Paper

An attempt to measure burden of disease using disability adjusted life years for Sri Lanka

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Abstract

Introduction Disability adjusted life years (DALY) is a measure of burden of disease (BOD) that assesses the years of healthy life lost due to disease or illness.

Objective The main objective of the study was to develop a draft measure of the BOD in Sri Lanka, using DALY.

Methods Computation was done for 100 disease categories identified to reflect the disease pattern in Sri Lanka. Factors that were considered for the calculation of DALY were incidence, degree of disability, duration of the illness and age of onset.

Results Injuries, ischaemic heart disease, asthma, disease of the pulmonary circulation and burns contribute to 55% of BOD in Sri Lanka.

Conclusion The highest burden was due to non-communicable diseases, as their duration and degree of disability are high. Diseases such as malaria, which are short term illnesses with low disability, although affecting large numbers, did not give a high value for DALY.

Introduction

In many countries health policy makers use mortality and morbidity data for health care planning. Such statistics as are used most of the time when allocating resources are not good indicators, for they reflect only one aspect of health, and are of limited value in respect of conditions that are rarely fatal, but cause impairment, disability and handicap. The recent trend is to use of burden of disease (BOD) to identify high morbidity diseases and to set priorities for intervention programmes. (1)

BOD contributes useful baseline data for health policy makers, as it measure the burden from premature death, as well as the non-fatal health consequences of disease and injury. BOD is calculated by using a variety of morbidity and mortality data and life tables. It gives a rank ordered list of diseases and illnesses and their relative (and absolute) values in terms of their impact on health (1). Once BOD in the community has been measured, it is necessary to try to identify the major preventable causes of disease so that appropriate intervention strategies can be developed.

Disability adjusted life years is a new measure of BOD that assesses the years of healthy life lost due to disease or illness. DALY are based on incidence and provides an estimate of the number of years of life lost due to premature death, and the number of years of life lived with a disability (1). It is a measure of BOD from which the health problems can be identified for planning health resource allocation, but it cannot be used as a final or single measure, as social, cultural and emotional dimensions also have to be considered.

Methods

The DALY calculation used interrelated numbers for disability weight, length of disease, average age of onset and incidence. The disease category factors such as disability weight, duration of disease and age of onset were identified for 100 disease categories compared with international norms. The study calculated DALY with available existing data in 1995 (2-11). The results are not definitive. In our calculation sex and specific age groups were not taken into consideration.

The incidence data were collected from available health statistics, clinic records, and recent medical literature (2-11), and were verified and validated by local experts. Where health statistics were not available experts in specified subjects were interviewed. Interviewed experts also assessed average age of onset and duration of disease, as these data are not routinely collected.

The disability due to each of the diseases and the weightage for each class were adapted from a classification by Murray (1). Disability classes were defined by an expert group. These experts had not been involved in the estimation of the incidence, duration or mortality of any

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disease. The experts chose a weight from 0 to 1.0 based on definition and a set of disability signals to each class. Neither the disability classes nor the weightage given for each class was validated for Sri Lanka by the authors before adaptation. They are shown in Table 1.

As years of life lost at different ages have different values, this was adjusted for age. The value of years lost in the future was discounted at a 3% annual rate. The peak value years considered were from 12 to 60 years lived with disability and adjusting the model for life tables available for Sri Lanka (12) assessed time lost by premature mortality.

In calculating DALY the following formula introduced by Murray (1) was used. Calculation was done on a computer. Age weighting function (β) which gives a value for life at different ages were considered by Murray as a continuous age weighting function, and chose a β of 0.04. The same value was adopted by us, without validating for Sri Lanka, as it is difficult to give a value for life, considering social ethics and productivity of a person.

$$-[DCe^{\beta a}/(\beta+r)^2 \bullet [e^{-(\beta+r)(L)}(1+(\beta+r)(L+a)-(1+(\beta+r)a)]]$$

D is the disability weight (or 1 for premature mortality),
r is the discount rate, (0.03)
C is the age weighting correction constant, (0.1624)
B is the parameter from the age-weighting function, (0.04)
A is the age of onset, L is the duration of disability or time lost due to premature mortality.

