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Measuring the Burden of Disease and the Cost-Effectiveness of Health Interventions

A Case Study in Guinea

Prabhat Jha
Kent Ranson
José Luis Bobadilla

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Cover photo: Health worker and baby.
Credit: World Bank/Curt Carnemark.

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FOREWORD

Health care investments in low-income countries such as Guinea are crucial to development. The choice of allocating spending to various health interventions is a complex one. This report draws upon the methodology of the *1993 World Development Report: Investing in Health* to offer a set of guidelines for the rational allocation of scarce health resources. Analytic efforts, such as this one, can help guide policy choices towards viable and cost-effective health care interventions. This study draws upon local data from Guinea, and represents a useful addition to our knowledge of disease burden and cost-effectiveness in low-income African countries. As a fully collaborative effort with the Ministry of Health in Guinea, this study represents an important aspect of the non-lending policy development work of the World Bank.

David de Ferranti

Director
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ABSTRACT

This study draws upon the methodology of the *1993 World Development Report: Investing in Health* to provide analyses of the burden of disease and cost-effectiveness of health interventions. The analysis aims to provide a common framework for the activities of the government of Guinea in prioritizing health care services. The burden of disease analysis presents detailed estimates of mortality in Guinea, by cause of death in 1992, using a new, rapid methodology. The cost-effectiveness analysis compares the costs of forty interventions selected from treatment protocols at health centers, health posts and first referral hospitals' health care intervention with their health impact. These two methodologies complement other methods to measure health system performance.

The results of the burden of disease study underscore the need for national health care planners and international donors to focus on diseases that cause the most premature deaths. In 1992, the largely avoidable or treatable communicable disease, maternal, and malnutrition diseases together accounted for 86,400 deaths or seventy percent of all deaths and, with perinatal disease, account for nine in ten deaths before age five. Injuries caused 9,000 deaths (seven percent) and non communicable diseases caused 28,700 deaths (twenty-three percent). Many deaths among the economically-productive adult age group could be also avoided. Detailed data on years of life lost, simplified estimates of years lived with a disability, a comparison to other regions, and estimates of the impact of population growth on burden of disease support these findings.

The cost-effectiveness analysis suggests that several affordable interventions already exist for the major causes of death in Guinea. Communicable, maternal, and perinatal diseases, the largest causes of death in Guinea, are subject to several highly cost-effective curative interventions. Those costing less than about one hundred dollars per year of life saved include treatment of childhood pneumonia, rehydration therapy for diarrhea at health centers and at health posts, treatment of childhood malaria at health centers, childhood vaccination at health centers, short-course tuberculosis treatment at health centers, treatment of sexually-transmitted diseases at health centers, and impregnated bed nets against malaria. Maternal and perinatal diseases have slightly less cost-effective interventions, involving prenatal and delivery care at health centers or programs using out reach trained birth attendants.

The report concludes with one possible minimum package of health services that includes outreach preventive programs and a package of curative treatments at health center and hospital levels. The total package of services would cost about thirteen dollars per capita and would address about sixty percent of total years of life lost. The analysis confirms that provision of a basic package of health services will require substantial increases in funding from the government of Guinea and donors. The minimum package is about three times the public per capita expenditure of four dollars. The core set of interventions at the outreach, health center, and first referral hospital level, should be the priority for the government of Guinea as it plans further health system reforms.

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PURPOSE OF STUDY

Like most other developing countries, the Republic of Guinea faces difficult choices in allocating limited financial resources to its people's health needs. Making these choices depends on accurate information about the country's health status and on the effectiveness of various interventions the country might undertake to improve health status.

The 1993 *World Development Report* of the World Bank, which focused upon investments in health (World Bank, 1993b), outlined two analytic steps to guide allocation of scarce health care resources in low and middle income countries. The first was the application of burden of disease measures to obtain estimates of deaths and disability from various diseases. The second was cost-effectiveness analysis to identify health interventions that make best use of money in reducing mortality and morbidity. The report suggested that addressing diseases with a high burden with the most cost-effective interventions could do much to reduce disease in the population. To yield meaningful results, burden of disease and cost-effectiveness studies should be made at a country or sub-country level. This is because large variation exists in epidemiological conditions, health services, and unit costs across countries.

This report presents the results of studies in Guinea based on the *World Development Report's* methodology, the outcome of discussion between Guinea's Ministry of Health and staff in the World Bank. While these analyses offer technical information to guide policy, actual choices must also take into account other factors: the feasibility of the interventions; institutional capacity; political support; and the results of macroeconomic, financial, and operational research. As well, consumer preferences for various interventions are important. Moreover, policy choices are influenced by the way the existing system of health care delivery works, including the allocation of investment and recurrent spending.

The analyses had five objectives:

(a) to provide a common framework for the government of Guinea in prioritizing health care services. Prioritization includes both current health expenditures and planned external aid from the World Bank and other international donors;

(b) to provide a framework for similar analyses at regional levels within Guinea;

(c) to permit a review of current health programs in the context of disease burdens and cost-effectiveness;

(d) to create a set of baseline data and methods that could become a template for similar analyses in other low-income African countries; and

(e) to create a data base that would permit selected inputs into economic analyses of projects in low-income African countries.

To achieve these objectives, the Population and Human Resources Division of the Western Africa Department, and the Human Development Department of the World Bank in conjunction with the Ministry of Health of Guinea undertook a study of the burden of disease and cost-effectiveness of various interventions. The study began with preliminary discussions in March 1994, followed by a mission by Bank staff in November 1994 to collect detailed data. Preliminary estimates were completed in March 1995 and shared with counterparts in Guinea. A second mission in July 1995 validated detailed assumptions. It also included a consultant who verified data sources and numbers for the cost-effectiveness analysis.[1]

[1] The results we present here for burden of disease, and cost-effectiveness analyses are the major results only. To obtain an annex containing more detailed data, or computer files of the analyses, please contact Prabhat Jha in the Human Development Department of the World Bank.

DEMOGRAPHIC AND HEALTH SYSTEM PROFILE OF GUINEA

Guinea is located in West Africa, north of the Ivory Coast. It is one of the poorest nations in Africa with a gross domestic product of $460 (US dollars[2]) per person per year (World Bank, 1993b). Moreover, Guineans suffer among the worst health indicators in the world. Life expectancy at birth is only forty-four years and newborns face a one in four chance of dying before age five. In 1993, according to government surveys, infant mortality was about one-hundred thirty-three deaths per thousand live births and maternal mortality was eight-hundred per hundred thousand live births. Both these measures are among the worst in Africa.

The population of Guinea was 6.6 million in 1995 and was 6.1 million in 1992, the year upon which we base the burden of disease analysis (World Bank, 1993a). Guinea's population is young: forty-seven percent of its people are under fifteen and only four percent are sixty or older. World Bank projections suggest children under fifteen will constitute over forty percent of the population until the year 2025. Life expectancy will increase only slightly, to forty-six years by 2005. Women constitute fifty-one percent of the population, because of a slightly higher mortality among male children. The sex ratio is generally constant over different age groups.

Approximately seventy-two percent of Guinea's population live in rural areas (DNSI, 1994). Apart from having less access to health services than urban inhabitants, only half of those in rural areas have access to drinkable water compared with almost three-quarters of urban residents; and only one percent have access to basic sanitation facilities compared with nearly a fifth of urban residents. About twenty-eight percent of the population live in Maritime Guinea and one million in Conakry, the capital city. Middle Guinea, Upper Guinea, and Forest Guinea constitute thirty-two, twenty-one, and twenty percent, respectively of the total population. International migration is responsible for 0.3 percent to 0.6 percent net migration out of the country.

The Ministry of Health is responsible for organization and delivery of health services in Guinea. An informal system of private and traditional practitioners receives about half of per capita health spending in Guinea. However, the major infrastructure of health facilities is in the public system. The public system relies upon thirty-three prefectures containing three-hundred and seventy-six centre de sante or health centers and three-hundred and forty-seven poste-de sante or health posts. There are thirty-three prefectoral and four regional hospitals and two teaching hospitals in Conakry. A 1993 inventory study by a consulting firm found two-hundred and sixty-nine health centers were part of the Extended Program of Immunization, Basic Care and Essential Medicines, (known as Programme Extendée Vaccination, here referred to as the extended program). Twenty-one health centers were not active due to construction or renovation, and eighty-six were not integrated into the extended program. This study also found one-hundred and fourteen of the health posts were not active and only thirty-five were part of extended program. The activities of the health centers are primary care, infant health (immunization, growth monitoring and nutrition), normal maternal labor (in rural areas; in urban areas, hospitals largely perform

[2] All dollar figures in this report are in 1994 US dollars. The conversion rate used in the report is 976 Guinean francs for every US dollar.

maternal care), family planning, minor surgery, simple diagnostic tests, sale of essential medications, dental care (in certain urban centers), and provision of information. Health posts promote health education, monitor the growth of infants and progress of pregnant women, offer limited primary care, sell essential medications, and make referrals to the health centers. Both health centers and health posts follow written protocols for presentations of common causes of illness (SEATS/JSI, 1994).

According to the government and the World Bank, most of Guinea's health centers and hospitals lack drugs and operating facilities, good management and trained staff, so that even where health services are available, they are inadequate and poorly utilized (World Bank, 1986 and 1993a; SEATS/JSI, 1994). Two other key problems include weak sector organization and institutional capacity and financial constraints and inefficient use of resources (World Bank, 1993a). In keeping with the international declaration of Alma-Ata in 1978, the government aims to make health services accessible to the largest number of people consistent with reasonable costs to the country. The focus is on the implementation of primary health care, particularly through the expanded delivery of immunization and essential drugs, and rehabilitation of physical structures and equipment at health centers and hospitals. The government has set a goal of activating all health centers by the end of 1996.

The average public spending on health in Guinea from 1991 to 1994 was slightly under four dollars per capita in real terms in 1994 US dollars (table 1). A 1991 household survey conducted by an international aid agency suggested private expenditures were about double this amount per capita. Of the private spending, the public system realized a cost-recovery of only ten to twenty percent. Thus, the actual total per capita spending of about eight dollars falls below the level of twelve dollars suggested by the *1993 World Development Report* for a minimum package of health services (World Bank, 1993b).

A recent review of public expenditures in Guinea showed health expenditures declined in real terms from 1988 to 1994 (World Bank, 1996). On a per capita basis, the drop was significant: from seven dollars in 1988 to under two dollars in 1994. Similarly, expenditures dropped from 1.3 percent of gross domestic product in 1988 to 1.0 percent in 1994 -- a performance that compares poorly with similar low-income countries. However, as a share of total public expenditures, health expenditures remained fairly constant at about 4.5 percent. In 1995, the government increased the health recurrent budget from 3.9 percent of the total public budget in 1994 to 5.4 percent in 1995. Despite this increase, the recurrent budget for the sector remains inadequate, exasperated by the large proportion of funds spent on salaries (which reached over ninety percent of the recurrent budget in 1994), and low budget implementation, especially for non-salary expenditures.

During the years 1991, 1992 and 1994[3], expenditures for primary care represented an average of twenty-eight percent of total expenditures on health. Secondary-care and tertiary-care facilities captured twenty-four and twenty-seven percent, respectively, and administration captured twenty-one percent. Three factors are noteworthy in this expenditure pattern. First,

[3] Data for 1993 budget expencitures were incomplete at the time for this analyses, and thus are excluded.

about three-quarters of expenditures at the secondary-care level went to prefecture hospitals that also deliver primary health services. Second, the increase in expenditures for tertiary care in 1994 was only temporary, largely for rehabilitation works performed at the two large hospitals in the capital. Lastly, hospitals included in the tertiary care category performed largely secondary-care tasks.

