

# I. MORTALITY STRUCTURE IN FIVE COUNTRIES—AN OVERVIEW

## *United Nations Secretariat\**

Governments and scholars are increasingly coming to recognize that a long and healthy life is one of the most highly valued components of welfare. Individuals around the world rank good health at or near the top of the list of attributes that they seek for themselves and their families. Health and longevity are not simply intermediate goals on the road to economic development but are among the principal characteristics that define development itself.

In order to achieve higher levels of health and longevity, it is clearly necessary that governments and individuals know what means exist for improving those levels. This knowledge is not something that needs to be rediscovered in every household, hamlet and country; to a very important extent, developing countries face similar problems in attempting to advance health and have access to similar solutions. What is required is that knowledge produced in one locale be made available to others.

This volume is an attempt to summarize and synthesize information on factors influencing health and mortality in five developing countries. These countries have been chosen because they have made special efforts to understand the determinants of ill-health in their populations. This understanding has required mounting an unusual statistical effort to characterize mortality levels and trends, disease patterns, social variations in mortality, and/or the effects of social and health programmes on mortality. The countries have usually received assistance from international agencies, from individual developed countries or from foundations in these efforts. But in most cases the countries themselves have taken the initiative to improve their information on health and have supplied extra resources for that purpose, the fruits of which are available beyond the country's borders.

Diseases are studied in laboratories, where the organism is investigated, and in clinics, where pathogenic processes are examined. But only when study reaches the level of the large group—a population—can one investigate the impact of factors identified in the laboratory or clinic on social aggregates. Only at the population level can the relative importance of various diseases be delineated, and only at the population level can a proper assessment be made of means for combatting those diseases. Control measures that may appear perfectly effective in the laboratory face many resource constraints and institutional obstacles when deployed in the population at large. Population-based studies are thus required to study use-effectiveness, rather than simply laboratory-effectiveness. Although each of the five countries studied

here has important population-based information on health and mortality, the nature of that information is very diverse. Sri Lanka presents perhaps the most unusual case because its information is principally derived from a national vital registration system that dates back to the early part of the twentieth century. Such systems are very rare in developing countries and they permit a broad-gauged view of the impact of various developments in the economic, social and health sectors on mortality over a broad sweep of time. The fact that those developments were sometimes regionally differentiated (e.g., the post-war antimalarial programme) and that the vital registration system also provided regional detail is of great assistance in identification of their impact.

The Bangladesh case study relies on information somewhat similar to that used in Sri Lanka. The large bulk of information from Bangladesh is derived from the Matlab area, where the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) has maintained a continuous vital registration system since 1966. This system has also been used to characterize levels and trends in mortality and to investigate the impact of large-scale changes (e.g., the drought and famine of 1974). Although its regional and temporal scope is limited, the Matlab surveillance area has been the basis for a number of health intervention activities, facilitating study of the impact of programmes. Teknaf, a second area surveyed by the International Centre for Diarrhoeal Research, Bangladesh, also provides estimates of the effects of various interventions.

Kenya and Senegal lack usable vital registration systems, except in selected cities. Data from these cities are mobilized here in an attempt to derive some evidence on disease patterns, however unrepresentative they may be at the national level. Substituting at the national level for a vital registration system has been a series of demographic surveys. These surveys are exploited in the chapters to provide indirect evidence on levels and trends in mortality, especially among children. Kenya has an exceptionally extensive series of such surveys, permitting more confidence to be placed in the resulting estimates. Both countries have had continuous field investigations of the Matlab type, the most important of which is the one conducted jointly with France in the Sine-Saloum region of Senegal.

The Guatemala case study, which touches on other parts of Central America as well, uses all of these forms of data: national vital registration, which is somewhat incomplete but of good enough quality to yield valuable insights, particularly on causes and ages of death; sample surveys that help to clarify levels and trends in mortality, particularly among children; and carefully designed inter-

\* Population Division, Department of International Economic and Social Affairs, United Nations Secretariat.

vention studies conducted under the auspices of the Instituto de Nutrición de Centro América y Panamá. These provide evidence on the impact of several experimental programmes on mortality.

Table 1 presents evidence on the approximate levels of mortality and of economic development in the five case study countries. Four of the five countries have levels of gross national product per capita that are less than half of the average for developing countries; Bangladesh has the second-lowest income in the world, according to World Bank rankings. Only Guatemala edges above the developing country average. Likewise, three of the five countries have levels of life expectancy that are below average for developing countries. Guatemala's level of life expectancy is in close accord with its ranking in income. But Sri Lanka's life expectancy exceeds the developing country average by 10.9 years, while its level of income is only one third of the average. On the other hand, Senegal (like much of West Africa) ranks considerably higher on an income scale than it does in mortality. The case studies shed a great deal of light on reasons for these unusual rankings. For example, the case study of Senegal describes with vivid numbers an extremely hostile disease environment, reflected in extraordinary seasonality and erratic trends; Meegama's study of Sri Lanka traces a prolonged period of development in the social and health sectors that is predicated on a high degree of popular participation in government decisions.