Results

Injuries, ischaemic heart disease and asthma were the leading causes of BOD in Sri Lanka (Table 2). Injuries, which showed the highest DALY is the commonest cause for hospitalisation (2). Ischaemic heart disease, which is the leading cause of death in Sri Lanka, gave the second highest BOD (2). BOD when calculated by DALY gives high values to conditions that have high mortality and life long disability. Hypertension which is a lifelong illness made a DALY of 242.3 per100 000, while malaria which causes a disability of a few days, and has a low mortality but high incidence (954 per 100 000), gave a DALY of 11.3 per 100 000. In Africa where the incidence and mortality due to malaria is high it was the leading cause of BOD in 1990 (1).

DALY calculated for India (1) in 1990 identified the 3 leading causes for BOD as lower respiratory tract infection, (10.2%) cardiovascular disease (9.7%) and diarrhoeal diseases (9.5%). For all other Asian countries the leading causes for BOD were injuries, followed by lower respiratory tract infection and cardiovascular disease (1).

The major disease groups that cause high BOD in Sri Lanka are cardiovascular and pulmonary diseases. Injuries and burns contribute to 19.7% of the BOD. Most of the BOD in Sri Lanka is due to non-communicable diseases. This is mainly because most of the communicable diseases that cause high mortality and lifelong disability are controlled by effective intervention programs, and because the incidence of these diseases is very low (eg poliomyelitis, whooping cough, diphtheria). In computation of DALY weightage was not given to short term illness, such as malaria or diarrhoeal disease, which do not cause severe disability, but increase the burden as a large number of patients are affected (1). (Table 3).

Table 1.   The disability classes and weights used for each class

	Description	Weight
Class 1	Limited ability to perform at least one activity in one of the following areas; recreation, education, procreation or occupation.	0.096
Class 2	Limited ability to perform most activities in one of the following areas; recreation, education, procreation, occupation.	0.220
Class 3	Limited ability to perform activities in two or more of the following areas; recreation, education, procreation, occupation	0.400
Class 4	Limited ability to perform most activities in all of the following areas; recreation, education, procreation, occupation	0.600
Class 5	Needs assistance with activities of daily living such as meal preparation, shopping or housework.	0.810
Class 6	Needs assistance with activities of daily living such as eating, personal hygiene or toilet use.	0.920

Table 2. Burden of disease by DALY

Disease name	ICD codes	Disability class	Max years lost	Incidence/ 100 000	DALY/ 100 000	% of total
Injuries	800-939	3	1.000	2486.040	1436.5	14.51
Ischaemic heart disease	410-414	3	99.000	141.50	1099.6	11.11
Asthma	493	2	99.000	142.80	901.9	9.11
Diseases of the pulmonary circulation	415-429	3	99.000	45.20	571.4	5.77
Burns	940-949	3	20.000	61.00	513.7	5.19
Arthropathies, rheumatism, osteopathies	680-709	3	99.000	132	480.9	4.85
Alcohol and drug dependence	303-304	3	99.000	40.55	465.6	4.70
Disorders of thyroid gland	240-246	1	5.000	458.66	278.3	2.90
Liver, biliary, pancreas disease	570-579	3	99.000	30.10	271.8	2.74
Cerebrovascular disease	430-438	3	99.000	58.30	257.1	2.59