Recurrent non-salary expenditures for primary health care facilities are inadequate. Public expenditures for medicines increased in 1994 to about sixty-four percent of recurrent non-salary expenditures. However, this amounted to less than twenty-five cents per capita, and compares poorly with the average expenditure of two dollars in other sub-Saharan countries (World Bank, 1994). The share remaining for other recurrent expenditures such as the maintenance of infrastructure and vehicles is insufficient. This creates deficiencies in supervision, patient referral, and vehicle operation. Finally, the expenditure on administration in Guinea is higher than the average for sub-Saharan Africa (World Bank, 1994).

Table 1. Health expenditures in Guinea from 1988 to 1994 (in millions of Guinean francs), and by level of care (as a percentage of total health expenditures)

Year	*Average for 1988 to 1994, excluding 1993*
In nominal terms	
Recurrent	7,600
Investment	8.300
Total health expenditure	15,900
In real terms (1994 values)	
Total health expenditure	23,300
Percent of total government expenditures	4.5
Percent of gross domestic product	0.78
Per capita in constant US dollars	3.9
By level of care, as percentage of total health expenditures	*Average for 1991-1994, excluding 1993*
Primary	28
Recurrent	13
Non-salary	1
Drugs	1
Investment	15
Secondary	24
Recurrent	17
Non-salary	8
Drugs	1
Investment	8
Tertiary	27
Recurrent	9
Non-salary	2
Drugs	1
Investment	18
Administration	21
Recurrent	7
Non-salary	1
Investment	13
Total	100
Recurrent	47
Non-salary	13
Drugs	3
Investment	53

MEASURING MORTALITY AND DISABILITY IN GUINEA

This section presents detailed estimates of mortality in Guinea, by cause of death in 1992. The methodology relies upon data specific to Guinea and on an external database for sub-Saharan Africa and uses a rapid methodology. Figure 1 shows the various steps in the rapid methodology. The sources of data are given below.

DATA SOURCES

A) Data on population and mortality for Guinea

We obtained numbers of age and sex-specific data on population and mortality in Guinea for 1992 from the World Bank demography database. These population projections are derived from data collected in Guinea in a full census in 1955 and a partial census in 1983. A demographic household survey conducted in 1992 showed a population and age distribution similar to the World Bank estimates (Chi square p value =0.39 and 0.92 for men and women, respectively; DNSI, 1994).

B) Data on all possible causes of death

We used estimates of the specific causes of death for sub-Saharan Africa from the Global Burden of Disease Project organized by the World Health Organization and the World Bank (known as Version 4 of the GBD; Murray and Lopez, 1994[4]). This consisted of age and sex-specific estimates for disease groupings based on the International Classification of Disease-9th version (ICD-9). The ICD-9 system covers nearly 100 percent of all causes of deaths, classified into three major categories: (1) communicable, maternal and perinatal; (2) injuries; and (3) non-communicable. We maintained the ICD-9 classification for specific diseases as utilized by the Global Burden of Disease Project. We combined all diarrhea diseases into one category, all maternal causes of death into one category, and all trypanosomiasis, schistosomiasis, and onchocerciasis into one category. We separated injuries into unintentional and intentional injuries. We also established four categories consisting of the following: (1) all neoplasms; (2) all nutritional and endocrine diseases; (3) epilepsy, psychosis, alcoholism, dementia, Parkinson's disease, and multiple sclerosis; and (4) rheumatic, ischemic and inflammatory heart disease, and cerebrovascular disease. Finally, we placed components of the respiratory, digestive, and genito-urinary diseases into three broader categories. The details of the methodology for the GBD are described elsewhere (Murray, 1994).

C) Local studies of childhood and maternal deaths, HIV infection, injuries and malnutrition

Given the high mortality and high fertility rates in Guinea, we adjusted estimates so as to optimize the quality of data for early childhood (age zero to four) and for maternal deaths. These relied upon: (1) local unpublished surveys of childhood mortality done in 1986 by the U. S. Agency for International Development in rural parts of Kindia province in Guinea; (2) studies of childhood

[4] These data are consistent with newer Version 6 estimates for mortality in sub-Saharan Africa, although injuries are a higher percentage of deaths in the latter. The rank order and percentage of deaths from the top five causes of death are similar.

mortality in Conakry conducted by Cornell University; and (3) maternal mortality estimates in Guinea (data on file, Ministry of Health, Guinea 1994). These data permitted adjustments for deaths from malaria, respiratory illness, malnutrition and diarrhea. Attributing deaths to malnutrition among children is controversial (Pelletier et al., 1993) because the direction of causation may be unclear: malnourished children are at increased risk of acquiring and dying from an infection; conversely, certain infections may lead to malnutrition. Using results from a similar study in Eastern Africa, we assumed that malnutrition was the *direct* cause in only eighteen percent of all deaths attributed to malnutrition in the AID and Cornell studies (World Bank, 1995). This avoided double-counting of causes of deaths.

We used two additional pieces of data to adjust the estimates of deaths. First, we reduced deaths from human immunodeficiency virus (HIV) infection by half to reflect a 1993 finding that, among patients at a sexually-transmitted disease clinic in Conakry, only 2.7 percent were seropositive for the HIV (data on File, Ministry of Health, 1994). This prevalence is significantly lower than that among other high-risk populations in sub-Saharan Africa (US Bureau of the Census, 1994). Second, we reduced estimates of deaths from war by an arbitrary one-quarter because Guinea has been at peace in recent history.

METHOD FOR DERIVING MORTALITY AND MORBIDITY ESTIMATES

After deriving final estimates for children aged zero to four, we used these to provide estimates for deaths at older ages, with a separate analysis for males and females. Figure 1 shows the details of this approach. Our method ensured that each death had only one cause and those total deaths in any age group did not exceed the data based upon the census information for Guinea. We explicitly assumed that the pattern of deaths *across* age groups was similar for the populations covered by the estimates. To validate our approach, we also calculated deaths at older ages based upon the cause-of-death structure taken as that *within* age groups for the Global Burden Disease Project for sub-Saharan Africa. These two approaches yielded virtually identical results (Chi square P value =0.99) in the final distribution of major causes of deaths.

A) Discounting of life years

To calculate the discounted years of life lost, we derived the average age of death for each age and sex group for the various diseases using a study in Ghana (Ghana Health Assessment Project Team, 1981). We subtracted the mean age of death from the maximum time lived in developed countries: eighty for women and seventy-eight for men (Ansley et al., 1982). We discounted years of life lost from death at a rate of three percent to take into account that society has a preference for consumption now rather than later (World Bank, 1993b). The higher the discount rate, the more years of life in the present are valued relative to those in the future.

Figure 1. Rapid method to calculate mortality data for Guinea

DATA SOURCES	METHOD, BY STEPS
Global Burden of Disease estimates	**Step 1**: Abstract the age-, sex-specific population values and age-, sex-, cause-specific numbers of deaths for sub-Saharan Africa. These data are presented in seven age categories; 0 to 4, 5 to 14, 15 to 29, 30 to 44, 45 to 59, 60 to 69 and 70 or more.
	Step 2: In place of zero (published) values, assume the number of deaths due to most diseases to be 500 for each age and sex-category in the entire sub-Saharan population.
	Step 3: Adjust proportionally the number of age and sex-specific causes of death such that their sum matches the total number of deaths in sub-Saharan Africa.
	Step 4: As described in the text, collapse the data into twenty-five disease categories, based upon the International Classification of Diseases system.
	Step 5: Calculate mortality rates for each age and sex-stratum.
	Step 6: For each stratum, calculate the ratios of the mortality rates among older age groups to the corresponding mortality rate among 0 to 4 year-olds. For "maternal causes" calculate the ratios of mortality rates among older age groups to the mortality rate among 5-14 year-olds.
Guinean studies of childhood mortality and data on HIV infection and injuries	**Step 7**: Adjust the mortality rates for the group aged 0 to 4 years to reflect data available from Guinea, using local studies with data on deaths in early childhood, studies of HIV prevalence and injuries.
Guinean data, derived from censuses, for population and mortality	**Step 8**: Multiply the sex-specific mortality rates generated in Step 7 for each disease by the corresponding population of 0 to 4 year-olds. Sum the resulting values to yield the total predicted number of deaths among 0 to 4 year-olds. Adjust proportionally the sex-specific mortality rates such that the predicted number of deaths matches the actual number of deaths among 0 to 4 year-olds.
	Step 9: Calculate mortality rates for the older age categories by multiplying the sex-specific mortality rates for each disease for 0 to 4 year-olds by the ratios calculated in Step 6.
Guinean studies of maternal mortality	**Step 10**: Divide the total number of maternal deaths in Guinea into the 5 age categories 5 to 14, 15 to 29, 30 to 44, 45 to 59, and 60 to 69 years of age such that the ratios of maternal mortality rates among older groups to the rate among 5 to 14 year-olds is the same as the ratios calculated in Step 6.
Guinean data, derived from censuses, for population and mortality	**Step 11**: Multiply the age and sex-specific disease mortality rates by the populations of the appropriate age-and sex-specific groups in Guinea. Sum the resulting values to yield the total predicted number of deaths for each age category. Adjust proportionally the sex and age-specific disease mortality rates (except maternal mortality rates) such that the predicted number of deaths for each age group matches the actual number of deaths.

B) Estimates of burden of disability

Unlike for deaths, there was no feasible method to estimate years of disability by age and sex group. Thus, we used a simplified methodology adjusting the Global Burden of Disease Project estimates of years lived with a disability in sub-Sahara Africa among age groups' 0-4, 5-14, 15-44, 45-59 and 60+ for each sex to the relative population size for Guinea. As with mortality estimates, we combined certain categories of diseases. These estimates are discounted at three percent per year and have been age-weighted with a maximum social age preference of twenty-four years (Murray, 1994). In contrast, the estimates for mortality are not discounted and are not age-weighted; the estimates for years of life lost are discounted but not age-weighted. Thus the three measures are not directly comparable, but as reported by Murray et al. (1994a), these different weighting schemes do not greatly alter the relations among the major causes of death -- communicable, maternal, and perinatal disease, injuries, and non-communicable diseases.

RESULTS FOR BURDEN OF DISEASE

Among a Guinean population estimated at 6.09 million, 124,078 people died in 1992 or 20.4 deaths per thousand population. As table 2 shows, the mortality rates among females and males were very similar--20.2 deaths and 20.5 deaths per thousand female and male population, respectively. A child born in Guinea faces a nearly one in four chance of dying before age five and has a life expectancy at birth of only forty-four years. A child reaching age five has about a one in fourteen chance of death before age fifteen. A child at age fifteen has a twenty-four percent chance of dying before age forty-five and adults who reach age forty-five have about a twenty-three percent chance of dying before age sixty. The table also reveals that mortality rates are higher for males than for females at younger ages but lower at older ages. Background annex 1, tables 1 to 4 provide detailed data for the results of the burden of disease analysis.

Causes of death. Overall, communicable, maternal, and perinatal diseases caused 86,400 deaths (seventy percent), injuries caused 9,000 deaths (seven percent) and non-communicable diseases caused 28,700 deaths (twenty-three percent). The proportions in the first category are similar for females and males. Deaths from injuries are more common among males, and deaths from non-communicable diseases are more common among females.

