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High levels of Burden of Disease for all age groups of the population in Sub Sahara Africa

by

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Abstract

The data as presented in the Global Burden of Disease study, a collaborative undertaking between the Harvard School of Public Health and the World Health Organization, provide the opportunity to assess how the total burden of disease (mortality and morbidity) is distributed over age groups. The data indicate that in Sub Sahara Africa all age groups, including the economically most active (15-45 years), are subject to high levels of burden of disease, much higher in comparison with high income countries, and also much higher in comparison with other developing regions. In view of the impact of disability on household functioning in all its aspects, including income generating capacity, results call for detailed studies on burden of disease at household level, for which household survey data might be an appropriate source of information. With respect to specific causes, mortality and disability resulting from violence, accidents, and mental illness, are estimated to account together for more than 40% of the disease burden in the 15-45 years age group in Sub Sahara Africa. Other diseases or disorders that significantly contribute to the total disease burden for adults are AIDS, other sexually transmittable diseases, tuberculosis, maternal conditions, malaria, and respiratory diseases. On the other hand, the contribution of tropical diseases such as schistosomiasis, river-blindness, filariasis, leishmaniasis and trypanosomiasis (but excluding malaria) is relatively limited.

1. Introduction

Sub Sahara Africa is known for high rates of mortality and morbidity. Infant and child mortality, and also maternal mortality, are higher than in any other developing region, while diseases such as malaria and tuberculosis are widely prevalent in most Sub Saharan African countries. In addition, over past years AIDS became the most threatening illness of the Sub Saharan region.

Mortality and morbidity, apart from their direct impact in terms of human suffering, affect households in their overall functioning and their economic performance. The consequences depend on which household members are affected (children, women at child bearing age, adults, the elderly), on the severity and duration of the various diseases and disorders, and on their eventual outcome. Thus, high rates of morbidity and mortality in children may considerably increase workloads of women as they are the first to provide the needed care. Premature death of women, often related with frequent pregnancies, could create problems with respect to the raising of children who have lost their mother. And overall mortality and morbidity in adults who are economically in their most productive years, might cause considerable losses in households' income earning capacities[1]. Also with respect to specific diseases, associated health problems and disease outcomes depend on the age at which the disease occurs. While, for example, in infants malaria contributes significantly to mortality, in adults the effects of malaria can be much milder as a result of acquired partial immunity against the malaria parasite (Gallup and Sachs, 2000).

Thus, for assessing the socio-economic consequences of morbidity and mortality on the population, information is required how diseases and disorders affect different age groups, in terms of intensity of the various diseases, in terms of duration, and also in terms of eventual outcomes. In response to the need for better information on the total burden of disease, and on the relative contributions of different types of disorders and diseases, over past years interest has increasingly grown for indicators that quantify information on mortality and morbidity. Most active in the field has been the World Health Organization (WHO), who has been playing a major role in promoting the concepts of Disability Adjusted Live Years (DALY's) and Disability Adjusted Life Expectancy (DALE). A major activity is the so-called Global Burden of Disease Study, which has among its objectives to combine in a quantitative way the effects of both mortality and morbidity (Murray and Lopez, 1996a). With the availability of such information, when disaggregated by age groups, it allows for an assessment of the distribution of the burden of disease over the life cycle. Also, when in addition mortality and morbidity are disaggregated by cause of death or by type of disease, an assessment can be made how specific diseases and disorders affect various age groups.

In the present paper, after a review of the approach and concepts in the Global Burden of Disease Study, an assessment is made how health problems and disease patterns are distributed over different age groups in Sub Sahara Africa. It is expected that results will form a stimulus for further investigations of the effects of poor health on the functioning of individuals and households in Sub Sahara Africa. The final objective is to contribute to a better assessment of the overall socio-economic consequences of poor health in Sub Sahara Africa.

2. Data and methods

The present report largely builds on existing data as produced in the Global Burden of Disease Study (GBD-study), a collaborative undertaking between the Harvard School of Public Health and the

[1] For examples of empirical studies on the effects of illness on income in developing countries: Sauerborn e.a. 1996; Asenso-Okyere, 1997; Ramaiah, 2000.

World Health Organization. Among the major outputs of the program is the Global Burden of Disease and Injury Series, a ten-volume exercise of which the first three have been published.

The first volume of the series, titled 'The Global Burden of Disease', provides data on various burden of disease variables for eight demographic regions in the world, including the Sub Sahara Africa region and the region dubbed Established Market Economies (EME), which are largely the OECD countries (Murray and Lopez, 1996b). For each demographic region, burden of disease data are given by age group, by sex and by cause. In the present study, data are presented on Sub Sahara Africa and, for comparison, on the EME-countries. Most presented results are derived from data reported for 1990, as this is the only year for which a comprehensive set on the three Burden of Disease variables (Years of Life Lost, Years Lived with Disability, Disability Adjusted Life Years) is available. For most figures and tables presented in the present report, data as published in the Global Burden of Disease study (Murray and Lopez, 1996b) have been converted into rates per 1000 people by age group.

In addition some data are taken from the 1999 and 2000 World Health Report (WHO, 1999, 2000), as these provide more recent estimates on burden of disease, though only expressed in Disability Adjusted Life Years (DALY's). It should be noted that the country grouping named 'Sub Sahara Africa' as followed in the GBD-study is not fully comparable with the country grouping 'Africa' as followed in the WHO report. Main differences are that the grouping 'Sub Sahara Africa' includes Sudan, which is not included in 'Africa', while 'Africa' includes Algeria, which is not included in 'Sub Sahara Africa'.

