
Total Percentage of African Health Projects	15.4%	1.5%	13.9
Total Value of Health Projects (US \$)	\$123,250,500	\$75,128	123,175,372
Total Percentage of African Health Dollars	44.2%	0.03%	44.17
Average Health Dollars per Capita	\$2.05	\$0.01	2.04
Average Life Expectancy at Birth (years)	53	56	3
Average Percentage Change in Life Expectancy at Birth	7.6%	6.7%	0.9
Average Infant Mortality Rate (per 1,000 live births)	92	79	13
Average Percentage Change in Infant Mortality Rate	(35.1%)	(29.5%)	5.6
Average Maternal Mortality Rate (per 100,000 live births)	878	1,875	997
Average Percentage Change in Maternal Mortality Rate	75.2% †	47.1% †	28.1
Average Total Fertility Rate (live births per woman)	5.0	5.1	0.1
Average Percentage Change in Fertility Rate	(13.3%)	(6.7%)	6.6
Average Immunization for Measles (% of children < 1 year)	58.3%	55.0%	3.3
Average Percentage Change in Immunization for Measles	7.2%	234.0%	226.8
Average Immunization for DPT (% of children < 1 year)	53.0%	51.0%	2.0
Average Percentage Change in Immunization for DPT	367.6%	194.3%	173.3
Average Population per Physician (persons)	3,943	12,350	8,407
Average Percentage Change in Pop per Physician	(4,115.1%)	14.0%	4,129.1
Average Population per Hospital Bed (persons)	1,012	4,281 †	3,269
Average Percentage Change in Pop per Hospital Bed	7.0% †	52.9% †	45.9
Average Gross National Product (GNP) per Capita (US \$)	\$487	\$1,267	780
Average Percentage Change in GNP per Capita	5.5%	102.6%	97.1
† Only 1 of the 3 countries reported information on this indicator			

Table E2. Average Indicators for Asian Countries with High & Low Project Dollars

AVERAGE INDICATORS FOR ASIAN COUNTRIES WITH HIGH & LOW DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the average of the most recent estimate during the period 1989 to 1994			
- changes in indicators reflect the average percentage change that occurred between 1985 and 1994			
Development Performance Indicators	3 Countries with Highest Project Dollars	3 Countries with Lowest Project Dollars	Difference between Country Groups
Total Population (millions)	1,221.930	106.493	1,115.437
Total Percentage of Asian Study Population	43.2%	3.7%	39.5
Average Percentage Change in Population	18.8%	31.5%	12.7
Average Population Growth Rate (annual percentage)	1.6%	2.6%	1.0
Total Number of Health Projects	72	6	66
Total Percentage of Asian Health Projects	32.5%	2.8%	29.7
Total Value of Health Projects (US \$)	\$651,553,459	\$158,500	651,394,959
Total Percentage of Asian Health Dollars	73.7%	0.01%	73.69
Average Health Dollars per Capita	\$1.21	\$0.001	1.209
Average Life Expectancy at Birth (years)	61	64	3
Average Percentage Change in Life Expectancy at Birth	13.1%	5.6%	7.5
Average Infant Mortality Rate (per 1,000 live births)	68	52	16
Average Percentage Change in Infant Mortality Rate	(35.2%)	(33.1%)	2.1
Average Maternal Mortality Rate (per 100,000 live births)	662	537	125
Average Percentage Change in Maternal Mortality Rate	(37.7%)	(9.8%)	27.9
Average Total Fertility Rate (live births per woman)	3.2	4.6	1.4
Average Percentage Change in Fertility Rate	(32.7%)	(18.9%)	13.8
Average Immunization for Measles (% of children < 1 year)	79.9%	73.7%	6.2
Average Percentage Change in Immunization for Measles	3,861.7%	321.2%	3,540.5
Average Immunization for DPT (% of children < 1 year)	82.4%	79.0%	3.4
Average Percentage Change in Immunization for DPT	1,349.4%	76.7%	1,272.7
Average Population per Physician (persons)	6,169	2,360	3,809
Average Percentage Change in Pop per Physician	(22.2%)	(33.4%)	11.2
Average Population per Hospital Bed (persons)	2,040	631	1,409
Average Percentage Change in Pop per Hospital Bed	(6.1%)	4.1%	10.2
Average Gross National Product (GNP) per Capita (US \$)	\$473	\$1,330	857
Average Percentage Change in GNP per Capita	44.4%	84.3%	39.9
† Only 1 of the 3 countries reported information on this indicator			