As table 3 shows, the top seven causes of death are the same for both sexes, ranging down from respiratory infections, malaria, diarrhea, childhood infections, cardiovascular diseases, tuberculosis, and perinatal causes. Of those diseases shared by males and females, the gap between the percentages for the two sexes is widest --being more common in women -- for cardiovascular diseases, and -- being more common in men -- for unintentional injuries.

Results for Age Groups. Figure 2 illustrates the relative importance of the major categories of cause of death in Guinea by age group. Table 4 lists, in decreasing order, the top ten causes of death by age group in Guinea. The mortality rate among children aged zero to four is 54.1 deaths per thousand population. Among this age group, ninety-one percent of deaths are due to communicable, maternal, and perinatal diseases, led by diarrhea, respiratory infections, malaria,

Table 2. Distribution of population and number of deaths in Guinea, by sex and age, 1992

Sex and age group	Percent of total population	Number of deaths	Deaths per thousand population	Probability of dying in this age group
Females				
0-4	9.7	29,624	50.4	23.7
5-14	13.9	7,103	8.4	7.6
15-44	20.8	11,716	9.3	24.4
45-59	4.1	4,788	18.9	22.8
60+	2.3	9,328	66.7	100.0
Total	50.8	62,559	20.2	...
Males				
0-4	9.5	33,639	58.0	23.0
5-14	13.7	6,885	8.3	6.7
15-44	20.3	9,689	7.8	24.8
45-59	3.8	4,147	18.1	25.9
60+	1.9	7,159	60.3	100.0
Total	49.2	61,519	20.5	...
Total males and females	100.0	124,078	20.4	...

Table 3. Distribution of deaths by cause in Guinea, by sex 1992

Both sexes		**Females**		**Males**	
Ranked cause of death	Percentage	Ranked cause of death	Percentage	Ranked cause of death	Percentage
Respiratory infections	13.3	Respiratory infections	13.4	Respiratory infections	13.2
Malaria	12.3	Cardiovascular	12.2	Malaria	12.6
Diarrhea diseases	11.8	Malaria	12.1	Diarrhea diseases	12.1
Childhood infections	10.5	Diarrhea diseases	11.6	Childhood infections	10.9
Cardiovascular	10.2	Childhood infections	10.2	Cardiovascular	8.2
Tuberculosis	7.1	Tuberculosis	6.9	Perinatal causes	7.6
Perinatal causes	6.3	Perinatal causes	5.2	Tuberculosis	7.3
Unintentional injuries	4.4	Maternal causes	4.6	Unintentional injuries	6.2
Malignant neoplasms	3.5	Malignant neoplasms	3.7	Intentional injuries	3.7
Intentional injuries	2.9	Nutritional/endocrine	2.7	Malignant neoplasms	3.4
Nutritional/endocrine	2.4	Unintentional injuries	2.6	Nutritional/endocrine	2.1
Maternal causes	2.3	Syphilis	2.2	Digestive	2.0
Syphilis	2.1	Intentional injuries	2.0	Syphilis	2.0
Digestive	2.0	Digestive	1.9	Tropical diseases	1.5
Tropical diseases	1.6	HIV	1.8	Congenital	1.4
HIV	1.5	Tropical diseases	1.6	HIV	1.3
Note: total deaths	124,078		62,559		61,519

childhood infections, and perinatal diseases. Among non-communicable diseases, congenital diseases are the largest causes of death.

The mortality rate among children aged five to fourteen is much lower, 8.3 deaths per thousand population. Among this age group, communicable, maternal, and perinatal diseases continue to predominate, constituting seventy-three percent of deaths; these are led by malaria, childhood infections, diarrhea, respiratory infections, and tuberculosis. Unintentional injuries constitute nine percent of deaths in this age group. Neuro-psychiatric disease is the leading non-communicable cause of death.

The mortality rate during young adulthood and early middle age (ages' fifteen to forty-four) is 8.6 deaths per thousand population. Three in five deaths in this group are caused by communicable, maternal, and perinatal diseases, led by tuberculosis and maternal causes (one in four of all deaths among women in this age group). Intentional and unintentional injuries together account for more than twenty-two percent of deaths. Non-communicable diseases are not yet prominent.

The mortality rate among people aged forty-five to fifty-nine years of age is 18.5 deaths per thousand population. The leading causes of death in this age group are non-communicable diseases (sixty-four percent), led by cardiovascular diseases and cancer. However, even in this age group, one in five deaths are due to tuberculosis.

Finally, as expected, people over sixty years have the highest mortality rate of 63.7 deaths per thousand population; three in four succumb to non-communicable diseases, mainly cardiovascular disease and malignant neoplasms. Even in this older age group, respiratory infections and tuberculosis cause substantial numbers of deaths.

Years of life lost. Table 5 presents years of life lost discounted at a rate of three percent. These show a pattern similar to that for deaths, with communicable, maternal, and perinatal diseases accounting for more than three-quarters of years lost. Non-communicable diseases account for sixteen percent, and injuries cause seven percent. Diseases of childhood obviously are responsible for the most lost years: diarrhea, malaria, respiratory infections, injuries, childhood cluster, and tuberculosis (see table 6).

Simple estimates of years lived with a disability. Table 7 provides estimates for years lived with a disability, discounted at three percent and with a maximum time preference of twenty-four years. This analysis shows that the group of communicable, maternal, and perinatal diseases account for about forty-three percent of these years lived with a disability. Non-communicable diseases account for a similar percentage. Injuries cause the most years lived with a disability, followed by neuro- psychiatric illness.

Approximately thirty-five percent of all years lived with a disability begin at ages' fifteen to forty-four and another thirty-five percent in children under age five. Years lived with a disability from ages' five to fourteen contribute sixteen percent to the total. There are important sex differences: sexually transmitted diseases account for nearly six times more such years in females

Figure 2. Distribution of deaths, by major cause and age in Guinea, 1992

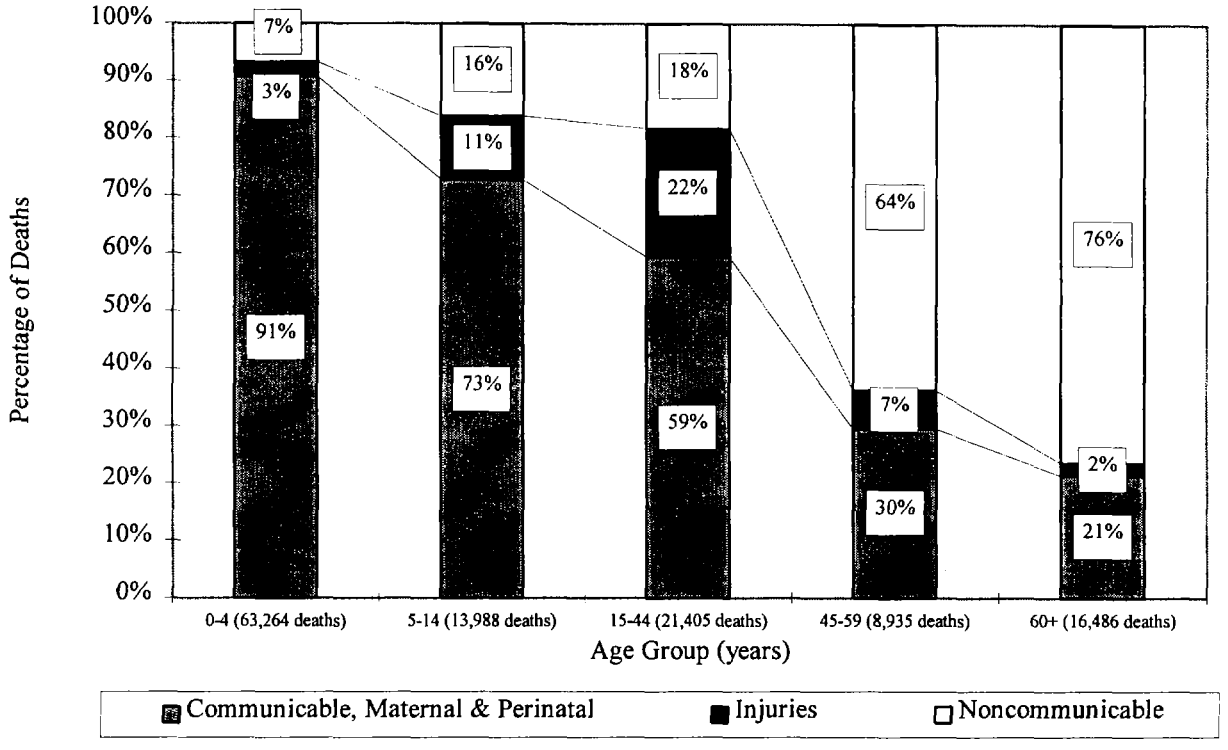


Table 4. Top ten causes of death in Guinea, by age, 1992 (ranked in order and percentage except as noted)

0 to 4		5 to 14		15 to 44		45 to 59		60+	
Diarrhea diseases	20.3	Malaria	19.0	Tuberculosis	19.4	Cardiovascular	29.4	Cardiovascular	50.0
Respiratory infections	19.3	Childhood infections	14.8	Maternal causes	12.8	Tuberculosis	19.8	Malignant neoplasms	12.6
Malaria	17.6	Diarrhea diseases	10.5	Intentional injuries	11.4	Malignant neoplasms	15.9	Respiratory infections	12.1
Childhood infections	17.3	Respiratory infections	10.5	Unintentional injuries	11.0	Digestive	6.5	Tuberculosis	7.4
Perinatal causes	12.4	Tuberculosis	8.9	Syphilis	6.5	Unintentional injuries	4.2	Respiratory	3.2
Congenital	2.2	Unintentional injuries	8.8	Malaria	6.1	Nutritional/endoc	3.4	Digestive	3.1
Nutritional/endocrine	2.1	Tropical diseases	4.8	HIV	5.9	Tropical diseases	3.2	Genito-urinary	2.3
Unintentional injuries	2.0	Neuro-psychiatric	4.2	Cardiovascular	5.7	Respiratory	2.9	Nutritional/ endocrine	2.2
Syphilis	1.7	Meningitis	2.7	Tropical diseases	3.4	Intentional injuries	2.6	Unintentional injuries	1.5
Digestive	0.8	Nutritional/ endocrine	2.4	Nutritional/ endocrine	3.3	Genito-urinary	2.6	Diabetes mellitus	
Total Deaths	63,264		13,988		21,405		8,935		16,486
Probability of dying in this age group	23.4		7.1		24.6		24.3		100.0