Finally, it may be noted that in the present study groupings and terminology with respect to various diseases, disorders and disabilities are based on those followed in the GBD-study. Yet, some selection has been made with respect to the levels of aggregation at which information on diseases or groups of diseases is presented (Tables 1 and 2).

3. Major concepts in the Burden of Disease approach

It is one of the major objectives of the Burden of Disease Study to express the health status of a population or population group in a single measure, one that reflects both the burden of mortality and the burden of morbidity.

With time being chosen as the unit of measurement, the burden of disease is expressed in so-called DALY's, where one DALY is equivalent to one lost year of healthy life.[2] For a population, the total numbers of DALY's incurred in a given year, and thus the incurred burden of disease consists of two components: the total numbers of years of life lost as a result of premature mortality (YLL's) and the total number of years that will be lived with a disease or disorder, with an adjustment for the severity of the disability resulting from the disease or disorder (YLD's). Thus, in calculating DALY's from road accidents in 1990 in a country, the total number of years of life lost as a result of fatal road accidents and the (adjusted) number of years of life that will be lived with disabilities by survivors of the accidents are added up.[3] As the burden of disease reflects, in effect, the difference between the actual health of a population and some 'ideal', desired or reference health status, the approach requires several decisions to be taken for the calculation of the burden of disease.

[2] Quantifying health has been the subject of research in numerous studies in past decades. For reviews, including descriptions on other health indicators (QALY, HeaLY) see e.g. Hyder e.a. (1998) and Murray (2000).

[3] An important methodological aspect in calculating burden of disease is the year to which the disease burden of an individual is attributed. The issue is in particular important for diseases which are highly dynamic in incidence and prevalence rates (see e.g. Hyder and Morrow, 1999).

First, to estimate the loss of years caused by premature mortality, it has to be decided what the life expectancy of individuals would be in the absence of premature mortality. The Global Burden of Disease Study assumes a standard life table for all populations, with life expectancies at birth fixed at 82.5 years for women and 80 years for men. These are based on the actual life expectancies at birth for the world's longest-surviving population, Japan.

A second characteristic of the burden of disease approach is that years of life lived at different ages are valued differently. From birth until approximately the age of 22 years the relative value of a year of life lived is increasing, while after the age of 22 years it slowly decreases. In addition to this age-weighting, the GBD-approach also incorporates the discounting of future life years at a rate of 3% per year. Thus, the value of years of life which are in time more remote are valued lower than years of life in the near future. One effect of this discounting procedure is that it reduces the impact of a child death compared with an adult death.

While thus the steps involved in the transition of premature mortality into YLL's are not without value assessments, probably the most difficult and most controversial component in the burden of disease approach are the decisions how to value years lived with disability. In other words, questions have to be answered how, for example, years lived in blindness compare to years lived with paraplegia, how years lived with AIDS compare to years lived with malaria, and how these conditions relate to the absence of disease or disorder.

Without going into a detailed description of the methodology used to arrive at disability estimates, it is noted that the disability weighting factors, which vary between zero and one, are based on social preferences, or, in economic terms, on perceived utility. Among the instruments being used for establishing the weighting factors is for example the person trade-off method, in which individuals, who are members of a panel, are requested to indicate how many life-years of being in some imperfect health status would be considered equivalent to being in perfect health status for one life-year. These and other procedures have resulted in factors to be applied to years lived with specific disabilities, resulting in quantitative expressions for years lived with disability (YLD's). Thus, for an individual with a specific disease, the number of YLD's follows from multiplying the number of years during which that person has the disease with a factor that expresses the degree that the illness affects the person's wellbeing.[4, 5]

It may be noted that for practically all above described procedures extremely difficult choices and value assessments have to be made, which has resulted in serious debate and controversy (Anand, and Hanson, 1997; Williams, 1999; Murray and Lopez, 2000). Among the issues of debate is the question whether the GBD-approach, and in particular the use of the summary indicator of population health, DALY, has the potential to play an important role in setting health priorities and guiding resource allocation (Sayers, B. and Fliedner, T.M., 1997). Another issue of controverse is the procedure of age-weighting which incorporates a notion of differences in economic productivity or differences in levels of investment in human capital between individuals at different stages of the lifer-cycle. In coming years, changes, revisions and refinements with respect to various aspects of the procedures in assessing burden of disease are likely to be proposed and possibly implemented (AbouZhar, C. and Vaughan, J.P., 2000). While such changes have the potential to contribute to better assessments of burden of disease, it should be noted that in particular for Sub Sahara Africa the actual

[4] Since the development of the original protocol for health state measurements in the Global Burden of Disease study, various modifications and refinements have been introduced (see Murray and Lopez, 2000, p 77).
[5] For more extensive discussion on disability weights, see e.g. Üstün, T.B. e.a., 1999.

data bases from which mortality and morbidity rates are derived are extremely weak, and numerous assumptions, intra- and extrapolations had to be made [6].

A last burden of disease variable to be mentioned is the so-called Disability Adjusted Life Expectancy, which is increasingly being promoted as a summary indicator of population health (WHO, 2000). The DALE is most easily described as the expectation of life lived in equivalent full health. While for high income countries, the Disability Adjusted Life Expectancy at birth is generally around ten percent lower than the unadjusted life expectancy at birth, for many poor countries the difference approaches 20 per cent (WHO, 2000).

Finally, it may be noted that another important component of the Global Burden of Disease study is the objective to arrive at estimates of the proportions of mortality and disability that can be attributed to certain risk factors, including tobacco, alcohol, poor water and sanitation, and unsafe sex. Though highly relevant from the point of view of policies to address health problems, the issue of risks factors will only be marginally addressed in the present analysis.

