Quantitative Assessments of Disease Impact on Society:

A Conceptual Approach to Prioritization & Agenda Setting of Health Problems for Policy Determination in Thailand

by

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A Synopsis of Health Indicator Nomenclature

Even prior to the WHO's much cited definition of "health", ways in which the level of "health", as a 'positive' state of well-being or a 'negative' state of disease or illness, may be measured at different levels of abstraction - from a 'personal' or 'individual' level to a 'societal' level, has constantly been at the forefront of discourse in research and conceptualization in the discipline of public health[1] as well as beyond.

Much of the development in this field originated from the conventional 'quantitative' fields within public health, namely epidemiology, demography and biostatistics. This practice of measuring health in precise units lend great credibility to the accuracy of empirical quantifications of the effects of disease and injuries on the individual, forming an important premise - that all diseases or illnesses ultimately causes two major effects on the individual, that is - it causes them to either get sick from it - a non-fatal health outcome or morbidity event, after which they are either cured or go into remission, continue to be afflicted, or ultimately die from it - a premature mortality event. These two fundamental manifestations, and their relationship thereof, led to numerous 'primary' indicators of the magnitude of disease in a population - incidence, prevelence, cause-specific mortality and case fatality rates, duration and remission rates, etc. Consequently, these indicators became the primary criteria for the much used techniques of disease ranking and priority setting[2] - analysis of leading causes of death, epidemiological surveillance systems etc.

At the level of the individual, the observed effects of disease and injuries on an individual's functional well-being had been traditionally 'measured' strictly in qualitative terms, serving the purposes of assessing severity through the level of disability and, in subsequent developments, measuring the effectiveness of interventions. These 'indicators' were initially disease specific, and relied primarily on a physician's direct observation and physical examination of the patient. Examples are the New York Heart Association Index or the Karnofsky Performance States Index. Along these lines, several supplementary indicators were also developed with the special purposes of assessing the efficacy of drugs and other interventions by using treatment-specific criteria.

As a rapid survey of the magnitude of disability afflicting society, the WHO initiated a systematic overview of the level of overall disablity in the world through the International Classification of Impairment, Disability and Handicap (ICIDH)[3]. This project viewed disability in a somewhat different light, not disease specific, the ICIDH defined 'disability' in terms of a progressive continuum from a state of impairment through to a state of handicap.

However, researchers interested about ways in which an individual's well-being and ability to function can be captured founded a new area of study - health indicators. Mostly concerned about the level of disability experienced by people afflicted with chronic diseases, numerous measurement scales were subsequently developed with the objective of assessing a chronically ill patient's well-being- or lack of, and, perhaps more importantly, used as an early tool in the early evaluation techniques of the effectiveness of health programs for groups of people as well as specific treatment modalities for individuals. Loosely grouped together, these are sometimes referred to as 'health status indicators'[4] - examples are the European Quality of Life (EuroQoL) index, the Quality of Well-Being Scale (QWB), the Sickness Impact Profile (SIP), the General Health Rating Index (GHRI), the Rosser Index etc[5]. These have been used in numerous circumstances, from passively measuring the level of health in a selected population to assessing the impact of different financing modalities on health outcomes. The research into this new field involved the work of a wide array of experts, not only within medicine, but also from the social sciences, namely, sociologists, psychologists and anthropologists. It also accelerated the growth of a newly emerging discipline - clinical epidemiology. However, most of the work done during the early period, as a rule rather than an exception, occured as parallel efforts with little cross-fertilization of concepts and ideas across disciplines. Findings were published within a circle of journals [6], were reviewed by its own intra-disciplinary peers, and organized their own conferences. However, at least one of these indicators - the EuroQoL, has been extensively tested and is generally accepted to be robust.

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[1] As an interesting case-in-point, one early forum for the publication of work in this field was the Journal of Chronic Disease. After organizing a conference on health status indicators in 1982 the renewed interest in this field was exemplified in the editors of the journal making, in their words, a "long overdue transformation". The name was changed to the Journal of Clinical Epidemiology.