Table 5. Distribution of years of life lost in Guinea, by sex and cause, 1992

Both sexes		Females		Males	
Ranked cause of years of life lost	Percentage	Ranked cause of years of life lost	Percentage	Ranked cause of years of life lost	Percentage
Malaria	14.2	Respiratory infections	14.2	Malaria	14.4
Respiratory infections	14.2	Malaria	14.1	Respiratory infections	14.1
Diarrhea diseases	13.9	Diarrhea diseases	13.7	Diarrhea diseases	14.0
Childhood Infections	12.3	Childhood Infections	12.1	Childhood Infections	12.6
Perinatal causes	7.5	Tuberculosis	6.6	Perinatal causes	8.8
Tuberculosis	6.3	Cardiovascular	6.3	Unintentional injuries	6.2
Cardiovascular	5.3	Perinatal causes	6.2	Tuberculosis	6.0
Unintentional injuries	4.5	Maternal causes	4.7	Cardiovascular	4.2
Intentional injuries	2.9	Unintentional injuries	2.7	Intentional injuries	3.6
Nutritional/endocrine	2.4	Nutritional/endocrine	2.6	Nutritional/endocrine	2.2
Maternal causes	2.4	Malignant neoplasms	2.4	Syphilis	2.1
Syphilis	2.2	Syphilis	2.3	Malignant neoplasms	1.9
Malignant neoplasms	2.2	Intentional injuries	2.1	Digestive	1.6
HIV	1.7	HIV	2.0	Congenital	1.6
Digestive	1.7	Digestive	1.7	Tropical diseases	1.5
Tropical diseases	1.5	Tropical diseases	1.6	HIV	1.4
Total years of life lost	3,157,636		1,579,520		1,578,117

Table 6. Top ten causes of years of life lost in Guinea, by age, 1992 (ranked in order and percentage except as noted)

0 to 4		5 to 14		15 to 44		45 to 59		60+	
Diarrhea diseases	20.3	Malaria	19.2	Tuberculosis	19.8	Cardiovascular	29.5	Cardiovascular	47.9
Respiratory infections	19.3	Childhood Infections	14.9	Maternal causes	13.2	Tuberculosis	19.6	Malignant neoplasms	13.6
Malaria	17.6	Diarrhea diseases	10.6	Intentional injuries	11.5	Malignant neoplasms	15.9	Respiratory infections	12.3
Childhood Infections	17.3	Respiratory infections	10.6	Unintentional injuries	11.1	Digestive	6.5	Tuberculosis	8.6
Perinatal causes	12.4	Tuberculosis	9.0	HIV	6.7	Unintentional injuries	4.1	Digestive	3.3
Congenital	2.2	Unintentional injuries	8.8	Syphilis	6.6	Nutritional/endocrine	3.5	Respiratory	3.1
Nutritional/endocrine	2.1	Tropical diseases	4.8	Malaria	6.2	Tropical diseases	3.4	Genito-urinary	2.4
Unintentional injuries	2.0	Neuro-psychiatric	4.2	Cardiovascular	5.4	Respiratory	2.9	Nutritional/endocrine	2.3
Syphilis	1.7	Meningitis	2.7	Tropical diseases	3.6	Genito-urinary	2.6	Diabetes mellitus	1.7
Digestive	0.8	Nutritional/endocrine	2.4	Nutritional/endocrine	3.2	Intentional injuries	2.6	Tropical diseases	1.4
Note: total years of life lost, in thousands	1,902		406		539		161		148

Table 7. Distribution of years of life lived with a disability in Guinea, 1992, by cause and sex

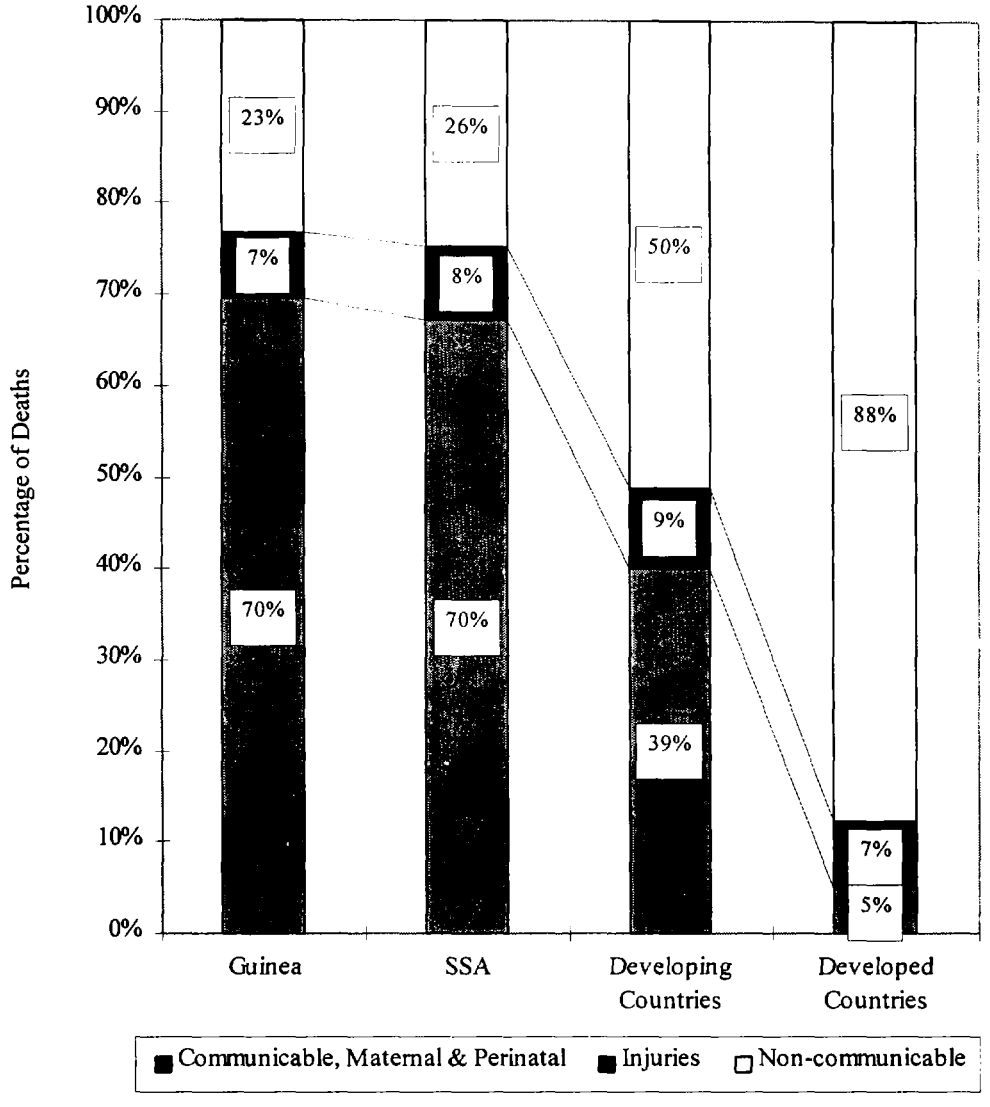
Both sexes		Females		Males	
Ranked cause	Percentage	Ranked Cause	Percentage	Ranked Cause	Percentage
Injuries	14.3	Maternal	11.6	Injuries	19.7
Neuro-psychiatric	11.4	Neuro-Psychiatric	9.8	Neuro-Psychiatric	13.1
Nutritional/endocrine	8.9	Injuries	9.0	Nutritional/endocrine	9.1
Malaria	7.3	Nutritional/endocrine	8.6	Malaria	7.4
Perinatal	7.1	Malaria	7.2	Perinatal	7.3
Maternal	5.9	STD's except HIV	7.0	Tropical cluster	7.2
Tropical cluster	5.5	Perinatal	7.0	Congenital	4.8
Congenital	4.8	Cardiovascular disease	4.7	Cardiovascular disease	4.3
Cardiovascular disease	4.5	Congenital	4.7	Respiratory-chronic	3.8
STD's except HIV	4.2	Respiratory-chronic	3.9	Digestive	3.6
Respiratory-chronic	3.8	Tropical cluster	3.8	Childhood cluster	2.6
Digestive	3.5	Digestive	3.4	Respiratory-acute	2.6
Respiratory-acute	2.6	Respiratory-acute	2.6	Tuberculosis	2.2
Childhood cluster	2.3	Sense organs	2.2	Genito-urinary	1.8
Tuberculosis	2.0	Trachoma	2.0	Sense organ	1.7
Sense organ	1.9	Childhood cluster	2.0	HIV	1.6
HIV	1.6	Tuberculosis	1.7	STD's except HIV	1.3
Genito-urinary	1.6	HIV	1.6	Intestinal worms	1.2
Note: total years lived with a disability	789,370		401,802		387,569

than in males, and men have more years than women from the tropical cluster of disease and from neuro-psychiatric illness.

Comparison with other regions. The distribution of causes of death in Guinea is similar to that in sub-Saharan Africa, which is not surprising given the methodology (figure 3). In comparison with developing and developed countries, the overall burden of mortality in Guinea is much higher. The explanation exists partly in Guinea's younger age structure, and thus a higher probability of deaths from diseases associated with childhood and childbearing.

However, even among children under age five, those in Guinea have a more than two-fold higher probability of death than do children in other developing countries. Among the middle aged (fifteen to fifty-nine), Guineans have a higher probability of death than people in other developing countries (forty percent versus twelve percent, respectively). These higher risks are largely due to a higher burden of communicable, maternal, and nutritional disease, that carry a high chance of death in the absence of available medical care. Thus, these higher risks also represent the relatively low access to medical care in Guinea.

Figure 3. Relative importance of causes of death in Guinea, sub-Saharan Africa, developing and developed countries



Item	Guinea	Sub-Saharan Africa	Developing countries	Developed countries
Probability of dying before age 5, in percent	23.5	15.8	9.7	1.7
Probability of dying between ages 15 and 60, in percent	39.9	35.1	21.8	11.7

Impact of population growth on burden of disease. World Bank estimates suggest that population growth in Guinea was 2.8 percent per annum in 1992 and it is projected to increase to 2.9 percent by 2000. The growth rate in Conakry is about five percent per annum. The population of Guinea is expected to reach over 7.6 million by 2000 and 11.6 million by 2015. No major declines in the fertility rate are expected before 2010, and therefore the number of births is expected to increase annually by 2.5 percent (from 298,000 in 1992 to 446,000 in 2012).

Figure 4 depicts future numbers of deaths based upon population growth and changes in death rates. Detailed estimates are in Background annex 1, table 4. These estimates assume that HIV-related deaths will increase at a net rate of one percent per year, that current levels of health service provision will be maintained, and that no major epidemics will occur. They suggest that the total number of deaths will increase by about 1.5 percent a year, despite a falling death rate. Given shifts in the age of the population (Figure 5), more deaths are likely to occur from tuberculosis and injuries, diseases that have a higher death rate in adolescents and young adults. These simple linear projections are not reliable for each specific disease, but they do suggest that the overall pattern of high mortality from communicable, maternal, perinatal, and nutritional diseases will continue among an ever-increasing *absolute* number of children born over the next decade.