Table 3. DALYs for all 100 disease Categories

Disease name	Disability class	Max years lost	Age of onset	Incidence/ 100 000	DALY/ 100 000
Injuries	3	1.000	20	2486.04	1436.5
Ischaemic heart disease	3	99.000	45	141.50	1099.6
Asthma	2	99.000	30	142.80	901.9
Diseases of the pulmonary circulation	3	99.000	25	45.20	571.4
Burns	3	20.000	25	61.00	513.7
Arthropathies, rheumatism, osteoporosis	2	99.000	50	132.00	480.9
Alcohol and drug dependence	3	99.000	30	40.55	465.6
Disorders of thyroid gland	1	5.000	15	458.66	278.3
Liver, biliary tract, pancreas disease	3	99.000	40	30.10	217.8
Cerebrovascular disease	3	99.000	60	58.30	257.1
Hypertension	2	99.000	50	66.50	242.3
Endocrine and metabolic disorders	2	99.000	15	27.92	219.7
Epilepsy	2	99.000	15	25.74	202.6
Congenital anomalies	3	10.000	1	80.75	196.5

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Disease name	Disability class	Max years lost	Age of onset	Incidence/ 100 000	DALY/ 100 000
Chronic obstructive pulmonary disease	3	99.000	50	37.60	137.0
Oesophagus, stomach, duodenum disease	2	1.000	30	382.58	121.2
Disease of urinary system	2	1.000	20	376.00	119.4
Disease of oral cavity, salivary, teeth, jaw	2	0.058	10	8477.70	117.8
Diabetes mellitus	1	99.000	40	53.30	115.5
Malignant neoplasm – breast	4	99.000	45	9.75	113.4
Disease of the skin and subcutaneous tissue	1	20.000	34	63.00	113.2
Cataract	2	5.000	65	146.45	110.4
Malignant neoplasm of lip, oral cavity, pharynx	5	99.000	58	9.23	86.6
Blindness	4	99.000	1	4.00	79.2
Respiratory infection	2	0.040	4	15845.00	77.4
Haemorrhoids	2	2.000	35	110.57	65.4
Lymphomas and leukemias	3	99.000	30	5.28	60.6
Tuberculosis	4	2.000	50	44.70	56.0
Malignant neoplasm of cervix	3	99.000	55	8.06	43.8
Tetanus	4	99.000	25	2.02	38.3
Anaemias	1	1.000	25	270.57	38.2
Diseases of arteries, veins, and circulatory system	1	99.000	50	23.96	38.0
Diseases of the digestive system	3	0.078	30	773.77	35.3
Poisoning	5	0.078	20	360.19	33.1
Rabies	4	99.000	20	1.58	32.2
Malignant neoplasm of respiratory system	5	99.000	54	2.85	32.1
Arthropod-borne haemorrhagic fever	4	99.000	6	1.47	31.3
Nutritional deficiencies	1	3.000	2	226.98	30.4
Malignant neoplasm – oesophagus	5	99.000	58	3.10	29.1
Mental disorders	1	99.000	20	8.00	26.1
Deafness	2	99.000	12	3.11	24.6
Symptoms, signs, and ill-defined conditions	2	0.058	20	1096.98	20.4
Pregnancy with abortive outcome	3	0.078	20	424.00	19.2
Malignant neoplasm – bone, cartilage, skin	5	99.000	30	0.80	18.6
Leprosy	2	5.000	35	11.15	15.4
Snake bite	4	0.078	30	216.98	14.8
Malignant neoplasm of ovary	3	99.000	47	1.91	13.5
Other unspecified neoplasms	3	99.000	50	2.04	13.5
Other disorders of the eye and adnexae	2	0.240	15	182.64	12.8
Viral hepatitis	3	0.240	20	87.36	12.2
Disease of male genital system	2	1.000	60	63.21	11.9
Malaria	3	0.020	25	954.00	11.3
Viral diseases	2	0.038	12	1124.72	11.3

(*contd.*)