TABLE 1. ESTIMATES OF INCOME AND LIFE EXPECTANCY IN COUNTRIES INCLUDED IN THE CASE STUDIES

Country	GNP per capita 1982 (1982 dollars)	Life expectancy at birth, 1980-1985	Life expectancy at birth, 1950-1955
Bangladesh	\$ 140	47.8	40.4
Sri Lanka	\$ 320	67.5	56.6
Kenya	\$ 390	52.9	38.6
Senegal	\$ 490	43.3	34.7
Guatemala	\$ 1 130	60.7	42.7
Less developed countries	\$ 983 <sup>a</sup>	56.6	47.0

Sources: World Bank, *World Development Report, 1984* (New York, Oxford University Press) and *World Population Prospects as Assessed in 1982* (ST/ESA/SER.A/86), table A-15.

<sup>a</sup> Computed from averages for income-level groupings.

#### SUMMARY OF RESULTS

All countries included in the case studies have experienced sizeable declines in mortality at the national level. As shown in table 1, developing countries as a whole gained nearly 10 years of life expectancy between the periods 1950-1955 and 1980-1985. Three of the five case study countries have rates similar to this figure. But Guatemala and Kenya appear to have progressed much more quickly than the typical rate. Progress was surely also extraordinarily rapid in Sri Lanka in the period before 1950-1955, because by that period its life expectancy already equalled the average achieved by developing countries 30 years later. So it is particularly fortunate that Sri Lankan data permit an examination of the factors involved in this early mortality decline. These declines can be traced back to the first decade of the twentieth century, when improved sanitation in the form

of better water supply and sewage disposal systems were instrumental, particularly in Colombo. These improvements were extended into the estate sector in the 1920s with comparable results. Deployment of trained midwives was also apparently efficacious during the period, especially in reducing neonatal tetanus deaths. Anti-malarial programmes after the Second World War were clearly an important source of mortality decline in previously malarial zones; but it is clear from developments in non-malarial areas that other factors were also at work, the most important of which were probably an extensive food grain distribution system and use of antibiotics. Meegama attributes the mortality decline since the 1950s to improved use of both preventative and curative medicine and to better sanitation. For example, the failure of malarial deaths to rise sharply despite a resurgence in the number of cases is possibly attributable to more effective use of anti-malarial drugs and to the improved overall physical condition of the population.

A key underpinning of the Sri Lankan successes in mortality reduction was the extension of the franchise to all adults, regardless of sex, in 1931. Meegama points out that Sri Lanka was the first Asian country in which women were enfranchised, a move that was justified explicitly on grounds of the high levels of infant mortality then prevailing. Popular participation in government decision-making has produced one of the clearest examples of national policy oriented towards satisfying the basic needs of the population, including the achievement of high levels of literacy.

In the other countries, which lack the data system present in Sri Lanka, it has not typically proven possible to treat the effects of national policies in such detail. Instead, the effects of particular programmes are usually examined regionally. The Guatemala case study reviews the effects of three health intervention programmes on mortality. All three were dominated by characteristics identified with the phrase, "primary health care". They involved the use of auxiliary health workers whose mandate was broad rather than targeted to a particular disease. The programmes entailed vaccination against diphtheria, pertussis, tetanus, polio and measles; vaccination of pregnant women against tetanus; health education and promotion; efforts to improve sanitation; simple curative measures; and a variety of attempts to improve diets and dietary practices. In two of the three areas, infant mortality fell spectacularly, and in the third it showed more modest declines. Various examinations of individuals involved in the interventions showed the expected relations; those receiving a greater programme "dose" typically showed greater improvement on health indicators. It should be noted that the interventions were carried out with a before-after design, and did not include control areas. However, the fact that the mortality improvement in two of the three areas was so large—apparently much larger than in Guatemala as a whole during equivalent periods—is substantial evidence that it was the programmes themselves that were responsible for the improvements. The studies provide substantial ammunition for advocates of primary health care approaches to developing country health systems and form a basis for a suggested organization of a primary health care scheme.

In the other countries, the health interventions were somewhat narrower in scope. A Bangladesh programme of vaccinating pregnant women to prevent neonatal tetanus reduced the death rate from this important cause by about half for women who were vaccinated. A diarrhoea treatment centre is estimated indirectly to have reduced death rates by 9-14 per cent. A programme of oral rehydration therapy in the home apparently reduced the number of visits made to clinics, but did not have an appreciable effect on mortality, possibly because death rates from dehydration were already very low because of the clinics. A large-scale maternal and child health/family planning programme in the late 1970s coincided with a sharp drop in the crude death rate (and an even larger drop in the crude birth rate), but the definitive studies have not been completed that would establish the link between these two events. Close to half of the crude death rate drop appears to be a result of age-distributional changes induced by the fertility decline.

In Senegal, a national campaign to distribute an anti-malarial drug (chloroquine) to all children under 15 appears to have reached about one third of the children and to have resulted in a drop of one third in the number of children seeking medical attention for malaria. A measles vaccination campaign in the period 1967-1969 initially reached about 75 per cent of the children but was conducted sporadically thereafter. In Ngayokhème, where no additional vaccination occurred until 1979, the number of new cases rose to their pre-1966 levels. The vaccination was far from totally effective even where it continued, presumably because the vaccine quality was variable.