Another important disciplinary contribution to this field has been those from economists. The field of cost-effectiveness analysis has greatly broadened the scope of incorporating health state measurements in evaluating health programs and interventions[7]. This was considered to be substantial improvement from a predecessor - cost-benefits analysis, which required ascribing monetary value to human life. Under the generalized grouping of "utility" measurements[8]- the most widely used being the metric of Quality Adjusted Life Years (QALYS)[9]. This incorporated a disease specific weight elicited from patients in different functional states which are then used to adjust the final unit of measurement - time. In the case of QALYS- years, but numerous related indicators also incorporate time as the unit of measurement - from the technically simple Potential Years of (or Years of Potential) Life Lost (PYLL or YPLL)[10] to others - Healthy Year Equivalent (HYE), Healthy Days of Life Lost (HDLL) etc. These techniques had the intuitively appealing quality of using time as the unit of measurement against a known input - costs. Thus, it became technically possible to prioritize health problems against the cost-effectiveness of interventions, subsequently identfying 'best buy' options for resource allocation. The initiation of groundbreaking projects and publication of several influential documents - the setting up of WHO's Collaborative Project in Health Economics, the Rokefeller Foundation's "Good Health at Low Cost[11]", and the World Bank's "Disease Control Priorities in Developing Countries[12]" added substantial weight to this field.

The application by economists from the field of welfare economics to assessing the health or state of well-being in a general population progressed from the discipline's involvement in the social and developmental dimensions of economics[13]. There has also been a coordinated effort between some economists and international agencies in counterbalancing the use of classic macro-economic indicators to assess a nation's state of "well-being". This took the form of the growth vs development debate and is most evident in the development of the United Nation's Development Program's (UNDP) annual publication of its "Human Development Index" (HDI)[14]- in part as a corrolary to the World Bank's own "[15]Social Development Index" (SDI), also compiled annually. However, while the HDI measurement unit is a single processed value scale (some advocate this scale as an alternative, or even a substitute for GNP), the SDI simply collates and graphically depicts social measurement parameters.

Rather than health states, the above efforts looked at the overall social dimensions of development. Until then, there has been few concerted efforts of measuring the overall burden attributable to disease and injuries on society. One of the earliest attempts has been the Ghana Health Assessment Project[16] in 1981 which collected data on the overall impacts of diseases- both fatal and non-fatal health outcomes, and designed a composite indicator, incorporating these two outcomes into a singular unit of measurement, the healthy days of life lost(HDLL) due to a disease. Subsequently, another study took a similar approach, refined the methodology, and went a step further in linking the relative efficay of interventions, incorporated individual preferences and determined a set of treatment package of "essential services" which was implemented. The proposal receiving funding and was delivered to the community in a social experimental model. This was the Oregon Health Project.[17] In 1992, the WB presented the idea that the role of measuring the burden of illness is vital to the process of priority setting for health service delivery in the largest undertaking, by far, of any group, in assessing the impact of disease and injuries on all societies- the Global Burden of Disease Project[18], which produced the data set for the World Bank's annual report highlighting issues in developmental economics - the World Development Report (WDR) 1993- Investing in Health[19]. This new approach to quantification of disease impact was conducted worldwide, with inter-regional comparisons as well as suggestions on application for resource allocation decisions. Subsequently, a more detailed explanation of the theoretical underpinnings of these concepts were published in "Bulletin of the World Health Organization" and compiled in a WHO report, "Global Comparative Assessments in the Health Sector" in 1994[20]

The Thailand Experience

The use of vital registration data for prioritization purposes began with the advent of cause of death registration in 1958. However, data up to 1976 was thought to be confounded with severe under-registration as discovered by the dual-record methodology of the two rounds of the Survey of Population Change (SPC)[21] in 1964-67, and 1974-76. It was not until 1985, that a thorough analysis of this discrepancy through the use of mortality adjustments was undertaken, first by the Morbidity and Mortality (MMD) Survey performed by Mahidol University's Institute for Population

and Social Research (IPSR)[22] , and subsequently in 1986 in a published report "New Developments in the Analysis of Mortality and Causes of Death"[23], also by IPSR in conjunction with WHO. In it, the authors determined some of the root causes for both faulty coding as well as under-reporting, made provisions for adjustments, utilizing the timing advantage of the MMD in being inter-censal.