Figure 4. Projections of number of deaths in Guinea, by cause

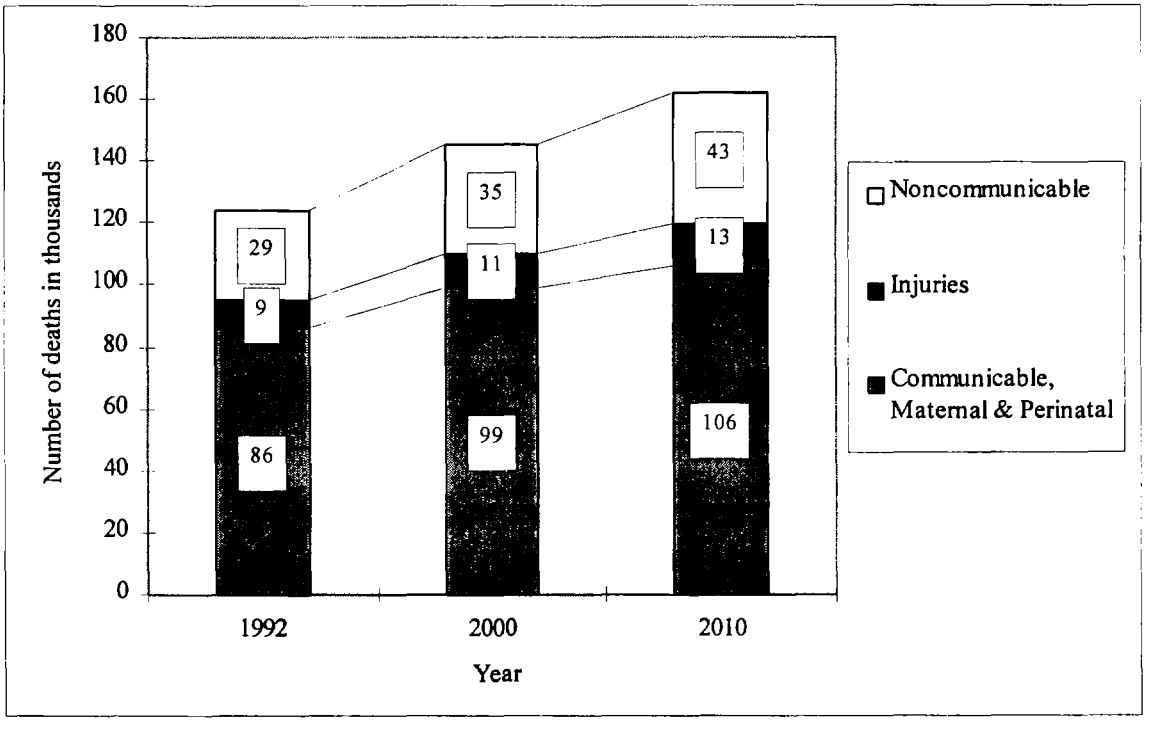
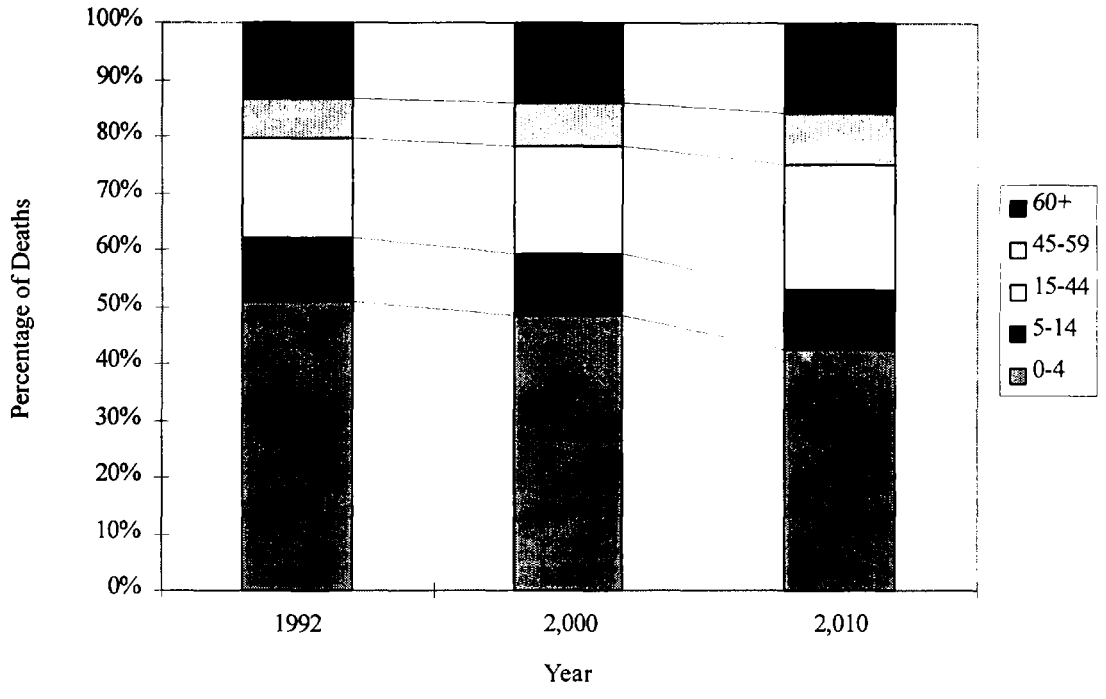


Figure 5. Distribution of deaths by age group in Guinea, 1992, 2000, and 2010



CONCLUSIONS AND POLICY IMPLICATIONS OF DISEASE BURDEN

This analysis underscores the need for national health care planners and international donors to focus on diseases that cause the most premature deaths. In Guinea, these are largely avoidable or treatable communicable disease, maternal, and malnutrition diseases that together account for nearly three in four of all deaths and, with perinatal disease, account for nine in ten deaths before age five. Moreover, thirty-one percent of deaths during the economically-productive ages of fifteen to fifty-nine are caused by tuberculosis, injuries and maternal deaths, which also may be treated or avoided.

Evaluating Health Programs and Performance Using Deaths and Disability

The Global Burden of Disease Project suggested that premature deaths cause over three-quarters of all the burden of disease, death and disability in sub-Saharan Africa (Murray et al., 1994a). The same is likely to be true for Guinea. Thus, reduction in deaths is a plausible goal for health care provision and is also a reasonable measure for evaluating the performance of the health care system. Nonetheless, disability is important, especially when its burden is high and cost-effective and feasible programs for addressing it are available. One example is intestinal helminthiasis among school-aged children (five to fourteen), which is responsive to school deworming programs (World Bank, 1993b).

While the reduction in deaths is a valid objective for health systems, people in Guinea may utilize health services more for relief of disability and even anxiety. Moreover, political and social

factors may influence the choice and location of services offered. Historically, the evaluation of delivery systems in Guinea and most other parts of the world has not relied upon reduction of premature deaths as an outcome measure. It would not be reasonable to assume that, in the short term, health systems may be modified to measure program performance by premature mortality reduction. In the longer term, these estimates of the burdens of mortality and morbidity are useful additions to health system management and organizational structures. The estimates are not as reliable as those gathered from comprehensive and time-consuming prospective epidemiological studies. However, they do provide a common framework for comparing reduction in mortality for one disease or reductions attributable to one program.

Regional and Equity Implications

While we do not describe them in detail here, regional differences in mortality within Guinea are likely important. For both demand and supply reasons, access to health services is lower in Upper and Forest Guinea, and malaria, tropical illness, maternal deaths and nutritional diseases are more prevalent in these regions than in Middle and Maritime Guinea. Data from a household survey (DNSI, 1994) suggests that burdens from communicable, maternal, and nutritional diseases are twenty to thirty percent higher among rural people and those with low educational status, conditions associated strongly with poverty. Thus, much of the burden of disease likely falls upon the poor, and effective health care provision yields improvements in equity. Even if it reduces disease by the same *relative* amount across income groups, the *absolute* reductions would be larger among the poor.

Addressing Population Growth and Future Burdens of Disease

This analysis reinforces the suggestion that the growth of population will result in substantial increases in absolute health burdens (Ainsworth, 1994). Health care planners must pay attention to allocating resources to cover not only today's population but also the larger numbers of children born in the future. The projections of future disease burden cannot be taken as precise, as more intense application of appropriate health services to the most prevalent diseases may occur, such as wider immunization campaigns against childhood infections and oral rehydration treatment for diarrhea. Past efforts at family planning services in Guinea have had limited success (World Bank, 1986; SEATS/JSI, 1994). Future efforts will need to focus on childhood mortality and the lowering of female fertility by improving its determinants--such as education, birth spacing, and contraceptive use. Only these efforts, along with economic growth may help avoid increases in absolute mortality. A reasonable goal is to narrow the gap between mortality and fertility decline (Bobadilla et al., 1993). Finally, growth in some diseases may be expected. Deaths from tuberculosis and injuries may grow, largely because the numbers in the age group affected by these conditions will increase. Thus more resources should be allocated in the future to controlling these causes.

The Role of Vital Registration and Epidemiological Studies

We analyzed all the major causes of death in Guinea and thus avoid the common scenario whereby some experts overestimate the mortality attributable to disease of interest. Our estimates are consistent with the pattern of utilization at Guinea's health centers and hospitals (World Bank, 1993a; SEATS/JSI, 1994). They are consistent also with estimates of mortality from a more formal epidemiological study done in Ghana in the late 1970s (Ghana Health Assessment Team, 1981;

table 8) and a recent study in Tanzania (Kitange et al., 1996). While the Guinea estimates likely suffer from imprecision, the magnitude of error is not likely to compromise the decision, based upon cost-effectiveness or other analyses, about allocation of resources among diseases. In addition, we have minimized error by focusing upon the maximum quality of information for early childhood and by ensuring that the overall total of each cause matched independent estimates of numbers of deaths. The estimates for disability are less robust than those for mortality as there was no clear way to calculate an upper limit for disability within each age and sex.

Table 8. Relative importance of causes of death in Guinea and Ghana

Guinea, 1992		Ghana, 1979	
Ranked cause of death	Percent deaths	Ranked cause of death	Percent deaths
Respiratory infections	13.3	Perinatal causes	13.6
Malaria	12.3	Childhood infections	12.2
Diarrhea diseases	11.8	Cardiovascular	11.1
Childhood infections	10.5	Respiratory infections	9.9
Cardiovascular	10.2	Other non-communicable (1)	9.0
Tuberculosis	7.1	Diarrhea diseases	5.9
Perinatal causes	6.3	Malaria	5.5
Unintentional injuries	4.4	Nutritional/endocrine	5.4
Malignant neoplasms	3.5	Injuries (2)	4.6
Intentional injuries	2.9	Digestive	4.5
Nutritional/endocrine	2.4	Tuberculosis	4.2
Maternal causes	2.3	Malignant neoplasms	3.2
Syphilis	2.1	Other infections (3)	2.6
Digestive	2.0	Maternal causes	1.9
Tropical diseases	1.6	Tropical diseases (4)	1.8

Notes: (1) Other non-communicable: sickle-cell disease and cirrhosis.
(2) Injuries: Unintentional and intentional injuries.
(3) Other infections: leprosy, chicken pox, hepatitis and influenza.
(4) Tropical diseases: hookworm anemia, trypanosomiasis, schistosomiasis and onchocerciasis.

Other methods exist for deriving mortality estimates, including more sophisticated regression models that make various assumptions about fertility and life expectancy (Murray, 1994). Although these may yield more precise numbers, the marginal improvement in their validity over those of cruder models remains unknown. The major causes of death may be determined definitively only by epidemiological studies and vital registration. Limited efforts with epidemiological monitoring in sub-Saharan Africa have been done successfully in a variety of local settings (Feachem et al., 1991). National efforts on representative samples are lacking. Some newer epidemiological methods are applicable to low-income countries. Among them are verbal autopsy (Gray et al., 1990) for childhood deaths, the sisterhood method for maternal mortality (David et al., 1991), capture-recapture methodology for completeness of data (Laporte, 1992), and the spouse case-control methods (R. Peto, unpublished data) exist. These may significantly enhance the quality of baseline data and thus national mortality and disability estimates, cost-effectiveness analysis, and examination of risk factors. Such efforts lie within the comparative advantage of governments (World Bank, 1994) and thus should be priorities as Guinea reforms its health system.