4. Results

4.1 Years of Life Lost, Years Lived with Disability, and Disability Adjusted Life Years lost for Sub Sahara Africa in comparison with high income countries

With the availability of quantitative information on years of life lost as a result of premature mortality (YLL) and quantitative information on years lived with disability (YLD), an assessment can be made of the relative contributions of mortality and morbidity to the total burden of disease, expressed in DALY's.

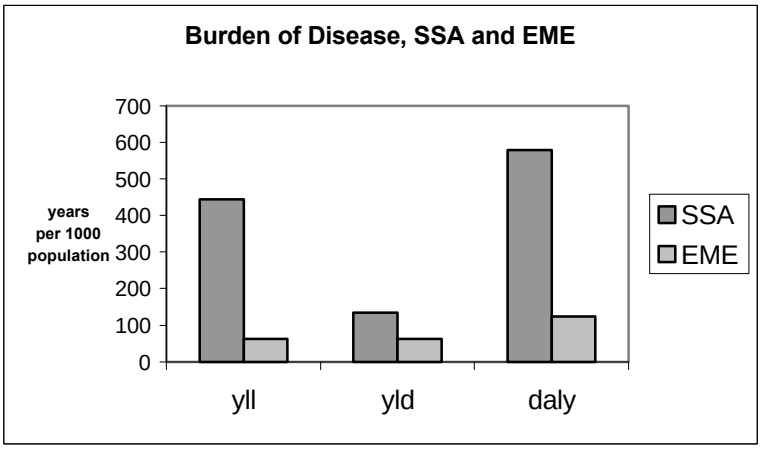


Figure 1
Relative contributions of YLL's and YLD's to Burden of Disease in SSA and EME, in 1990; YLL's, YLD's and DALY's expressed in number of years per 1000 population.
Source: Murray, 1996b, calculated from Annex Tables 7, 8 and 9.

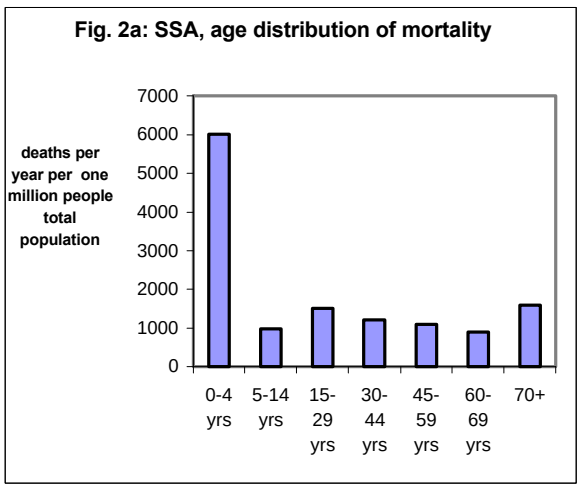
[6] In fact, mortality figures for Sub Sahara Africa as published in the GBD-study are largely based on mortality data for a sample of one per cent of the population of South Africa, and the poor database for SSA has led some authors to the viewpoint that GBD-data for SSA should not be used (see e.g. Cooper, 1998).

First, figure 1 shows that, on the basis of estimates for 1990, the total burden of disease in Sub Sahara Africa is approximately four times higher than in the EME-countries. Also in comparison with other developing regions, Sub Sahara Africa has by far the highest level of total burden of disease (Murray, 1996a). The figure also indicates that in Sub Sahara Africa premature mortality contributes much stronger to the total burden of disease than disability. Expressed as percentage of total DALY's, the Years of Life Lost account for almost 80% of the disease burden, while the Years Lived with Disability account for just over 20 %. For comparison, for the group of EME-countries, the total burden of disease is equally accounted for by premature mortality as by morbidity, each contributing approximately 50% to the total number of DALY's lost.

Thus, data as presented in figure 1 confirm the relatively high level of burden of disease in Sub Sahara Africa in comparison with high income countries, while they also show that in particular premature mortality is in Sub Sahara Africa a major contributing factor.

4.2 Distribution of mortality over age-groups

Before presenting age-specific information on the burden of disease variables (YLL, YLD and DALY), first in figures 2a and 2b data are presented on the distribution of mortality over age-groups. Figure 2a shows how mortality in Sub Saharan Africa, expressed in numbers of deaths per one million total population (all age groups together), is distributed over various age-brackets. Thus, for example, in 1990 there were per one million people approximately 6000 cases of death in the 0-4 years age group. While the figure clearly illustrates the high level of child mortality in Sub Saharan Africa, it also illustrates that for individuals older than five years, the occurrence of death is rather evenly distributed over all other age brackets. For comparison, the distribution of mortality over age-brackets is also given for the group of high-income countries. As shown in figure 2b, in the high-income countries the occurrence of death before the age of 45 years is relatively uncommon, and by far the highest numbers of deaths occur at ages of 70 years and older.



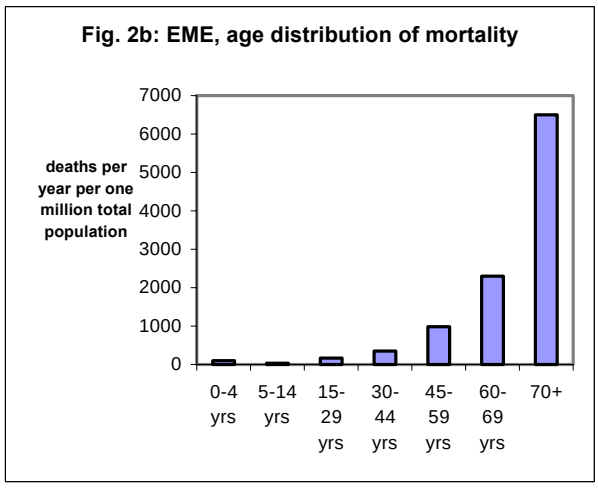


Figure 2

Distribution of mortality over age-brackets, expressed in numbers of deaths per one million total population, in 1990 (figure 2a: Sub Saharan Africa, figure 2b: Established Market Economies).
Source: Murray, 1996b, calculated from Annex Table 12).