The results from these studies formed the important basis for Thailand's first full report with the major objective of delineating the health situation and an explicit prioritization exercise - the National Epidemiological Board of Thailand's "Review of the Health Situation in Thailand - Priority Ranking of Diseases[24]" in 1987. In addition to adjusted mortality data, this report also relied on estimates of morbidity, utilizing different sources of information. It then underwent a simple prioritization technique, incorporating mortality and morbidity data into a single, composite ranking of diseases. The initial results were then presented, in parts that were completed, at the First Thai National Health Assembly, the first and only highest level meeting of policy-makers from agencies related to health, held in 1988. [1]

In 1989, a project was commissioned, by WHO, to assess past and present patterns as well as project trends of sickness and deaths. The research[25], "Morbidity and Mortality Patterns in the Thai Population" was published -revealing a comprehensive analysis of factors affecting past morbidity and mortality trends, including adjustments methodologies, and with detailed breakdowns by cause, age, sex, region as well as projections to the year 2000.

In 1993, the National Economic and Social Development Board (NESDB), the Thai government's main planning agency, published a report proposing major policy trends in health for the next decade[26]. One of the major recommendations outlined included a "systematic review of priorities in all disease groups" and "identification of an essential package of health services to address the identified patterns of disease problems". This was in line with the major proposition of WDR 1993 in that the fundamental gap in health outcomes across societies are a result of the relative inefficiencies of resource allocation. It also concluded that a policy strategy beginning with an assessment of disease burden, followld by an analysis of the relative cost-effectiveness of interventions would identify a 'best-buy' package of "Basic Essential

[1]The meeting was attended by 5 ministers and directors of all state planning agencies..

Package" of health services. In turn, this would, when 'optimized' under the resources constrains available to the health sector, serve as a blue print for a basic reforming of service delivery systems.

Study Overview

This report was commissioned by the Health Systems Research Institute (HSRI) to serve as a preliminary baseline review of the health needs of the general population, as part of a research package which also included a project on essential services package determination and equity issues in health . In determining the strategy in which 'need' may be defined and determined, three distinguishing characteristics of this project was considered; the project's main objective, criteria for selection of measurement technique, and usage of results.

Objective

The major objective of this study to assess the level or impact of disease, injuries and states of ill-health quantitatively as a tool for prioritization and ranking according to disease categories. In order to achieve this, it became necessary for the results to be generated from a single composite-type indicator which accounted for both non-fatal health outcomes as well as from premature mortality due to different causalities.

Criteria for Selection of Measurement Technique

1 Assess the availability and completeness of required data as a basis for calculating various indicators.

2 Identification of the most appropriate measurement parameter, considering the feasibility of obtaining available data, as well as the parameter's robustness and relevance in capturing the true impact of disease, illnesses and states of ill-health on Thai society.

3 Its potential usage as data which may be used by decision and policy makers as a means for inter-country and inter-regional comparisons.

It was evident from the outset that the key to discerning the quality of output for any given indicator was the quality of data sources used. Thus, this underlying premise effectively percluded all of the disease specific and, more importantly most of the health status indicator using quality of life techniques, since these required relative functional states elicited from patients of specific disease groups. As these data were generally unavailable for secondary usage, health related quality of life- HRQoL- type indicators were not used.

Similar were the utility-based indicators, including Quality Adjusted Life Years (QALYs), since most international experiences utilizing QALYs applied more towards the evaluation of disease and program-specific interventions, rather than societal-level composite measurements of disease impact.

The ICIDH classification utilized an array of measurement units which required community-based surveys specific to these purposes.

There also exists an array of indicators designed for the purpose of prioritization of health problems. Most of these utilize a profile of variables about each disease entity's characteristics. Hanlon's Criteria divides individual diseases into 4 components- size, seriousness, effectiveness, and a qualifying 4^{th} component, 'PEARL', for policy committment, economics, acceptability, resources and legality. The results are presented as ratings, for priority ranking. The WHO has also developed a prioritization method based on three disease and intervention parameters-disease magnitude, disability, and treatability. However, these techniques have had limited research experience and is still being assessed for validity.