COST-EFFECTIVENESS OF HEALTH INTERVENTIONS IN GUINEA

Cost-effectiveness analysis is a method of comparing the costs of a health care intervention with its health impact. It provides a comparison of discounted years of life saved to a unit cost, for various interventions. This analysis, like that in the last section, utilizes mortality, as defined by years of life saved. In the context of the burden of disease described in the previous section, the prime purpose of cost-effectiveness analysis is to guide the allocation of the scarce resources in Guinea toward maximum benefit in health gains. It also offers governments, communities and foreign donors a common framework for evaluating health interventions. Cost-effectiveness analyses do not offer fully valid estimates for each specific intervention, but do permit comparison and ranking across interventions.

METHODOLOGY FOR COST-EFFECTIVENESS ANALYSIS

We analyzed a total of forty interventions selected from treatment protocols at health centers (or centre de sante), health posts (or poste de sante), and prefectoral (or first referral) hospitals in Guinea. We chose these in consultation with health care providers as the most commonly performed interventions. We also included several interventions that are planned but not yet implemented, such as school-based health programs, or that have been cost-effective in similar countries, such as anti-tobacco programs. We chose four levels of interventions: (1) those at outreach level which rely upon reaching members of the community in their own surroundings; (2) at the health post level; (3) at the health center level; and (4) at the prefectoral hospital level. As much as possible, we structured the analysis to enable comparisons across current common interventions by using estimates of *actual,* rather than *ideal* practice.

The interventions are defined as preventive or curative, and are defined by their referral level. All outreach, or community-based programs were preventive interventions. At the health post, health center and hospital levels, interventions were curative except for the immunization program. Cost-effectiveness analyses need to consider how many people without the condition need to be screened in order to treat an affected person. As the referral rate in Guinea from health center to hospital is less than one percent, we adjusted the analysis to account for visits for those interventions available at both health centers and hospitals. Overall, twenty-two of the forty interventions are directed towards the health of children under age five or maternal health.

For each intervention, we assigned a value for efficacy, or the reduction in disease incidence or the reduction in case fatality rate among untreated populations under ideal conditions. Background annex 2, table 1 contains the detailed calculation for all interventions used. The major sources of these data were a recent World Bank book (Jamison et al., 1993), a study in Ghana (Ghana Health Assessment Team 1981), and the literature. Ideal efficacy is that found in clinical trials under well-controlled situations, but is seldom seen in actual practice. After discussions with clinicians, and reviewing results from other countries, we adjusted the ideal efficacy to reflect

diagnostic accuracy, the quality of service delivery, the availability of drugs and equipment, patient compliance, and other factors (Drummond et al. 1987).

We used maximum downward adjustments to derive conservative estimates for ideal efficacy: for outreach programs the adjustment ranged from thirty to seventy percent, depending upon the expected compliance by the user. At a health post, adjustment ranged from twenty to fifty percent. At a health center, adjustment was a generic seventy percent. A hospital had a higher value of eighty percent to reflect the better quality of care at hospitals. The overall effectiveness of an intervention is the efficacy multiplied by the adjustment factor. For example, immunization has an efficacy of ninety-five percent, and an adjustment of seventy percent because of poor drug supply, inadequate refrigeration of the vaccine, and other factors. Thus the overall effectiveness is 66.5 percent (0.95 x 0.70).

For each disease category, we derived a median age of death from the literature and the Ghana study (Ghana Health Assessment Team, 1981) and we assigned discounted life years to each disease using a Coale and Demeny, Model West 26 life table (Ansley et al., 1982). The latter used a life expectancy of eighty for women and seventy-eight for men, with future years of life discounted at three percent. The years of life saved represents the difference between the life years lost among those without treatment and those with treatment, after taking into account the proportion of the population already receiving the treatment (or treatment coverage). For each intervention, we assigned a target population of people who could potentially benefit from the intervention, depending upon the level of the intervention, population size and expected number of cases.

Costs of Labor, Drugs, Equipment, and Overhead. To determine labor costs we calculated the total monthly official salary for four levels of government staff: a senior doctor; a new graduate doctor; a nurse, midwife, health aide, or laboratory technician; and an outreach worker or assistant agent. We made a forty percent adjustment for pensions and a fifty percent multiplier to reflect poor manpower planning, an inefficient referral system, and other inefficiencies in the system. We divided these costs by one-hundred and seventy-one working hours per month to derive hourly salaries. In Guinea, very few health care workers receive housing or other benefits, so we excluded this category of benefit. We obtained data on the types of drugs, their dosages, and the length of treatment from protocols of the health centers and from hospital guidelines, as well as from expert opinion. For each drug, we used the highest price obtained from the Central Pharmacy, direct health center purchases, and independent private distributor, and we used a two-fold multiplier to account for transportation costs, spoilage, theft, and loss. The cost per use of equipment was the replacement cost of the equipment divided by the number of uses in its lifetime and multiplied by the number of uses for that intervention.

We derived the overhead for an intervention by taking the national non recurrent salary budget, the amortized investment budget, and the administrative budget weighted by number of visits across the levels of care (health center, health post and hospital). This figure includes vehicle and other transport costs for the facility. We derived overhead costs for hospitalizations similarly. Overhead costs for hospital outpatient interventions were one-seventh of those for in-patients, as noted in a recent study (World Bank, 1996)

RESULTS OF COST-EFFECTIVENESS ANALYSES OF INTERVENTIONS

Table 9 lists the main results of the total cost of the interventions, target population, present coverage, and overall cost-effectiveness expressed as 1994 US dollars per life year saved. Of the interventions evaluated, eight were at the outreach level, four at the health post level, twelve at the health center level and sixteen at the hospital level.

Table 10 ranks the interventions from most to least cost-effective along with the percentage of years of life lost in their target population. According to these analyses, several interventions cost about one-hundred dollars per year of life saved or less, and address more than five percent of their target population. These include treatment of childhood pneumonia at three dollars per years of life saved, rehydration therapy for diarrhea at health centers (seven dollars) and at health posts (eight dollars), treatment of childhood malaria at health centers (eight dollars), childhood vaccination at health centers (twenty-five dollars), short-course tuberculosis treatment at health centers (eleven dollars), treatment of sexually-transmitted diseases at health centers (sixty-seven dollars) and impregnated bed nets against malaria (forty-three dollars). Maternal and perinatal diseases, which together account for nine percent of years of life lost in the target group, have slightly less cost-effective interventions: prenatal and delivery care at health centers (one-hundred and thirty-three dollars) or programs using outreach trained birth attendants or TBA (two-hundred and sixty-one dollars).

For non-communicable diseases, the most cost-effective interventions appear to be preventive outreach programs. These include tobacco legislation and warnings and an injury prevention program (both at sixty-five). Among curative programs for non-communicable disease, appendectomy (thirty-six dollars) and hernia repair (seventy-four dollars) are the most cost-effective. Finally, although it is not examined in this analysis, many of these interventions also reduce morbidity. For example, school-based health programs should reduce the relatively large burden of intestinal worms and micronutrient deficiency in children and also should reduce the large percentage of visits to health center arising from intestinal worm infection (World Bank, 1993a).

These analyses reveal tremendous variation in the costs involved in gaining one life year. It is not obvious that preventive interventions are always the most cost-effective. For example, the cost of gaining one year of life from water and sanitation improvement is three-hundred and forty-two dollars versus seven dollars for treatment of diarrhea in children at health center. The ratios reflecting the most cost-effective interventions are driven largely by low cost rather than by high efficacy. Among outreach interventions with cost-effectiveness ratios below one hundred dollars per years of life saved, all but one (condom use for bar ladies) have absolute costs of less than four dollars per person. Similarly, for health center and health post interventions with cost-effectiveness ratios below one-hundred dollars, all except two (short-course tuberculosis treatment and childhood vaccination) have absolute costs of less than four dollars per person.

At health center and health post, four of the top most cost-effective interventions have costs less than three dollars per person. In contrast, the average cost per treatment is at least ten times higher among hospital-based interventions with cost-effectiveness ratios below one-hundred

Table 9. Summary of population, coverage, and cost-effectiveness for forty health interventions in Guinea, 1994

Level	Disease and intervention	Name of target group	Adjusted efficacy (percent)	Size of target group	Current coverage (percent)	Years of life saved per person with treatment	Total cost in thousands of Guinea francs	Cost per year of life saved in thousands of Guinea francs	Cost per year of life saved in US dollars
Malaria									
	Use of impregnated bednets	Age <5 in malaria areas	16.5	818,300	1	0.070	2,920	42	43
	Treatment of children at health post	Age <5 in malaria areas	19.5	818,300	22	0.134	1,053	8	8
	Treatment of children at health center	Age <5 in malaria area	32.5	818,300	22	0.223	2,844	13	13
	Hospital treatment of severe childhood malaria	Severe malaria age <5	52.0	40,915	8	0.512	43,555	85	87
Acute respiratory infection									
	Educate mothers on childhood pneumonia at health center	Age <5	0.6	1,169,000	8	0.002	229	105	108
	Treatment of children at health center	Age <5	40.0	701,400	45	0.753	2,204	3	3
	Treatment of adults at health center	Age >5	6.0	436,020	30	0.023	2,993	130	134
	Hospital treatment of children with severe pneumonia	Age <5	64.0	35,070	8	2.280	68,441	30	31
	Hospital treatment of adults with severe pneumonia	Age >5	24.0	436,020	13	0.306	63,550	208	213
Maternal and family planning									
	Outreach family planning services	Married women age 15 to 49	27.0	1,334,000	3	0.267	73,857	276	283
	Trained birth attendants (TBA) prenatal and delivery care at health post	Births plus mothers	15.0	166,800	15	0.099	25,172	254	261
	Normal prenatal and delivery care at health center	Newborns and delivering mothers	28.0	222,400	28	0.185	23,936	130	133
	Normal prenatal and delivery care at hospital	Newborns and mothers	32.0	111,200	37	0.211	26,090	124	127
	Obstructed birth/Cesarean section	Referrals from lower levels	56.0	5,560	10	2.309	41,481	18	18
Nutritional deficiency									
	School-based vitamin A/iodine/deworming	Age 5 to 14 in school	28.0	673,600	5	0.028	1,849	66	67
	Surveillance and treatment of mild malnutrition at health center	Age <5	17.5	1,169,000	25	0.021	15,855	760	779
	Hospital treatment of severe malnutrition	Severely malnourished <5	24.0	58,450	5	1.687	68,848	41	42
Diarrhea									
	Construction of pit latrines and safe water supply	Age <5	21.0	1,169,000	15	0.080	26,775	335	343
	Rehydration therapy at health post	Age <5	27.0	233,800	10	0.175	1,300	7	8
	Rehydration therapy at health center	Age <5	45.0	233,800	20	0.291	1,876	6	7
	Hospital treatment for severe diarrhea in children	Age <5	48.0	4,676	29	0.569	41,305	73	74
Cardiovascular									
	Tobacco legislation and warnings	Age >15	0.2	1,622,500	5	0.000	10	63	65
	Hypertensive treatment at health center	Hypertensive adults	15.0	37,100	16	0.029	67,746	2,323	2,381
	Aspirin in pre-existing cardiovascular disease (CVD) at health center	Pre-existing CVD in adults	12.0	31,100	5	0.070	17,534	251	257
	Hospital treatment of rheumatic fever	Age 5-19 with RHD	10.0	1,665	5	0.457	30,851	67	69
	Hospital treatment for stroke or heart attack	Heart attack/stroke patients	17.5	16,540	20	0.549	153,280	279	286
AIDS and sexually-transmitted disease programs									
	AIDS education via media	Pop >15	0.1	3,245,000	10	0.000	4	12	12
	Condom use/provision for bar ladies	Bar Ladies	16.0	16,458	10	0.531	41,903	79	81
	Condom distribution for public at health post	Age >14 and < 60	18.0	2,986,000	3	0.055	12,379	225	230
	Treatment of sexually-transmitted diseases (STDs) at health center	Age >14 and < 60 with STDs	30.6	318,540	20	0.179	11,730	66	67
	Screening blood for transfusion at hospital	Annual transfusions	69.3	10,350	90	0.214	22,421	105	107
	Hospital treatment of AIDS patients	People with AIDS	14.4	1,681	14	0.108	138,476	1,282	1,314
Childhood infections									
	Childhood vaccination at health center	Age <5	66.5	1,169,000	40	0.690	16,658	24	25
	Hospital treatment for complicated measles	Age <5	24.0	5,845	20	0.867	40,413	47	48
Tuberculosis (TB)									
	Short-course treatment for TB at health center	New cases with sputum TB	49.0	9,200	35	4.715	51,716	11	11
	Hospital short-course treatment for TB	New cases with sputum TB	56.0	9,200	10	5.388	228,746	42	43
Injury or trauma									
	Legislation/fines/seat belts for injury prevention	Age >5	0.2	1,873,000	10	0.000	10	65	67
	Hospital treatment for severe injury	Chest/orthopedic trauma	21.0	12,400	30	0.837	227,229	271	278
Surgical									
	Appendectomy	Appendicitis	35.0	12,196	30	1.860	65,819	35	36
	Hernia repair	Hernia	28.0	24,392	20	0.714	51,768	72	74