It is important to note that in figures 2a and 2b mortality rates in the various age brackets are expressed relative to the total population and not relative to the population in each age bracket. Thus, the much lower mortality in the 70+ age group of Sub Sahara Africa in comparison with the high income countries is largely explained by the fact that the share of the population being 70 years or above is in Sub Sahara Africa much lower than in the EME-countries.

As it is the primary objective of the present study to make comparisons between the *relative* occurrence of mortality and morbidity in different age-segments, in figures 3a and 3b mortality rates are expressed as numbers of deaths per 1000 people in each age group. As a result of the differences in age structure between the populations of Sub Sahara African countries and the countries classified as Established Market Economies, the distribution of mortality in figures 3a and 3b differs from the distributions as presented in Figures 2a and 2b. As expected, the strongest effect of expressing mortality as rates per 1000 people within each age group is manifested in the higher age groups (60-70 years, and above 70 years), as the relative shares of older age groups are much lower in Sub Sahara Africa in comparison with the high-income countries. Yet, it may be noted that for all age segments the age-group specific mortality rates are considerably higher in Sub Sahara Africa in comparison with the Established Market Economies. In the remaining part of this study, the burdens of disease in terms of Years of Live Lost, Years Lived with Disability, and Disability Adjusted Live Years will be expressed as rates per 1000 people in each age group.

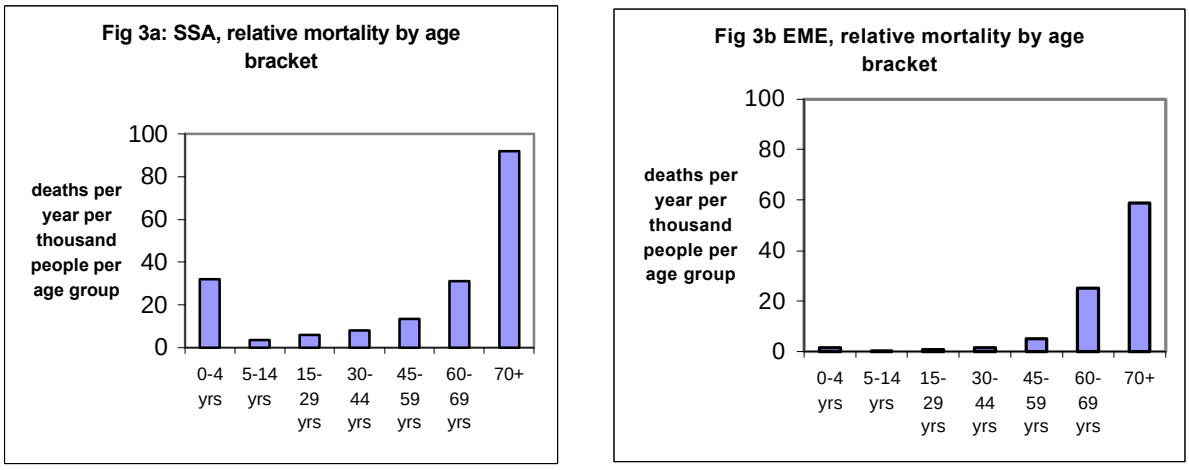


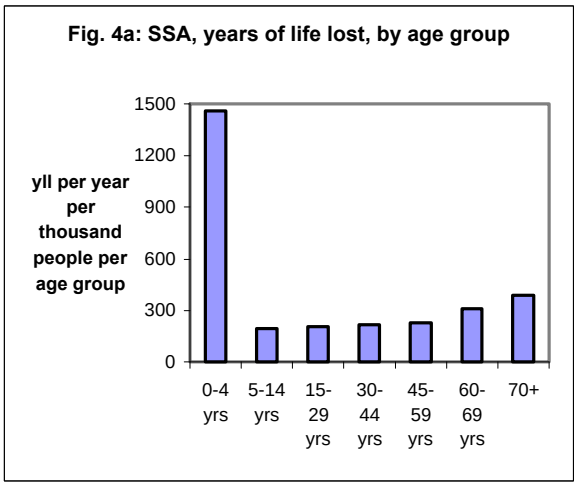
Figure 3

Distribution of mortality over age-brackets, expressed in numbers of deaths per one thousand people per age-group, in 1990 (figure 3a: Sub Saharan Africa, figure 3b: Established Market Economies).
Source: Murray, 1996b, calculated from Annex Table 12).

4.3 Years of Life Lost per thousand people by age group

Figures 4a and 4b provide information on Years of Life Lost as a result of the occurrence of premature death in the various age-brackets, again expressed per thousand people in the respective age segments. As described above, age weighting and discounting have been applied in calculating the Years of Life Lost. On the basis of figures 4a and 4b several observations can be made. In the first place, as a direct consequence of the high rates of infant and child mortality, for the Sub Sahara Africa region the number of Years of Life Lost in the 0-4 years age group is very high, about 20 times higher than the result for the EME-countries. In the second place, and in line with the mortality rates presented in figures 3a and 3b, also for the other age groups, and in particular for the economically

most active age segments, the burden of disease expressed in Years of Life Lost is much higher in the countries from Sub Sahara Africa in comparison with the high-income countries. For the age segments 15-29 years and 30-45 years, the numbers of Years of Life Lost are in Sub Sahara Africa respectively 7 and 6 times higher in comparison with the Established Market Economies. Finally, it may be noted that for the higher age groups the differences in Years of Life Lost between Sub Sahara Africa and the high-income countries are less pronounced which is the direct result of the procedures used in the calculation of Years of Life Lost, where mortality at younger age contributes much stronger to the total number of Years of Life Lost than death occurring at ages which are closer to the normative life expectancy.