It was determined that the indicator which met the above criteria needed to be one which is derived from a uniform set of input data points which were positive or empirical in nature. In addition, these inputs must be readily available from primary sources, with logical estimation methods for those which were not. The most basic form of data pertaining to disease magnitude were morbidity and mortality- type indicators. Since, as previously mentioned, the Global Burden of Disease analysis for WDR 1993 utilized a methodology which required the inputs of these basic data on diseases- incidence, prevalence, cause-specific mortality- broken down simply by age and sex, with international comparisons possible, the measurement parameter- Disability Adjusted Life Years (DALYS) was chosen as being best suited for this purpose.

The technical basis of DALYS[1]

This was based on the methodology developed for WDR 1993. The Disability Adjusted Life Years is a composite indicator incorporating both non-fatal health outcomes as well as mortality from diseases. This included a combined measurement of the time lived with a disability with the time lost due to premature mortality from individual disease. These were translated into a relative unit - time, or, more specifically life-years lost from each disease. For mortality, time lost were calculated from the stream of life-years lost relative to a predetermined endpoint for each age group, similar but not identical to PYLL, DALYS utilized a standard expectation of life at each age from a model life table as an arbitrary cut-off point. In the case of morbidity, the years lived with a disability from a state of ill-health due to a disease was calculated by a set of generic disability weights, a quantitative valuation of the level of reductions in functional capacities, which varied from disease to disease. These were adjusted with regards to the natural history or progression of each disease, as captured through disease-specific epidemiological information- severity, average duration, remission rates.

The data obtained were then combined relative to the value of time lived at different ages (though age-weighting functions), and time periods relative to the present (discounting rates). The results - a singularly composite, time-based value - Disability Adjusted Life Years. These were then compiled, broken down into disease groups and age- then quantitatively ranked by magnitude of impact. This represented the final output of the study.

[1] For details, see Murray CJL, "Quantifying the Burden of Disease: The Technical Basis for Disability Adjusted Life Years" Bulletin of the WHO, 1994, 72 (3):429-445

Study Applications

In order to maximize this study's usefulness, it is crucial to understand and recognize what the study results signify. As indicator of the impact of disease and injuries on society - as measured quantitatively through the magnitude impact from time lived with a disability and premature mortality, some practical uses include as;

1 A general indication for the priority ranking of health problems as measured by the combined impact of ill-health from diseases.

2 A data set which may be used to determine health status and project trends in health of the population.

3 An input for assessment of relationship to interventions and cost-effectiveness used to identify 'essential' package of health and medical (preventive and curative services) relevant to the observed patterns of disease impact.

4 A means of setting research priorities.

5 In Thailand's case, a specific use as a baseline level of health determination prior to the implementation of;

5.1 The 8th National Economic and Social Development Plan (1997-2002)

5.2 The change from the 9th revision of the International Classification of Diseases (ICD-9) to the 10th revision (ICD-10), scheduled for October, 1997 (pre-bridge-coding)

However, DALY's may be less useful if used as a tool for direct allocation of health resources to specific disease intervention programs, or as determinants of equity in health[27]

Methodology

Sources of Data

This study was divided into two distinct phases.

The first phase of this study entailed the collection of basic disease-specific data on deaths - cause-specific mortality by age groups, and available morbidity indicators. The sources of data were as follows;

Mortality

The major source of mortality data is from Thailand's vital registration system, collected from the reporting system comprising of health facility- and community-based death certificate issuance (comprising approximately 20% and 80% of total registered deaths respectively). These were coded according to the ICD-9, and then sent to the Ministry of Public Health for compilation of cause-specific mortality.

Morbidity

In contrast to mortality data compiled from the vital registration system, data on morbidity are much more diverse and their quality varied. These sources from which data .. obtained were ranked according their relative degree of reliability , by order of preference -

1 *Population-based epidemiological surveys* - These included

1.1 the National Health Examination Survey by the Thailand Health Research Institute (1991-2)

1.2 the Health and Welfare Survey conducted by the National Statistical Office at 5-year intervals (1985 &1991)

1.3 Other surveys

2 ***Population surveillance systems*** - these were used for specific disease groups; the MOPH's report of notifiable diseases - comprising of 50 diseases, mostly communicable , the AIDS sentinel serveillance system etc.

3 ***Epidemiological estimates*** - these were derived from studies utilizing epidemiological estimation techniques for selected diseases.