Table E3. Average Indicators for Latin American Countries with High & Low Project Dollars

AVERAGE INDICATORS FOR LATIN AMERICAN COUNTRIES WITH HIGH & LOW DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the average of the most recent estimate during the period 1989 to 1994			
- changes in indicators reflect the average percentage change that occurred between 1985 and 1994			
Development Performance Indicators	3 Countries with Highest Project Dollars	3 Countries with Lowest Project Dollars	Difference between Country Groups
Total Population (millions)	20.113	73.828	53.715
Percentage of Latin American Study Population	4.7%	17.3%	12.6
Average Percentage Change in Population	25.7%	18.7%	7.0
Average Population Growth Rate (annual percentage)	2.8%	1.7%	1.1
Total Number of Health Projects	11	31	20
Percentage of Latin American Health Projects	5.5%	15.5%	10.0
Total Value of Health Projects (US \$)	\$263,588,539	\$1,474,821	262,113,718
Percentage of Latin American Health Dollars	63.7%	0.4%	63.3
Average Health Dollars per Capita	\$14.87	\$0.05	14.82
Average Life Expectancy at Birth (years)	66	73	7
Average Percentage Change in Life Expectancy at Birth	13.8%	3.8%	10.0
Average Infant Mortality Rate (per 1,000 live births)	46	19	27
Average Percentage Change in Infant Mortality Rate	(41.1%)	(36.6%)	4.5
Average Maternal Mortality Rate (per 100,000 live births)	464 †	124	340
Average Percentage Change in Maternal Mortality Rate	54.7% †	24.8%	29.9
Average Total Fertility Rate (live births per woman)	4.6	2.7	1.9
Average Percentage Change in Fertility Rate	(16.5%)	(22.3%)	5.8
Average Immunization for Measles (% of children < 1 year)	51.7%	88.0%	36.3
Average Percentage Change in Immunization for Measles	62.4%	20.9%	41.5
Average Immunization for DPT (% of children < 1 year)	64.7%	87.7%	23.0
Average Percentage Change in Immunization for DPT	58.3%	27.7%	30.6
Average Population per Physician (persons)	1,492 †	unknown	unknown
Average Percentage Change in Pop per Physician	0.1% †	unknown	unknown
Average Population per Hospital Bed (persons)	637	476	161
Average Percentage Change in Pop per Hospital Bed	36.5% †	16.9% †	19.6
Average Gross National Product (GNP) per Capita (US \$)	\$1,000	\$4,020	3,020
Average Percentage Change in GNP per Capita	9.9%	94.5%	84.6
† Only 1 of the 3 countries reported information on this indicator			

Table E4. Performance Indicators for African Countries with Highest Project Dollars

AFRICAN COUNTRIES WITH HIGHEST PROJECT DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Egypt	Zaire	Guinea
Total Population (millions)	56.767	42.540	6.425
Percentage of African Study Population	10.5%	7.9%	1.2%
Percentage Change in Population (1985-1994)	22.1%	34.2%	28.8%
Population Growth Rate (annual percentage)	1.8%	3.1%	2.6%
Number of Health Projects	21	7	1
Percentage of African Health Projects	11.2%	3.7%	0.5%
Value of Health Projects (US dollars)	\$60,497,960	\$35,452,540	\$27,300,000
Percentage of African Health Dollars	21.7%	12.7%	9.8%
Health Dollars per Capita (within country)	\$1.07	\$0.83	\$4.25
Life Expectancy at Birth (years)	62	52	44
Percentage Change in Life Expectancy at Birth (1985-1994)	8.8%	4.0%	10.0%
Infant Mortality Rate (per 1,000 live births)	52	unknown	131
Percentage Change in Infant Mortality Rate (1985-1994)	(53.6%)	unknown	(16.6%)
Maternal Mortality Rate (per 100,000 live births)	unknown	876	880
Percentage Change in Maternal Mortality Rate (1985-1994)	unknown	75.2%	unknown
Total Fertility Rate (live births per woman)	3.5	unknown	6.5
Percentage Change in Fertility Rate (1985-1994)	(31.4%)	unknown	4.8%
Immunization for Measles (% of children under 1 year of age)	89.0%	36.0%	50.0%
Percentage Change in Immunization for Measles (1985-1994)	20.3%	(12.2%)	13.6%
Immunization for DPT (% of children under 1 year of age)	86.0%	23.0%	50.0%
Percentage Change in Immunization for DPT (1985-1994)	(9.5%)	(37.8%)	1,150.0%
Population per Physician (persons)	1,316	unknown	6,570
Percentage Change in Pop per Physician (1985-1994)	79.8%	unknown	(8,310.0%)
Population per Hospital Bed (persons)	517	702	1,816
Percentage Change in Pop per Hospital Bed (1985-1994)	7.0%	unknown	unknown
Gross National Product (GNP) per Capita (US dollars)	\$710	\$240	\$510
Percentage Change in GNP per Capita (1985-1994)	10.9%	0%	unknown