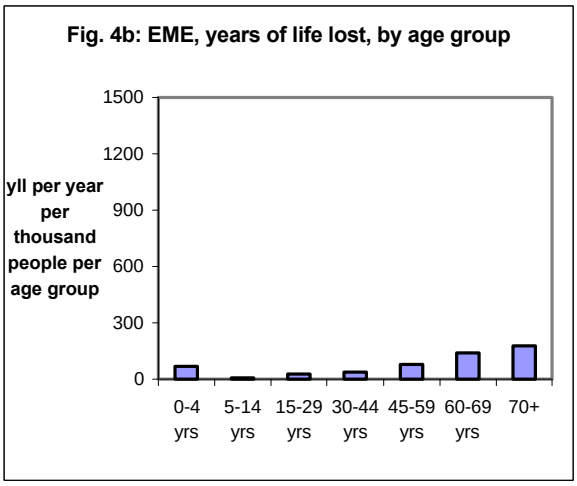


Figure 4
Distribution of Years of Life Lost (YLL) over age-brackets, expressed in numbers of deaths per thousand people of each age-group, in 1990 (figure 4a: Sub Saharan Africa, figure 4b: Established Market Economies).
Source: Murray, 1996b, calculated from Annex Table 7.

4.4 Years Lived with Disability, expressed per thousand people, by age group

The second component in the quantitative expression of burden of disease is the number of Years Lived with Disability, which expresses the number of years that individuals will be living with a certain disability after the onset of the disorder. As in the calculation of Years of Life Lost, age-weighting and time-discounting is applied, while in addition weighting factors have been used to account for differences in severity of the various types of disorders.

Figures 5a and 5b show the distribution of the numbers of Years Lived with Disability over the different age segments, both for Sub Sahara Africa and for the Established Market Economies. For the lower age groups it appears that results for the numbers of Years Lived with Disability are approximately three times higher in Sub Sahara Africa in comparison with the high-income countries, for the older age groups the difference appears to be about two-fold. It should be kept in mind that the types of prevailing diseases differ between Sub Sahara Africa and the Established Market Economies, with for example infectious diseases being more prevalent in Sub Sahara Africa and degenerative disorders more widely prevalent in high income countries. Results, therefore, depend partially on the appropriateness of the disability weights that have been attributed to the various diseases. Yet, results

at least provide a strong indication that the burden of disease resulting from disabilities is for all age-groups considerably higher in Sub Sahara Africa in comparison with high-income countries.

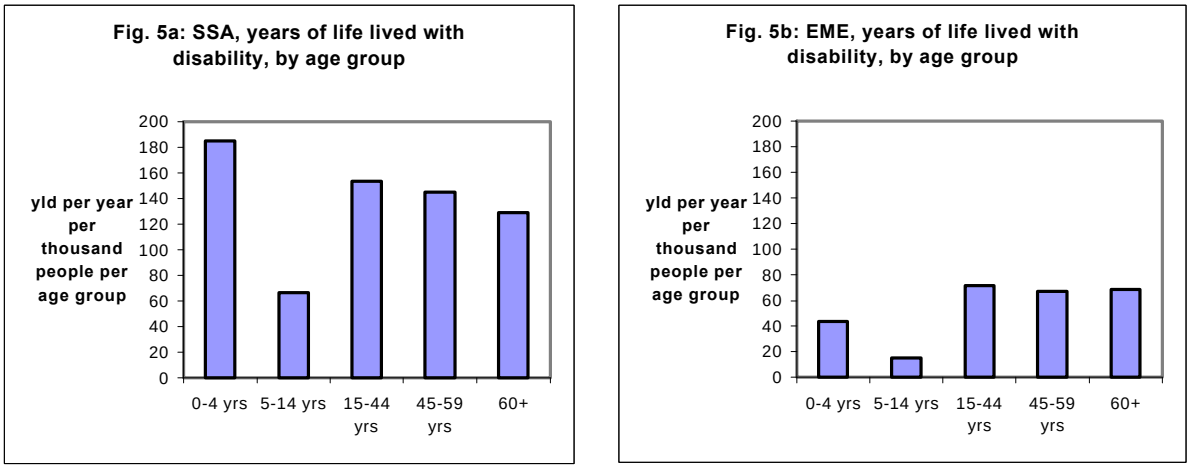
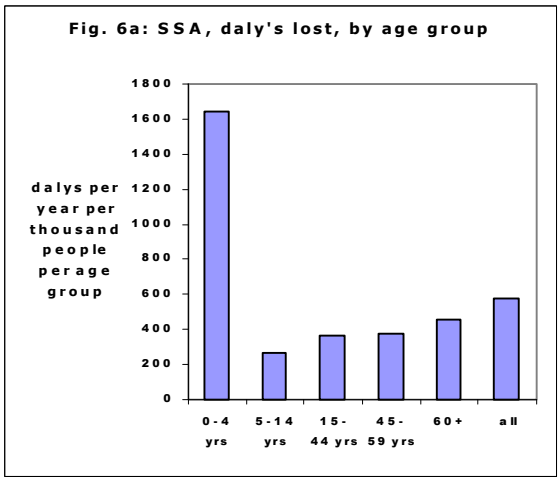


Figure 5
Distribution of Years Lived with Disability (YLD) over age-brackets, expressed in numbers of deaths per one thousand people of each age-group, in 1990 (figure 5a: Sub Saharan Africa, figure 5b: Established Market Economies).
Source: Murray, 1996b, calculated from Annex Table 8.