4 ***Facility-based reporting systems*** - from the MOPH's report of 17 causes of outpatient visits and 67 causes of inpatient hospitalization collected from public facilities. Some were available on a disease-specific basis, such as the National Cancer Registry.

5 ***General epidemiological studies*** - where national data was unavailable, estimates based on international epidemiologic studies of disease incidence and

prevalence - regional surveys, autopsy studies etc. were used to achieve informed estimates for some diseases.

6 *Expert Opinions*

Data Compilation and Adjustments

Data collected for cause of death suffered from under-reporting. In addition, nearly half of the reported deaths were classified under the group 'ill-defined causes of death ICD9:780-799' (see table 1)

TABLE 1

Number and percentage of total number of deaths coded as "ill-defined" (ICD9:780-799) in Thailand from 1987-1993

	1987	1988	1989	1990	1991	1992	1993
Ill-Defined causes	111,379	106,667	110,112	109,176	113,536	117,119	117,807
% of total deaths	47.9	46.1	44.7	43.2	43	42.6	42%

source: MOPH

Although this problem has been repeatedly identified in previous studies, the proportion of ill-defined coding of deaths still remain high, nearly half of all deaths. In adjusting the cause-specific mortality data, this portion of unattributable deaths needed to be looked at. In order to accomplish this, an analysis of 4-digit coding data was undertaken, with age breakdowns to demonstrate the portion of ill-defined causes which could be seen to be pre-mature, attributable mortality.

Since it is vital, in order to appropriately depict the impact of all disease; for all deaths to be ascribed to a disease cause, adjustments were required for both mortality and morbidity categories. Guidelines for these adjustment algorithms were taken from previous national studies on causes of deaths and illnesses, as well as techniques derived from international experiences. Previous studies, in addition to the IPSR's " Analysis of Mortality and Causes of Death" and the 1988 "Mortality and Morbidity Differentials", also included additional demographic studies commissioned by the

NESDB's Working group on Population Projections "Adjustment of Mortality Statistic and Life Table Construction in Thailand" [28]

The initial results were then used as source inputs in adjusting mortality and morbidity data.

TABLES 2 & 3

2

CAUSE SPECIFIC MORTALITY 1987	T 0-4	T 5-14	T 15-44	T 45-64	T 65+	unknown	TOTAL
TOTAL	16,099	7,540	44,872	60,880	98,043	4,906	232,340
TOTAL Defined	10,057	5,193	35,632	43,325	24,606	2,148	120,961
III. ICD 9:780-799 (Symptoms, Signs and Ill-defined conditior	6,042	2,347	9,240	17,555	73,437	2,758	111,379
ICD 9:780 (General symptoms)	3,771	1,431	4,331	6,694	4,889	595	21,711
ICD 9:789 (Abdomen and pelvis)	82	33	278	603	193	29	1,218
ICD 9:797 (Senility)	-	-	3	8	64,859	1,403	66,273
ICD 9:799 (Other ill-defined)	2,086	850	4,437	9,957	3,306	715	21,351
ICD 9:7802 (Syncope and Collapse)	401	180	1,469	3,206	3,652	209	9,117
ICD 9:7806 (PUO)	3,117	1,182	2,760	3,425	1,209	369	12,062
ICD 9:7979	-	-	3	8	64,859	1,403	66,273
ICD 9:7991 (Resp. Failure)	476	222	1,145	1,352	1,463	61	4,719
ICD 9:7999 (Other unknown)	1,607	625	3,284	8,370	1,821	654	16,361

3

CAUSE SPECIFIC MORTALITY 1993	T 0-4	T 5-14	T 15-44	T 45-64	T 65+	unknown	TOTAL
TOTAL	11,071	5,780	67,968	73,411	122,905	4,596	285,731
TOTAL Defined	7,680	4,553	58,595	56,905	37,857	2,334	167,924
III. ICD 9:780-799 (Symptoms, Signs and Ill-defined condkk	3,391	1,227	9,373	16,506	85,048	2,262	117,807
ICD 9:780 (General symptoms)	1,647	629	3,938	5,794	4,326	290	16,624
ICD 9:789 (Abdomen and pelvis)	75	31	191	411	149	8	865
ICD 9:797 (Senility)	-	-	-	-	75,463	1,289	76,752
ICD 9:799 (Other ill-defined)	1,599	527	4,956	9,987	4,892	660	22,621
ICD 9:7802 (Syncope and Collapse)	119	93	1,770	3,385	3,484	102	8,953
ICD 9:7806 (PUO)	1,361	486	1,989	2,315	783	182	7,116
ICD 9:7979	-	-	-	-	75,463	1,289	76,752
ICD 9:7991 (Resp Failure)	561	187	2,236	2,425	2,938	119	8,466
ICD 9:7999 (Other unknown)	1,028	336	2,681	7,512	1,933	540	14,030