Table E5. Performance Indicators for African Countries with Lowest Project Dollars

AFRICAN COUNTRIES WITH LOWEST PROJECT DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Mali	Benin	Mauritius
Total Population (millions)	9.524	5.325	1.115
Percentage of African Study Population	1.8%	1.0%	0.2%
Percentage Change in Population (1985-1994)	28.9%	31.7%	9.3%
Population Growth Rate (annual percentage)	3.1%	2.8%	1.6%
Number of Health Projects	1	1	1
Percentage of African Health Projects	0.5%	0.5%	0.5%
Value of Health Projects (US dollars)	\$30,000	\$28,000	\$17,128
Percentage of African Health Dollars	0.01%	0.01%	0.01%
Health Dollars per Capita (within country)	\$0.003	\$0.01	\$0.02
Life Expectancy at Birth (years)	49	50	70
Percentage Change in Life Expectancy at Birth (1985-1994)	11.4%	4.2%	4.5%
Infant Mortality Rate (per 1,000 live births)	125	96	17
Percentage Change in Infant Mortality Rate (1985-1994)	(30.6%)	(18.6%)	(39.3%)
Maternal Mortality Rate (per 100,000 live births)	1,249	2,500	unknown
Percentage Change in Maternal Mortality Rate (1985-1994)	unknown	47.1%	unknown
Total Fertility Rate (live births per woman)	7.1	6.1	2.0
Percentage Change in Fertility Rate (1985-1994)	6.0%	(6.2%)	(20.0%)
Immunization for Measles (% of children under 1 year of age)	40.0%	70.0%	unknown
Percentage Change in Immunization for Measles (1985-1994)	263.6%	204.3%	unknown
Immunization for DPT (% of children under 1 year of age)	35.0%	67.0%	unknown
Percentage Change in Immunization for DPT (1985-1994)	94.4%	294.1%	unknown
Population per Physician (persons)	19,448	16,435	1,167
Percentage Change in Pop per Physician (1985-1994)	(23.4%)	19.9%	(38.5%)
Population per Hospital Bed (persons)	unknown	4,281	unknown
Percentage Change in Pop per Hospital Bed (1985-1994)	unknown	52.9%	unknown
Gross National Product (GNP) per Capita (US dollars)	\$250	\$370	\$3,180
Percentage Change in GNP per Capita (1985-1994)	78.6%	32.1%	197.2%

Table E6. Performance Indicators for Asian Countries with Highest Project Dollars