4.5 Disability Adjusted Life Years Lost, expressed per thousand people, by age-group

With the availability of the information on the Years of Life Lost as a result of premature mortality and the Years Lived with Disability as result of illness and disorders, a quantitative assessment can be made of the total burden of disease expressed in Disability Adjusted Life Years lost.

Figures 6a and 6b present the results, for Sub Sahara Africa and the Established Market Economies, for the numbers of Disability Adjusted Life Years lost, specified by age groups. Again, and directly following from the in the previous sections presented data, for all age groups the total burden of disease is considerable higher in Sub Sahara Africa in comparison with the high-income countries. While for the youngest age-group, 0-4 years, the difference is largely the consequence of much higher mortality rates, for the other age groups both mortality and morbidity contribute rather equally to the observed differences in total burden of disease between the two country groups. For the age groups 15-44 years, the burden of disease is estimated to be approximately three times higher in countries in Sub Sahara Africa in comparison with the Established Market Economies.



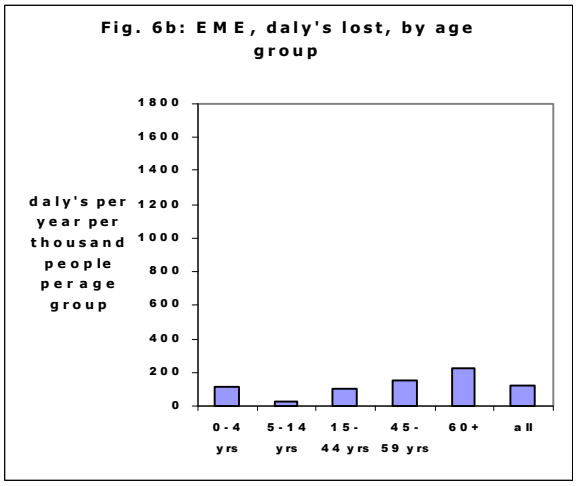


Figure 6
Distribution of Disability Adjusted Life Years lost (DALY) over age-brackets, expressed in numbers of years lost per one thousand people of each age-group, in 1990 (figure 6a: Sub Saharan Africa, figure 6b: Established Market Economies).
Source: Murray, 1996b, calculated from Annex Table 9.

4.6 Burden of Disease in Sub Sahara Africa, by age group, and by illness or disorder

In the previous sections, all information on mortality, morbidity, and total burden of disease has been presented at the aggregate level with respect to the different types of diseases and disorders. In this section, an assessment will be made how various types of disabilities contribute to the total burden of disease in Sub Sahara Africa, and how patterns of diseases and disorders vary over age groups. In particular, attention will be given to the main types of diseases and disorders which appear to be prevalent among the most active age segments of the population.

Table 1 presents information for Sub Sahara Africa on the distribution of DALY's, disaggregated by diseases and disorders and by age groups. As in the previous sections, data are presented as numbers per thousand people in each age group.

First, for all age groups together, the table shows that injuries, caused by accidents or resulting from violence, account for a considerable part (almost 15%) of the total burden of disease. With respect to illnesses, diarrheal diseases, childhood diseases, and respiratory infections are the most important contributors to the burden of disease, followed by malaria, perinatal conditions, cardiovascular diseases, and tuberculosis. The contribution of AIDS to the total burden of disease is approximately three percent, but it should be noted that since 1990 AIDS incidence and prevalence have been increasing dramatically. According to recent WHO estimates, by 1999 the contribution of AIDS to the total disease burden in Africa has increased to approximately 20 per cent (WHO, 2000).

When considering the various age groups, there are marked differences with respect to the relative contributions of the various diseases and disorders to the total burden of disease. As expected, in children diarrheal diseases, childhood diseases (measles, pertussis, tetanus), malaria, respiratory infections and perinatal complications take a large share of the disease burden, apart from disability and mortality resulting from injuries.

For the age group between 15-44 years, again the very high burden of disease caused by accidents and violence is striking, accounting for more than 30% of the total disease burden. Also remarkable is the fact that mental diseases are a very prominent factor in the total burden of disease in this age group, with a contribution of almost 12%. Thus, together more than 40 per cent of the total

burden of disease in the 15-44 year age segment in Sub Sahara Africa is estimated to result from either violence and accidents or from mental disorders.

Table 1. DALY's by age and cause (thousands), Sub Sahara Africa, estimates for 1990

	Total	0-4	5-14	15-44	45-59	60+
Population (million)	510	94	140	210	42	24
All causes	579	1647	265	365	374	461
Tuberculosis	20	14	8	28	33	18
Sexually transmittable diseases[a] (STD's), excluding HIV	12	31	1	15	1	3
Human immunodeficiency virus (HIV)	16	23	2	27	6	2
Diarrheal diseases	63	297	21	5	4	8
Childhood diseases	60	275	30	2	1	1
Malaria	53	238	17	10	6	3
Respiratory infections	61	273	24	4	4	37
Maternal conditions	19	0	3	43	0	0
Perinatal conditions	38	205	0	0	0	0
Nutritional deficiencies	18	70	9	5	4	5
Malignant neoplasms	12	3	6	7	47	64
Neuro-psychiatric conditions	23	4	5	45	22	17
Cardiovascular diseases	23	9	13	15	66	129
Respiratory diseases	15	21	7	10	36	45
Digestive diseases	11	9	7	8	27	28
Congenital anomalies	8	38	2	1	1	0
Unintentional injuries	54	62	69	52	21	11
Intentional injuries	35	25	12	62	14	7
Tropical cluster diseases	11	2	13	13	14	5
Subtotal	551	1600	249	351	309	382
% of Total	95	97	94	96	83	83