There were 232,340 and 285,731 reported deaths in 1987 and 1993 respectively. Of these, 111,379 or 47.9% of all deaths in 1987 and 117,807 or 41.2% of all deaths in 1993 were classified as ill-defined, or coded in the ICD9:790-799 category. An analysis of 4 digit coding within the ill-defined coding range, with age breakdowns, was performed, revealing interesting results. (tables 2 & 3) A specific ill-defined category, ICD9:7979 - 'Sinility', represented, in loose terms, deaths in the elderly (age 65+) due to what appeared to be natural causes, which represented 60% and 63% of ill-defined death respectively in 1987 and 1993. However, a large portion of the remaining 40% to 36% of ill-defined deaths represented unknown pre-mature mortality cases, with a significant portion occuring in the younger age-groups. Since these deaths needed to be accounted for, the 3 and 4-digit codes, provided evidence of the observed 'ill-defined' symptoms surrounding the mortality event (such as 'syncope and collapse' (ICD9:7802), 'convulsions' (ICD9:7803), pyrexia of unknown origin (ICD9:7806)). These were allocated to the corresponding disease groups, using adjustment algorithm techniques.

A note on mortality data

The total impact from both time lived with a disability and premature mortality in Thailand, as measured by disability adjusted life years, in 1987 and 1993 was conducted using available secondary data sources from the country's available system of health reporting and information. The process of collecting, adjusting and analyzing of these data provided knowledge regarding the data available for decision-making currently in place in Thailand. These, gained from the process of undertaking this study, has, in the author's view, been as informative as the outcomes of the study itself.

Given that a sound policy decision should be based upon a factually representative set of data and information, Thailand has generous room for improvement. Even in the case of mortality, which was crucial to the conduct of this study- cause specific mortality provided the only means for a reasonable 'cap' which was invaluable for morbidity estimates and adjustment, because, while it is possible for morbidity estimates, by

themselves, to be degrees of magnitude inaccurate, the sum of each individual cause-specific mortality cannot exceed total mortality. Therefore, the relationship between observed mortality and morbidity, as indicated by case fatality rates, served as an important variable used in our adjustment algorithms.

However, incompleteness, underregistration and ill-defined and other 'garbage' coding of routinely collected mortality statistics proved to be a large hindrance to accurate estimation. In part, this was in part due to the Ministry of Health's status at the receiving of this information, since vital registration falls under the domain of the Ministrty of Interior, which does not have personnel knowledgeable with the intricacies of ICD coding. For example, in terms of the overall disease profiles, the total rate of impact has risen over the years, as has the crude death rate, from 4.3 : 1000 in 1987, to 4.9 : 1000 in 1993. This is in contrary to most of the world's newly-developing regions, which are on a state of gradual mortality decline.[1] This is an example of one of the most basic data needed for even the most cursory assessment of health status.

The most useful attempt to improve and refine this data has been the periodic working groups commissioned to provide reports, with little policy translation of the recommendations articulated in these reports. Accordingly, the area of mortality and morbidity differentials, adjustment methods, cause of death modeling, validity of cause attribution, etc., presents itself as a potential policy-based research area.

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[1]However, it has been indicated that part of this may be due to a better reporting system.

Data Format

Data sources for morbidity and mortality were used to calculate the impact of diseases and ill-health using the DALYs formula. A trend analysis was undertaken utilizing two observation points in time - 1987 and 1993.

Disease-specific breakdowns were conducted using the WDR-1993 disease classification which divided disease groups into three broad categories loosely reflecting the disease pattern changes of the epidemiological transition. These were;

Group I Pre-epidemiological transition disease profiles which included all infectious and communicable diseases, maternal and child diseases including nutritional disorders. Post- epidemiological transition disease profiles comprised of two disease groups; Group II includes all non-communicable diseases and Group III were injuries - accidents and intentional injuries.