twenty-five dollars. This difference stems partly from the higher effectiveness of these interventions at hospital levels, versus at the health center and health post level.

Grouping interventions by level of activity can tell us something about the willingness of users to pay for various services (table 11). For example, only government is likely to have much incentive to pay for outreach programs with a high public goods content. Willingness to pay for curative treatment with a high private content is likely higher. In Guinea, previous studies suggest that up to forty percent of people presenting at health centers cannot pay basic fees for treatment (World Bank, 1996). Thus, prioritizing key interventions within a level of care, such as a health center, may help achieve efficient use of public funds to provide free or subsidized care to those unable to pay.

Table 11 also presents the costs of achieving the government's objectives for the year 2000. The numbers assume the following: (1) coverage for childhood respiratory, diarrhea diseases and immunization will be stated government goals; (2) a population growth rate of 2.9 percent between 1994 and 2000; and (3) no increase in marginal unit costs of incremental additions of coverage. This analysis reveals that in the year 2000, provision of the current forty interventions will cost over eighty-seven million dollars, at 1994 dollar values. The total represents about eleven dollars per capita in the year 2000, and is nearly quadruple that of current per capita public spending on health. Of the total amount, over eighty-five percent will be needed to expand activities at the outreach, health center, and health post levels. Goals for expanding hospital services are more modest, thus they will require the remaining fourteen percent. The incremental cost for meeting coverage goals for outreach, health center and health post levels is about forty-three million dollars, and that for hospitals about two and half million dollars.

A MINIMUM PACKAGE OF HEALTH SERVICES

Based upon cost-effectiveness that is around one-hundred dollars per years of life saved and that addresses a substantial percentage of target years of life lost, we suggest one possible minimum package of health services in table 12. This includes outreach programs for AIDS prevention, tobacco control, injury prevention, condom use for bar ladies, school-based health programs, impregnated bednets for malaria, and outreach family planning. These outreach programs have a large public goods' component. The per capita cost for these outreach programs to achieve the government goals for the year 2000 is slightly over one dollar, and the programs address about twenty-one percent of the total years of life lost.

For interventions at the health center or health post level, the minimum package has a combination of single and integrated treatments. The single treatments include short-course treatment of tuberculosis, childhood vaccination, treatment of adult pneumonia, and treatment of sexually-transmitted diseases. The two integrated packages are integrated management of the sick child (malaria, pneumonia and diarrhea), and integrated antenatal care, delivery and family planning services. The cost per life year saved for integrated care of the sick child is fifteen dollars. The cost per life year saved for the integrated antenatal care and family planning is above one-hundred dollars, but is included because it address major causes of deaths in Guinea, and because

Table 10. Health interventions in Guinea, ranked by cost-effectiveness

Intervention	US dollars per life year saved	Percentage of years of life lost for target population
Under fifty dollars per life year saved		
Treatment of children with pneumonia at health center	3	13.5
Rehydration therapy at health center	7	14.2
Rehydration therapy at health post	8	5.1
Treatment of children with malaria at health post	8	4.4
Short-course treatment for tuberculosis at health center	11	5.7
AIDS education via media	12	1.7
Treatment of children with malaria at health center	13	12.3
Obstructed birth/Cesarean section	18	0.5
Childhood vaccination at health center	25	15.5
Hospital treatment of children with severe pneumonia	31	1.0
Appendectomy	36	0.2
Hospital treatment of severe malnutrition	42	0.2
Use of impregnated bednets for malaria	43	17.6
Hospital short-course treatment for tuberculosis	44	0.6
Hospital treatment for complicated measles	48	1.7
Fifty to one-hundred dollars per life year saved		
Tobacco legislation/warnings	65	2.4
Legislation/fines/seat belts for injury prevention	65	2.2
School-based vitamin A/iodine/deworming	67	2.1
Treatment of STDs at health center	67	1.7
Hospital treatment of rheumatic fever	69	0.3
Hernia repair	74	0.2
Hospital treatment for severe diarrhea in children	74	1.0
Condom use/provision for bar ladies	81	1.7
Hospital treatment of severe childhood malaria	87	0.9
One-hundred to three-hundred dollars per life year saved		
Screening blood for transfusion at hospital	107	0.1
Educate mothers on childhood pneumonia at health center	108	0.7
Normal prenatal and delivery care at hospital	127	1.0
Normal prenatal and delivery care at health center	133	4.9
Treatment of adults with pneumonia at health center	134	8.0
Hospital treatment of adults with severe pneumonia	213	0.4
Condom distribution for public at health post	230	1.7
Aspirin in pre-existing CVD at health center	257	0.5
TBA pre-natal and delivery care at health post	261	3.9
Hospital treatment for severe chest/orthopedic injury	278	0.6
Outreach family planning services	283	2.4
Hospital treatment for stroke or heart attack	286	2.6
Over three-hundred dollars per life year saved		
Construction of pit latrines and safe water supply	343	0.2
Surveillance and treatment of mild malnutrition at health center	779	0.6
Hospital treatment of AIDS patients	1,314	0.0
Hypertensive treatment at health center	2,381	0.3

Table 11. Cost-effectiveness of health services in Guinea, by level of care and future costs from expanded coverage of health services (assuming no improvement in quality of care)

Level and intervention	US dollars per year of life saved	Coverage (percent)		Costs in thousands of US dollars	
		Present	Planned for 2000	Total for 2000	Additional to expand coverage
OUTREACH LEVEL					
AIDS education via media	6	10	50	9	7
Use of impregnated bednets for malaria	43	1	50	1,453	1,424
Tobacco legislation/warnings	65	5	50	10	9
Legislation/fines/seat belts for injury prevention	65	10	50	12	10
School-based vitamin A/iodine/deworming	67	5	25	379	303
Condom use/provision for bar ladies	81	10	50	419	336
Outreach family planning services	283	3	5	5,992	2,397
Construction of pit latrines and safe water supply	343	15	60	22,842	17,131
Total	...	...	...	**31,115**	**21,616**
HEALTH POST LEVEL					
Rehydration therapy	8	10	30	111	72
Treatment of children with malaria	8	22	40	419	184
Condom distribution for public	230	3	5	2,248	899
TBA prenatal and delivery care	261	15	25	1,277	511
Total	...	...	...	**4,055**	**1,666**
HEALTH CENTER LEVEL					
Treatment of children with pneumonia	3	45	80	1,504	658
Rehydration therapy for diarrhea	7	20	50	267	160
Short-course treatment for tuberculosis	11	35	50	289	88
Treatment of children with malaria	13	22	40	1,132	497
Childhood vaccination	25	40	80	18,948	9,474
Treatment of sexually-transmitted diseases	67	20	50	2,272	1,363
Educate mothers on childhood pneumonia	108	8	25	81	57
Normal prenatal and delivery care	133	28	50	3,237	1,426
Treatment of adults with pneumonia	134	30	30	476	0
Aspirin in pre-existing CVD	257	5	5	33	0
Surveillance and treatment of Mild malnutrition	779	25	50	11,272	5,636
Hypertensive treatment	2381	16	16	489	0
Total	...	...	...	**40,002**	**19,360**
HOSPITAL LEVEL					
Obstructed birth/Cesarean section	18	10	50	140	112
Treatment of children with severe pneumonia	31	8	25	730	486
Appendectomy	36	30	50	488	195
Treatment of severe malnutrition	42	5	25	1,224	979
Short-course treatment for tuberculosis	44	10	10	256	0
Treatment for complicated measles	48	20	40	115	57
Treatment of rheumatic fever	69	5	5	3	0
Hernia repair	74	20	40	614	307
Treatment for severe diarrhea in children	74	29	50	117	49
Treatment of severe childhood malaria	87	8	25	542	375
Screening blood for transfusion	107	90	99	279	25
Normal prenatal and delivery care	127	37	37	1,297	0
Treatment of adults with severe pneumonia	213	13	13	4,230	0
Treatment for severe chest/orthopedic injury	278	30	30	1,028	0
Treatment for stroke or heart attack	286	20	20	617	0
Treatment of AIDS patients	1314	14	14	40	0
Total	...	...	...	**11,720**	**2,586**
Total for all programs				*86,892*	***45,228***
Excluding water and sanitation				*64,050*	***28,096***
Excluding water and sanitation and hospitals				*52,330*	***25,510***

Table 12. Total and per capita costs of a minimum package of health services in Guinea (assuming no improvement in quality of care)

Level and intervention	US dollars per year of life saved	Coverage (percent)		Costs in thousands of US dollars		Per capita costs in 1994 US dollars		Percent of total years of life lost addressed
		Present	Planned for 2000	Total for 2000	Additional to expand coverage	Total for 2000	Additional to expand coverage	
OUTREACH								
AIDS education via media	6	10	50	9	7	0.00	0.00	
Use of impregnated bednets	43	1	50	1,453	1,424	0.20	0.20	
Tobacco legislation/warnings	65	5	50	10	9	0.00	0.00	
Legislation/fines/seat belts for injury prevention	65	10	50	12	10	0.00	0.00	
School based vitamin A/iodine/deworming	67	5	25	379	303	0.05	0.04	
Condom Use/Provision for bar ladies	81	10	50	419	336	0.06	0.05	
Outreach family planning services	283	3	5	5,992	2,397	0.83	0.33	
Total				**8,273**	**4,484**	**1.14**	**0.62**	***20.3***
INTEGRATED HEALTH CENTER OR POST								
Integrated management of sick child	3	25	80	3,774	2,595	0.52	0.36	
Short-course treatment for tuberculosis	11	35	50	289	88	0.04	0.01	
Childhood vaccination	25	40	80	18,948	9,474	2.62	1.31	
Treatment of sexually-transmitted diseases	67	20	50	2,272	1,363	0.31	0.19	
Integrated antenatal care/childbirth/family planing	123	25	50	58,518	29,259	8.08	4.04	
Total				**83,801**	**42,779**	**11.57**	**5.91**	***39.8***
Total for outreach and health center or post				**92,074**	**47,263**	**12.72**	**6.53**	***60.4***
HOSPITAL								
Obstructed birth/Cesarean section	18	10	50	140	112	0.02	0.02	
Treatment of children with severe pneumonia	31	8	25	730	486	0.10	0.07	
Appendectomy	36	30	50	488	195	0.07	0.03	
Treatment of severe malnutrition	42	5	25	1,224	979	0.17	0.14	
Short-course treatment for tuberculosis	44	10	10	256	0	0.04	0.00	
Treatment for complicated measles	48	20	40	115	57	0.02	0.01	
Treatment of rheumatic fever	69	5	5	3	0	0.00	0.00	
Hernia repair	74	20	40	614	307	0.08	0.04	
Treatment for severe diarrhea in children	74	29	50	117	49	0.02	0.01	
Treatment of severe childhood malaria	87	8	25	542	375	0.07	0.05	
Screening blood for transfusion	107	90	99	279	25	0.04	0.00	
Total			**4,509**	**2,586**	**0.62**	**0.36**	***2.0***	
Total for all programs				***96 583***	***49,849***	***13.34***	***6.88***	***62.4***

antenatal care is a common service provided at health centers (SEATS/JSI, 1994). The total package of services at the health center or health post level would cost about twelve dollars per capita and would address about forty percent of total years of life lost.