ASIAN COUNTRIES WITH HIGHEST PROJECT DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Bangladesh	India	Indonesia
Total Population (millions)	117.941	913.600	190.389
Percentage of Asian Study Population	4.2%	32.3%	6.7%
Percentage Change in Population (1985-1994)	20.3%	19.4%	16.8%
Population Growth Rate (annual percentage)	1.5%	1.7%	1.6%
Number of Health Projects	10	31	31
Percentage of Asian Health Projects	4.5%	14.0%	14.0%
Value of Health Projects (US dollars)	\$307,474,612	\$189,077,410	\$155,001,437
Percentage of Asian Health Dollars	34.8%	21.4%	17.5%
Health Dollars per Capita (within country)	\$2.61	\$0.21	\$0.81
Life Expectancy at Birth (years)	57	62	63
Percentage Change in Life Expectancy at Birth (1985-1994)	14.0%	12.7%	12.5%
Infant Mortality Rate (per 1,000 live births)	81	70	53
Percentage Change in Infant Mortality Rate (1985-1994)	(36.7%)	(35.2%)	(33.8%)
Maternal Mortality Rate (per 100,000 live births)	887	437	unknown
Percentage Change in Maternal Mortality Rate (1985-1994)	(70.4%)	(5.0%)	unknown
Total Fertility Rate (live births per woman)	3.6	3.3	2.7
Percentage Change in Fertility Rate (1985-1994)	unknown	(31.3%)	(34.1%)
Immunization for Measles (% of children under 1 year of age)	73.9%	85.8%	80.0%
Percentage Change in Immunization for Measles (1985-1994)	7,290.0%	unknown	433.3%
Immunization for DPT (% of children under 1 year of age)	71.1%	90.2%	86.0%
Percentage Change in Immunization for DPT (1985-1994)	3,455.0%	120.0%	473.3%
Population per Physician (persons)	5,309	unknown	7,028
Percentage Change in Pop per Physician (1985-1994)	(19.1%)	unknown	(25.3%)
Population per Hospital Bed (persons)	3,246	1,371	1,503
Percentage Change in Pop per Hospital Bed (1985-1994)	(7.5%)	5.5%	(16.3%)
Gross National Product (GNP) per Capita (US dollars)	\$230	\$310	\$880
Percentage Change in GNP per Capita (1985-1994)	53.3%	10.7%	69.2%

Table E7. Performance Indicators for Asian Countries with Lowest Project Dollars

ASIAN COUNTRIES WITH LOWEST PROJECT DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Vietnam	Yemen	Malaysia
Total Population (millions)	72.039	14.785	19.669
Percentage of Asian Study Population	2.5%	0.5%	0.7%
Percentage Change in Population (1985-1994)	22.4%	46.7%	25.5%
Population Growth Rate (annual percentage)	2.0%	3.3%	2.4%
Number of Health Projects	4	1	1
Percentage of Asian Health Projects	1.8%	0.5%	0.5%
Value of Health Projects (US dollars)	\$125,500	\$29,000	\$4,000
Percentage of Asian Health Dollars	0.01%	0.003%	0.001%
Health Dollars per Capita (within country)	\$0.002	\$0.002	\$0.0002
Life Expectancy at Birth (years)	68	53	71
Percentage Change in Life Expectancy at Birth (1985-1994)	6.3%	6.0%	4.4%
Infant Mortality Rate (per 1,000 live births)	42	102	12
Percentage Change in Infant Mortality Rate (1985-1994)	(20.8%)	(21.5%)	(57.1%)
Maternal Mortality Rate (per 100,000 live births)	105	1,471	34
Percentage Change in Maternal Mortality Rate (1985-1994)	(4.5%)	unknown	(15.0%)
Total Fertility Rate (live births per woman)	3.1	7.4	3.4
Percentage Change in Fertility Rate (1985-1994)	(32.6%)	(5.1%)	(19.0%)
Immunization for Measles (% of children under 1 year of age)	85.0%	57.0%	79.0%
Percentage Change in Immunization for Measles (1985-1994)	347.4%	unknown	295.0%
Immunization for DPT (% of children under 1 year of age)	83.0%	62.0%	91.9%
Percentage Change in Immunization for DPT (1985-1994)	97.6%	unknown	55.8%
Population per Physician (persons)	2,279	unknown	2,441
Percentage Change in Pop per Physician (1985-1994)	(43.7%)	unknown	(23.1%)
Population per Hospital Bed (persons)	261	1,196	437
Percentage Change in Pop per Hospital Bed (1985-1994)	(3.7%)	unknown	11.8%
Gross National Product (GNP) per Capita (US dollars)	\$190	\$280	\$3,520
Percentage Change in GNP per Capita (1985-1994)	unknown	unknown	84.3%

Table E8. Performance Indicators for Latin American Countries with Highest Project Dollars