Annual data from Ngayokhème since 1962 have revealed enormously high levels of child mortality, levels that many would have thought to have passed out of existence without such clear evidence of their continued presence. This continuous registration system in the Sine-Saloum area enables examination of the health effects of a natural experiment in the form of a drought in the early 1970s. Unlike the case of Bangladesh, one effect of the drought in Senegal seems to have been a sharp reduction in mortality because it reduced the prevalence of mosquitoes and hence of malaria. This difference in reaction points clearly to the need to recognize the disease environment as an independent actor in developing country mortality, while illustrating at the same time the value of comparative case studies.

Analysis of the Kenya data indicates the extremely important role played by the education of mothers in explaining the mortality decline. This is consistent with results from a number of other countries. The data showed, however, little relationship between district mortality and availability of health services. The authors indicate that this surprising finding may be because utilization of services was the key variable, rather than availability. There is evidence that utilization of services may be related to the increased education of mothers, especially at the three-year mark.

Case studies for Bangladesh and Senegal wrestle with the thorny problem of establishing cost estimates for various health interventions. The per capita costs of the primary health care programmes tested in Guatemala were on the order of \$2 per capita per year. In Bangla-

desh, the calculation was taken one step further to provide a crude estimate of the cost of averting a death as a result of activity of the treatment centre. This cost was estimated to be \$48-\$102 per death averted. But D'Souza notes that the cost could be as much as 12 times higher, depending on how overhead costs are allocated. Complicating cost estimates in both countries is that one programme often saves resources authorized for another programme; oral rehydration therapy in Bangladesh and the primary health care interventions in Guatemala resulted in reduced attendance rates at pre-existing facilities. Clearly, some form of centralized planning is useful to take account of this interdependence.

In addition to describing activities that have proven successful or unsuccessful in altering levels of mortality, the case studies also provide a rich description of mortality conditions that can be used as the basis for structuring future programmes. In some instances these descriptions emphasize the cause of death structure. The case studies of Bangladesh, Guatemala and Sri Lanka show clearly that neonatal tetanus can be sharply reduced through vaccination campaigns. So when tetanus remains a serious cause of death, as in Bangladesh, a feasible remedy is immediately suggested. Likewise, the success of anti-malarial campaigns in Senegal and Sri Lanka points to a feasible strategy for reduction of the high rates remaining in Senegal. In these cases, information on causes of death can be almost self-explanatory in designing health intervention strategies. In a similar vein, the tremendous seasonality of mortality in rural Senegal points clearly towards important causal mechanisms underlying its mortality profile.

Knowing the level of mortality from certain other causes of death, such as diarrhoeal or respiratory disease, has less value in designing health programmes since the diseases themselves are not defined precisely enough that they have a straightforward aetiological implication. Furthermore, they can be attacked through many routes. Unfortunately, in developing countries a very large fraction of child deaths fall into these more nebulous categories. As a rule, mortality conditions, including causes of death, are even less well-defined among adults in developing countries than are conditions among children. The analyses of adult mortality in chapters on Kenya and Sri Lanka are therefore especially welcome. In Sri Lanka, an alarming pattern is developing in which cardiovascular mortality for males has been rising sharply, repeating a pattern seen earlier in many developed countries. In Kenya, nearly one fifth of all deaths are due to the "diseases of development": cardiovascular disease, cancers and motor vehicle accidents.

Analogous to evidence on cause of death structure, descriptions of very large socio-economic differentials in mortality in the various case studies point to social and economic strategies for improving health conditions. These improvements are usually sought in their own right, but recognition of the health benefits can provide additional support and direction for policies. There is somewhat less uniformity in results in the various chapters on this score than might have been hoped. The failure of education of parents to appear as a variable significantly affecting child mortality in Senegal is particularly puzzling, since this variable has been shown to have a large

effect on mortality nearly everywhere that it has been studied, including in chapters for Bangladesh, Kenya and Sri Lanka. On the other hand, urban residence appears far more important a variable in Senegal than it normally is elsewhere. The meaning of these findings for Senegal is not yet clear and clearly calls for further study.

These results suggest that the meaning of social variables can vary rather considerably from place to place and that the relations often need to be investigated at the national or subnational level. But even in such instances, comparisons across case studies help to establish the social context that shapes this meaning. In the case of sex differentials in child mortality, for example, the Senegal study shows clearly that differences are negligible in childhood (except for measles, which may be

higher for girls because they socialize earlier). But in Bangladesh, there is a clear pattern of excess female mortality after the neonatal stage. It is demonstrated that this is likely to reflect a culturally conditioned reaction to scarcity by showing that excess female mortality increased sharply during the famine of 1974-1975. In Sri Lanka, which had a similar sex mortality differential in earlier times, the pattern has disappeared as general mortality conditions have improved.

The studies thus use a wide variety of data and approaches to address a common set of questions: what are the main sources of variation in mortality today, including such disparate matters as climate, malnutrition, illiteracy and health sectoral inadequacies, and what means have proven effective in the past for altering those conditions?