[a] STD's: syphilis, chlamydia, gonorroea; Childhood-cluster diseases: in particular measles, pertussis and tetanus; Respiratory infections: mainly lower respiratory infections (pneumonia); Maternal conditions: heamorrhage, sepsis, hypertensive disorders, obstructed labour, abortion; Nutritional deficiencies: in particular protein-energy deficiency, vitamin A deficiency, iron-deficiency; Malignant neoplasms: various neoplasms including liver cancer, lymphomas and multiple myeloma, cervix uteri cancer, stomach cancer; Neuro-psychiatric conditions: in particular unipolar major depression and bipolar disorder, alcohol dependence, obsessive compulsive disorder; Cardiovascular diseases: mainly ischaemic heart disease and cerebrovascular disease; Respiratory diseases: including chronic obstructive pulmonary disease (COPD), asthma; Digestive diseases: peptic ulcer, liver cirrhosis, appendicitis; Unintentional injuries: including road accidents, various other causes; Intentional injuries: mainly violence and war; Tropical-cluster diseases: lymphatic filariasis, trypanosomiasis, schistosomiasis, onchocerciasis, leishmaniasis.
Source: Murray, 1996b, Annex Table 9f.

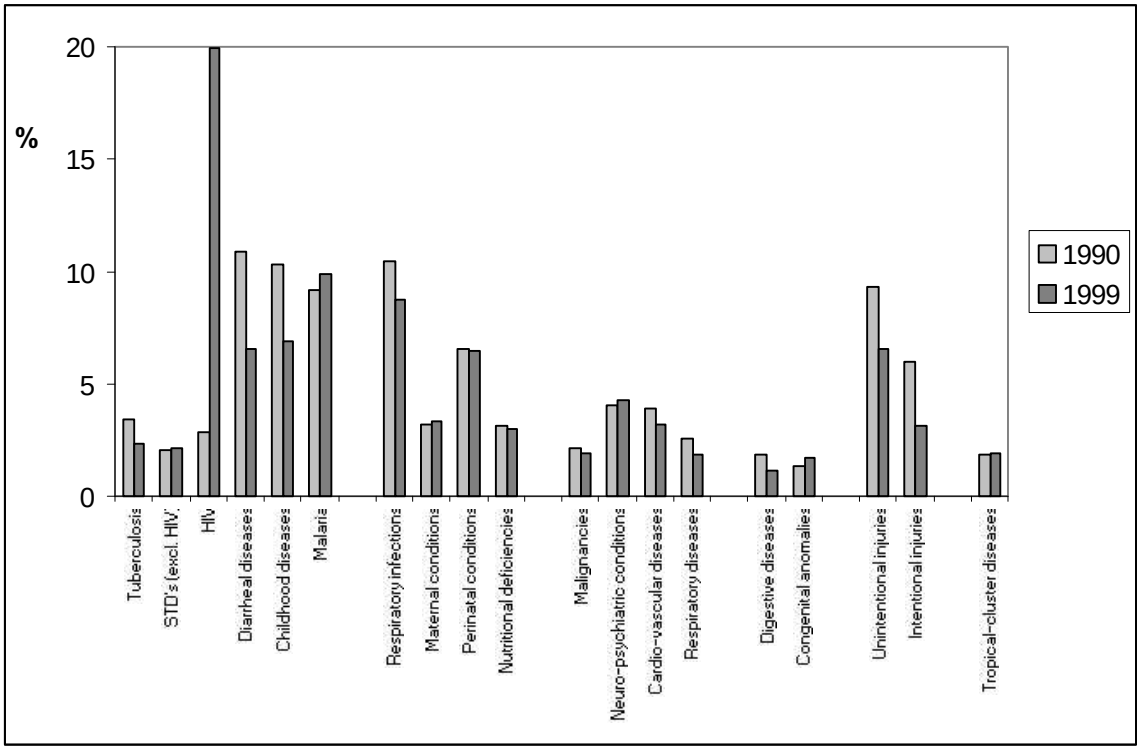
With respect to infectious diseases, AIDS and tuberculosis each contribute approximately eight percent to the disease burden, while with respect to women pregnancy related morbidity and mortality take a heavy toll. It is noteworthy that common tropical diseases, such as schistosomiasis, and river-

blindness (but excluding malaria), do not clearly stand out as major contributors to the burden of disease among adults, together accounting for approximately four per cent.

Finally, towards the higher age groups there is a clear trend of increasing importance of non-communicable diseases such as cardio-vascular disease and cancer as major contributors to the total burden of disease in Sub Sahara Africa, and the patterns of morbidity and mortality for these age groups approach those of higher income countries.

It cannot be stressed enough that all figures presented in the previous sections are based on a very limited and weak database and the information can only be considered a very crude assessment of the nature and severity of the disease burden in Sub Sahara Africa. In addition, the presented information is based on information being available in the early 1990's, and since then changes have occurred with respect to disease prevalence rates in Sub Sahara Africa.

Figure 7. Relative contribution of various diseases and disorders to total Burden of Disease in Sub Sahara Africa, in 1990 and in 1999.



Source: 1990, Murray, 1996b, Table 9; 1999, WHO, 2000, Annex Table 4.

In figure 7 the pattern of the burden of disease in 1990, as presented in the GBD-study has been compared with the pattern according to a more recent estimate by WHO for 1999 (WHO, 2000). The figure shows that by far the largest change in relative contribution to disease burden is caused by the increased incidence of AIDS. While the overall disease burden is estimated to be, on a per capita basis, in 1999 lower in comparison with 1990, the contribution of AIDS to the disease burden increased dramatically, from around three to almost 20 per cent. Other changes of some significance are observed in the contributions of injuries to the disease burden, increasing between 1990 and 1999 from about 10 percent to 15 percent, and in the contributions of diarrheal and childhood diseases, which are considerably lower in the 1999 estimates in comparison with 1990.