LATIN AMERICAN COUNTRIES WITH HIGHEST PROJECT DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	El Salvador	Guatemala	Nicaragua
Total Population (millions)	5.635	10.322	4.156
Percentage of Latin American Study Population	1.3%	2.4%	1.0%
Percentage Change in Population (1985-1994)	18.9%	29.6%	28.7%
Population Growth Rate (annual percentage)	2.2%	2.9%	3.3%
Number of Health Projects	4	5	2
Percentage of Latin American Health Projects	2.0%	2.5%	1.0%
Value of Health Projects (US dollars)	\$159,941,888	\$60,639,763	\$43,006,888
Percentage of Latin American Health Dollars	38.6%	14.7%	10.4%
Health Dollars per Capita (within country)	\$28.38	\$5.87	\$10.35
Life Expectancy at Birth (years)	67	65	67
Percentage Change in Life Expectancy at Birth (1985-1994)	17.5%	10.2%	13.6%
Infant Mortality Rate (per 1,000 live births)	42	44	51
Percentage Change in Infant Mortality Rate (1985-1994)	(45.5%)	(37.1%)	(40.7%)
Maternal Mortality Rate (per 100,000 live births)	unknown	464	unknown
Percentage Change in Maternal Mortality Rate (1985-1994)	unknown	54.7%	unknown
Total Fertility Rate (live births per woman)	3.8	5.2	4.9
Percentage Change in Fertility Rate (1985-1994)	(24.0%)	(7.1%)	(18.3%)
Immunization for Measles (% of children under 1 year of age)	53.0%	48.0%	54.0%
Percentage Change in Immunization for Measles (1985-1994)	29.3%	77.8%	80.0%
Immunization for DPT (% of children under 1 year of age)	60.0%	63.0%	71.0%
Percentage Change in Immunization for DPT (1985-1994)	36.4%	16.7%	121.9%
Population per Physician (persons)	unknown	unknown	1,492
Percentage Change in Pop per Physician (1985-1994)	unknown	unknown	0.1%
Population per Hospital Bed (persons)	699	673	538
Percentage Change in Pop per Hospital Bed (1985-1994)	unknown	unknown	36.5%
Gross National Product (GNP) per Capita (US dollars)	\$1,480	\$1,190	\$330
Percentage Change in GNP per Capita (1985-1994)	82.7%	3.5%	(56.6%)

Table E9. Performance Indicators for Latin American Countries with Lowest Project Dollars

LATIN AMERICAN COUNTRIES WITH LOWEST PROJECT DOLLARS			
- health & economic indicators obtained from the World Bank (1996a)			
- current indicators reflect the most recent estimate during the period 1989 to 1994			
Countries	Colombia	Argentina	Costa Rica
Total Population (millions)	36.330	34.194	3.304
Percentage of Latin American Study Population	8.5%	8.0%	0.8%
Percentage Change in Population (1985-1994)	18.3%	12.8%	25.1%
Population Growth Rate (annual percentage)	1.8%	1.2%	2.2%
Number of Health Projects	12	15	4
Percentage of Latin American Health Projects	6.0%	7.5%	2.0%
Value of Health Projects (US dollars)	\$612,266	\$509,680	\$352,875
Percentage of Latin American Health Dollars	0.2%	0.1%	0.1%
Health Dollars per Capita (within country)	\$0.02	\$0.01	\$0.11
Life Expectancy at Birth (years)	70	72	77
Percentage Change in Life Expectancy at Birth (1985-1994)	4.5%	2.9%	4.1%
Infant Mortality Rate (per 1,000 live births)	20	23	13
Percentage Change in Infant Mortality Rate (1985-1994)	(50.0%)	(28.1%)	(31.6%)
Maternal Mortality Rate (per 100,000 live births)	107	140	unknown
Percentage Change in Maternal Mortality Rate (1985-1994)	(15.1%)	64.7%	unknown
Total Fertility Rate (live births per woman)	2.6	2.6	2.9
Percentage Change in Fertility Rate (1985-1994)	(25.7%)	(18.8%)	unknown
Immunization for Measles (% of children under 1 year of age)	75.0%	99.0%	90.0%
Percentage Change in Immunization for Measles (1985-1994)	44.2%	10.0%	8.4%
Immunization for DPT (% of children under 1 year of age)	84.0%	84.0%	95.0%
Percentage Change in Immunization for DPT (1985-1994)	40.0%	27.3%	15.9%
Population per Physician (persons)	unknown	unknown	unknown
Percentage Change in Pop per Physician (1985-1994)	unknown	unknown	unknown
Population per Hospital Bed (persons)	733	218	unknown
Percentage Change in Pop per Hospital Bed (1985-1994)	16.9%	unknown	unknown
Gross National Product (GNP) per Capita (US dollars)	\$1,620	\$8,060	\$2,380
Percentage Change in GNP per Capita (1985-1994)	31.7%	164.3%	87.4%