Components of a minimum package at the hospital level include: emergency obstetric procedures; treatment of severe cases of childhood pneumonia, malnutrition, diarrhea, and malaria; appendectomy and hernia repair; treatment of tuberculosis; and screening of blood transfusions. As the coverage goals for these are modest, the hospital services would cost only about sixty cents per capita but would address only two percent of total years of life lost.

This analysis suggests that for approximately thirteen dollars per capita, a comprehensive set of basic public health and clinical service goals may be offered to Guineans, which would address a large proportion of major causes of premature mortality, and by extrapolation, much of

morbidity. Reaching such goals is not possible from the current total public spending of about four dollars per capita.

The minimum package presented here offers only a broad guideline to the types of allocation decisions needed to maximize health for Guineans at the lowest possible cost. The package does not include outreach programs such as improved water and sanitation, which cost about three dollars more per capita. While water and sanitation services have externalities far beyond reducing diarrhea and waterborne diseases, and are often demanded as a priority item by people, it is probable that they would be financed from sectors outside health. Furthermore, the package does not include several interventions, such as simple treatment of skin infections, that might encourage more people to use the services as they perceive its benefits. An approximate guideline for such interventions would be to allocate an additional twenty percent (or two dollars per capita) to the cost of the package. Finally, the outreach programs for AIDS education, anti-tobacco campaigns and injury prevention may not be implemented in the short-term as they rely upon widespread literacy and enforcement of legislation.

Improvements in community effectiveness of services offered such as better compliance with family planning or with diarrhea treatment, would probably improve the overall cost-effectiveness of health care service delivery. Cost savings may also result from improved quality and coverage from individual interventions, although these are much harder to quantify. As noted, we have made generous adjustments to ideal efficacy. Better quality of services would improve cost-effectiveness. For example, the integrated management of a sick child is not yet commonly practiced in Guinea, but shows a higher cost-effectiveness than do individual programs. This improvement comes from limiting the percentage of missed diagnoses among children presenting with symptoms attributable to diarrhea, malaria, or pneumonia.

The minimum package presented includes costs for hospital care. *Better Health in Africa* (World Bank, 1994) recognized that a well-functioning first-referral hospital is crucial to the entire package of health services delivery. The analysis here suggests that there are several cost-effective health interventions at hospitals. While the per capita figure for curative hospital services is low, it represents a considerable expense per patient. In addition, we assume only modest goals of coverage for in-hospital services. Higher coverage would increase costs considerably. The analysis does consider the current lack of referral system in Guinea. Should primary level care erode further, then costs of coverage for the population at the more expensive hospital levels would rise.

POLICY IMPLICATIONS OF COST-EFFECTIVENESS ANALYSIS

The cost-effectiveness analysis holds several implications for health planners. First, it suggests that cost-effective interventions are available for the major causes of death in Guinea, and are accessible to its people. Communicable, maternal, and perinatal diseases, the largest causes of death in Guinea, are subject to several highly cost-effective curative interventions. The same is true for preventive programs for injuries and anti-tobacco programs to reduce cardiovascular disease and cancer. Second, the analysis confirms that provision of a basic package of health services will require substantial increases in funding from the government of Guinea and donors. A minimum

package costs about thirteen dollars per capita, which is about three times the current public per capita expenditure of four dollars. Third, a focus on the core set of interventions at the outreach, health center and health post levels shown in table 12 should be the top priority for government as it plans further health system reforms.

The analysis also has implications for investment patterns. First, it assumes the presence of a large base of investment in infrastructure, drugs, equipment, work force, training, and other delivery components needed to offer a minimum package of services to the population at a particular unit cost. To a large extent, the Guinean government currently focus on building and refurbishing physical structures (World Bank, 1993a; SEATS/JSI, 1994). As well, its goal is to activate all health centers within a short time frame. The proposed minimum package allocates only small amounts to investment items, largely selected equipment. For recurrent budget items, it allocates approximately ninety percent for non salary items, and ten percent for salary items. The requirement for large non-salary expenditure exists even considering that the analyses adjust for the large current inefficiencies in drug and personnel allocation (as reflected in the generous multiplier for these in the analyses) and the current inefficient referral system. In marked contrast, actual recurrent spending in Guinea is about eighty-five percent for salary items and fifteen percent for non-salary items (World Bank, 1996). While a complete change in this spending pattern is impossible, it does suggest that the implementation of minimum package is consistent with previous efforts to inon salaryn-salary recurrent expenditures (World Bank, 1993a; SEATS/JSI, 1994).

Cost-effectiveness and burden of disease analyses are only two methods that measure health system performance, and have complimentary roles to other analyses (table 13). A plausible set of variables to measure health system performance include health status, equity or poverty reduction, access to services by the population, macroeconomic and microeconomic efficiency, clinical effectiveness, consumer satisfaction and long-run sustainability (Schieber, 1995). Cost-effectiveness analyses provide information on microeconomic efficiency and clinical effectiveness, by estimating how improved effectiveness may reduce costs. An example is the case for integrated management of the sick child. Although not done here, cost-effectiveness analyses may also provide estimates of the costs for improved access, given that unit costs for incremental expansion of coverage have increasing costs. Finally, they may provide estimates for future costs for coverage, and thus help establish long-run sustainability. Burden of disease analyses provides a measure of health status by providing a static measure of disease burden. It provides limited information on equity, as disease burden is strongly associated with poverty, especially for communicable and maternal diseases. Burden of disease provides limited information on access and microeconomic efficiency, in that lower existing access and poor efficiency should result in high burdens of disease. Finally, projections of future burden of disease may help guide estimating costs for meeting disease coverage, and thus help inform policy makers of the long-run sustainability of current health spending in relation to needs.

Table 13 lists the key conclusions from the analyses in Guinea, namely that the health status reflects a high burden of preventable or curable communicable and maternal diseases, and that cost-effective interventions exist that address these diseases. Effective responses to the high disease burden necessitate increases in spending on health, increased clinical effectiveness and quality, all

Table 13. Contributions of burden of disease and cost-effectiveness analyses to evaluation of health sector performance

Variable	*Burden of disease*	*Cost-effectiveness analyses*	*Some other available tools*	*Results for Guinea*
Health status	Covers all diseases and provides static measure of burden	N/A	Vital registration, cause of death, morbidity surveys,	High burden from communicable disease, mostly in under age 5
Equity or poverty reduction	Higher burdens are in poor, thus spending prioritized by burden helps equity impact	N/A	Expenditure Incidence Analyses (or subsidy analyses)	Rural areas likely have higher disease burden.
Access to services	Low access equals higher burden	May provide information on how incremental increases in coverage are more expensive	Utilization surveys and physical inventories of facilities	Poor access means high communicable disease burden
Macroeconomic efficiency (overall spending in relation to outcomes)	N/A	N/A	Public expenditure analyses	N/A
Microeconomic efficiency (including spending by level of care or by disease)	Provides indirect information only: high burdens should reflect poor efficiency	Allows comparison of actual interventions to ideal practice	Several: reviews of payment schemes, referral systems, etc.	1) Poor efficiency of public facilities is seen in high burden and low effectiveness of care 2) Improved quality of care requires more spending on non-salary, recurrent items
Clinical effectiveness	N/A	Better effectiveness means lower cost-effectiveness	Performance versus other facilities	Better quality is possible with specific inputs, e.g., integrated management of sick children
Consumer satisfaction	N/A	N/A	Consumer surveys	
Long-run sustainability	Provides indirect information only: estimates of burdens from population growth and the epidemiological transition	Helps estimate future costs for coverage of a minimal package	Public expenditure analyses	1) Future burden of disease will be driven largely by fertility and not epidemiological transition 2) Costs for the minimum package alone are three times current public spending

of which may be done by focusing on a core package of clinical and preventive interventions. Fortunately, methods complementary to burden of disease and cost-effectiveness have examined health system performance. These include utilization surveys, public expenditure reviews, expenditure-incidence analyses (SEATS/JSI, 1994; World Bank, 1996). However, other aspects of system performance remain unmeasured, including vital registration, cause-of-death surveys, reviews of payment and finance schemes, and consumer surveys of satisfaction.

The cost-effectiveness analyses reported here have several limitations. First, they do not provide a direct analytic basis for managing issues such as decentralization, drug delivery, personnel planning, infrastructure development, quality of care, and other aspects of health care delivery. Second, as the analyses depend upon data for both the numerator and denominator, even minor misclassification of either could greatly alter the estimated ratios. However, such error likely applies across all interventions and is below the level of error that would distort the decision to allocate resources across levels. Third, while these interventions address major causes of death in Guinea, their full implementation will not necessarily reduce deaths dramatically for the population as a whole. Allocation of resources toward an intervention is generally on a marginal basis and results in slow, modest reductions in overall mortality. In addition, the estimates of disease-specific mortality do not rely upon rigorous epidemiological data and thus are likely to contain measurement error. For this reason, we have not calculated the reduction in mortality expected from these interventions. Fourth, some interventions that do not appear cost-effective in this analysis, for example, provision of adequate water and sanitation, are nonetheless important in improving the general quality of life in a community. Fifth, these cost-effective analyses do not take into account private costs incurred by a patient, such as the costs of travel or of time lost from work, and the like.

The analysis reflects the actual practice in Guinea, rather than an ideal effectiveness of interventions. Significant reductions in total costs (and thus in per capita costs) would result from enhanced community effectiveness of the interventions. Such effectiveness involves improved access, compliance, drug supply, and training. Quantifying the magnitude of such internal efficiency gains is difficult. Improving quality requires additional expenditure on training, planning, and management. These, in turn, tend to require non-salary recurrent expenditures.

To guide policy choices, the minimum package requires testing in focal areas, and such testing must include careful observation of costs and consequences, and must be accompanied by collection of better epidemiological data, health service utilization, and consumer satisfaction surveys. Guinea has a strong record of innovation. Such piloting, drawing upon similar experiments in other countries, would be a useful guide to widespread implementation of a program of cost-effective interventions addressing the major causes of death and disability in Guinea.

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