Disease name	Disability class	Max years lost	Age of onset	Incidence/ 100 000	DALY/ 100 000
Complications related to pregnancy	2	0.058	25	569.30	10.8
Pneumonia	3	0.156	7	120.00	6.4
Acute rheumatic fever	4	99.000	26	0.26	4.7
AIDS	4	0.020	15	288.68	4.6
Shigellosis	2	0.078	10	232.33	4.3
Chickenpox	3	0.156	45	53.66	4.0
Disorders of female genital system	4	99.000	65	0.75	3.8
Malignant neoplasm of prostate	3	99.000	30	0.32	3.6
Malignant neoplasm of testis	4	0.156	25	26.04	3.6
Septicaemia	3	99.000	53	0.63	3.5
Malignant neoplasm of uterus	5	99.000	55	0.31	3.4
Malignant neoplasm of other digestive organs	4	0.116	20	28.68	2.9
Leptospirosis	3	99.000	65	0.80	2.7
Malignant neoplasm of bladder	3	99.000	55	0.42	2.2
Malignant neoplasm – other	3	0.058	18	64.04	2.1
Typhoid and paratyphoid fever	1	0.038	5	740.75	1.8
Intestinal helminthiasis	1	0.038	5	584.00	1.4
Scabies	1	0.058	22	123.30	1.0
Syphilis, gonorrhea, other venereal diseases	1	0.038	2	740.75	0.8
Ill-defined intestinal infections	3	0.038	15	36.98	0.7
Amoebiasis	3	0.240	30	4.43	0.6
Benign neoplasms	4	0.116	12	5.72	0.4
Arthropod-bone encephalitis, Japanese encephalitis	2	0.058	5	56.23	0.4
Diseases of the ear and mastoid	2	0.078	1	165.00	0.4
Perinatal conditions	4	0.058	3	17.67	0.2
Meningococcal infections	2	0.058	15	14.25	0.2
Other bacterial diseases	1	0.038	2	213.58	0.2
Intestinal infection	2	0.058	30	7.74	0.1
Filarial infection	2	0.078	12	4.97	0.1
Dengue	2	0.010	18	14.64	0.0
Food poisoning	2	0.058	10	3.02	0.0
Mumps	2	0.058	3	5.92	0.0
Measles	1	0.078	20	1.70	0.0
Mycoses	1	0.038	5	4.53	0.0
Other infections and parasitic diseases	1	0.020	6	6.98	0.0
Streptococcal sore throat	1	0.058	15	0.75	0.0
Rickettsioses and arthropod-borne diseases	1	0.038	12	0.91	0.0

Discussion

Most of the values presented here are uncertain, as data on duration of illness, degrees of disability and age of onset were estimates. State hospital inpatient data available were not comprehensive enough to assess the incidence, age of onset and duration of disability of most of the common diseases in Sri Lanka. The health statistics do not indicate the health problems of people who do not seek health care and those who seek treatment from other sources. About a third of patients, according to a recent survey (13) seek treatment from ayurvedic or private western medical practitioners, and from private hospitals. Data are not collected from these sources in Sri Lanka when computing national health statistics. There are also no records maintained at the outpatient departments of government hospitals to assess the outpatient morbidity.

There are other limitations in the present study. Grouping people into different disability categories according to disease categories may not be applicable to all people, as there are individual variations, especially with multiple illnesses. Another drawback is calculating incidence rates for the total population without using age specific rates.

This study is the first attempt at quantifying BOD for Sri Lanka with available data, which, however, were not adequate for accurate calculation. The study indicates the need for calculating BOD using accurate data, and for further research on variables that go into calculations of DALY.

Conclusions

An attempt was made to calculate BOD for Sri Lanka using DALY. BOD was calculated for 100 disease categories identified to reflect the disease pattern in Sri Lanka by using available data. As accurate information was not available, estimates were computed for the factors that were used for the calculation of DALY (incidence, degree of disability, duration of the illness and age of onset). Injuries, burns, cardiovascular and pulmonary diseases contribute to 55% of BOD in Sri Lanka. The highest burden is from non-communicable diseases, as their duration and degree of disability are high. The study indicates the need to improve existing health statistics. With better and more accurate data, estimation of BOD should be an ongoing process to assess health priorities, as it provides health planners with useful baseline data and information to monitor and evaluate intervention programs.

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