4.7 Burden of disease in Sub Sahara Africa excluding mental diseases and injuries from violence and accidents

As shown in the previous section, the contributions of mental diseases and injuries to the total burden of disease in Sub Sahara Africa is very high. As a result, the contributions of other diseases known to be widely prevalent in developing countries seem to be relatively low, and there is the risk that, on the basis of the in the previous section presented data, the health problems related with diseases such as malaria, tuberculosis, diarrhea, etc. are underexposed. In this respect, it is important to note that in particular for mental diseases the available evidence on prevalence rates is very weak, while also the establishment of appropriate weighting factors for the different types of mental diseases is extremely difficult. With respect to injuries, in particular when caused by violence or war, it can be expected that the disease burden is very unequally distributed over the population, with relatively high burdens in war stricken areas. Therefore, in the present section, the relative contributions of various types of diseases to the total disease burden have been recalculated, excluding the disease burden caused by mental disease and injuries. Results are presented for the age group 15-44 years, as it in this age group where the burden of disease related to mental diseases and to injuries is particularly high (see Table 1). Table 2 gives the relative contributions of the various diseases and disorders to the total disease burden for the 15-45 years age groups, however without including mental diseases and injuries. Not only information on the total disease burden (DALY's) is presented, but also on the contributions related to respectively mortality (YLL's) and to morbidity (YLD's). The various diseases have been listed in a slightly more disaggregated way, and traditional tropical diseases such as schistosomiasis and river-blindness are listed separately.

Table 2. Relative contributions of mortality (YLL's) and morbidity (YLD's) to total burden of disease (DALY's) by cause for adults, 15-44 years, Sub Sahara Africa, 1990, excluding mental diseases and injuries from violence or accidents

	DALY's	YLL's	YLD's
Tuberculosis	14	20	3
STD's	7	1	17
HIV	13	16	8
Diarrheal diseases	2	3	1
Malaria	5	7	1
Trypanosomiasis	2	2	0
Schistosomiasis	1	0	4
Lymphatic filariasis	2	1	5
Onchocersiasis	1	0	3
Respiratory infections	2	3	0
Maternal conditions	21	19	24
Nutritional deficiencies	3	1	6
Malignant neoplasms	4	5	1
Cardio-vascular	7	9	3
Respiratory diseases	5	2	9
Digestive diseases	4	4	5
Osteoarthritis	1	0	2
Other	7	6	8

Source: Murray, 1996b, Annex Table 9f

The table shows that, when mental diseases and injuries are excluded, the largest contributions to the disease burden in adults in their functionally and economically most active years are related to pregnancy related illness and disorders, tuberculosis, and AIDS, with contributions of respectively 21, 14 and 13 per cent, followed by cardiovascular diseases, malaria and respiratory diseases. With respect to the relative contributions of the various diseases to mortality and morbidity, it is interesting to note that for example malaria mainly contributes in terms of mortality (YLL's), while sexually transmittable disease mainly contribute in terms of morbidity (YLD's). Also for the traditional tropical diseases such as schistosomiasis, lymphatic filariasis and onchocerciasis, the contribution to the disease burden is mainly in terms of morbidity.

5. Discussion

The present study aims to make an assessment how the burden of disease affects different age groups in Sub Sahara Africa. By considering in particular the burden of disease for the functionally and economically most active age groups, the presented data give an idea how households in their overall performance might be affected.

The data reveal, in the first place, that in Sub Sahara Africa not only children, but also adults are seriously subject to high rates of both mortality and morbidity, rates which are considerable higher than those for high-income countries.

With respect to adults in the 15-45 years age group, the high burden of disease resulting from violence and accidents and from mental illness is remarkable. Yet, it should be noted that information from other sources than the GBD-study on these disabilities and disorders is extremely scarce (Patel, 1995; Forjuoh, 1996; Krug, 2000; Simkiss, 2000), and that in particular with respect to mental illness presented data need to be treated with great caution.[7] In addition, it appears to be extremely difficult to assess to what extent various forms of mental illness affect household economic functioning.

With respect to the common tropical diseases such as schistosomiasis, river-blindness, lymphatic filariasis, leishmaniasis, trypanosomiasis, etc., the GBD-study suggests that the morbidity burden inflicted upon adults is relatively limited, not only relative to the burden caused by injuries and mental illness, but also relative to aids, other sexually transmittable diseases, tuberculosis, maternal conditions, malaria, and respiratory diseases. In this respect, it may be noted that current levels of disease prevalences can be considered to reflect to some extent successes and failures of past and present health policies.

Irrespective of the question what the relative contributions of the various diseases and disorders are to the total burden of disease, there appears to be little doubt that both mortality and morbidity are likely to have a strong impact on many aspects of household functioning, in terms of earnings, time lost because of illness, time loads for taking care of ill family members, expenses for treatment, etc.

Results call for detailed studies on the burden of disease at household level, for which household survey data might be an appropriate source of information. Household survey data might provide further opportunities to assess the impact of diseases and disorders on household functioning and households' economic performance. Specific research question are which households are hardest hit by the burden of disease (by region, by type of household, by demographic characteristic of household, etc.), what are their coping mechanisms, and what are current policies to reduce the burden

[7] In the World Bank publication "Disease and mortality in Sub Saharan Africa" (Feachem and Jamison, 1991), the attention given to mental disease is extremely limited, while information on disability resulting from accidents or violence is totally absent.

of disease. The information should finally lead to policies that improve health, while at the same time increasing households' functional capacities.

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