(for details, see appendix- figure 12)

Additional disease-specific variable were used for the calculations, these included the disability weights from the Global Burden Of Disease Study, used for WDR1993, average duration, remission rate, and case fatality rate for each disease.[1]

Two main components of DALYs were broken down; a mortality component - which is, in effect, a derivative of Years of Life Lost (YLL) (which utilized standard expectation of life at each age rather than an arbitrary set point), (see figure 1) and a morbidity component, designated Years Lived with a Disability (YLD). (see figure 2)

The final output of these calculations were then presented in two format groups. Firstly, The magnitude of disease impact were graphic presented in tablature with depictions showing time trends, age, disease goup variations, and breakdown of impact component due to morbidity and mortality. Secondly, priority ranking according to disease-specific magnitude of impact was also conducted. These were broken down showing the top 15 disease priority of all ages for each year, as well as the top 5 disease priorities for each age group.

[1] For full details regarding sources for individual disease estimates, variables used, disability weighting- see full report, upcoming (in Thai)- HSRI

Results

The total impact of disease and injuries as measured by disability adjusted life years in Thailand was 11,371,782 DALYs in 1987, and 13,416,609 DALYs in 1993. The increase in total numbers was more than could be accounted for by population growth alone, with the DALYs rate being 213 per 1000 in 1987, and 230 per 1000 in 1993.(figure 3) Broken down by cause, the impact of disease from pre-mature mortality component was around 6.6 mil DALYs in 1987 and 7.3 mil DALYs in 1993, representing 58% of total impact in 1987, and 54% in 1993. The remaining increases was due to the impact from morbidity - or time lived with a disability, from 42% of total impact in 1987, to 46% of total impact in 1993.(figure 4) This was an increase from 4.76 mil DALYs in 1987, to 6.1 mil DALYs in 1993. Therefore, the largest increase in total impact of disease, by source, was due to the morbidity, or disability component.

Alternatively, if we consider the total impact in terms of disease groups, we can see that the largest increases were evident in groups II - non-communicable disease, going from 40.5% (4.6 mil DALYs) of total impact in 1987, to 46.5% (6.2 mil DALYs) of total impact in 1993, and even more so in group III- injuries, from 13.7% of total impact in 1987, to 16% in 1993. In absolute terms, the fastest growth in terms of impact from disease groups was in Group III - injuries, from 1.56 mil DALYs to 2.62 mil DALYs, in 1987 and 1983 respectively. This represented a 68% growth over 5 years, nearly doubling the growth in Group II - non-communicable diseases, which was also substantial at 36% over the same period. The impact from communicable, and maternal & child diseases - Group I, actually decreased, in real terms, from 2.8 mil DALYs in 1987, to 2.4 mil DALYs in 1993. (figure 5) Together, these data represent an empirical evidence of an epidemiological transition as seen from the 5 year trend in secular disease profiles- towards one dominated by non-communicable diseases and injuries. In addition, this transition also manifests in terms of an increasing total impact of disease due to the increase in time lived with a disability, (figures 6 & 7) congruent with the chronic, and debilitating nature of most non-communicable diseases and the sequele from injuries.

When we consider the component source of impact by individual disease groups, it can be noted that the impact from mortality (figures 8 & 9) is approximately

equal to that from morbidity, or disability in two groups, Group I - communicable and maternal and child disease, and Group III - injuries. This relationship has remained constant over the observed years. However, the impact of non-communicable disease is mostly, (just under 60% in both observed years), due to morbidity or disability.

In terms of the impact of disease and injuries on different age-groups, a striking feature is the age-distribution. While Groups I- diseases affects both the youngest (0-5yr), and working age (15-44) age groups and Group II- diseases predominantly affects the oldest, more than 45 yr age groups, Group III injuries seem to single out the working age (15-44yr) population, with the total increase within this age group being largely due to premature mortality. Altogether, the total impact of injuries, over the observed years, from being slightly more than half (1.5 mil DALYs-Gr III to 2.8 mil DALY'-Gr I) of the impact from Group I - diseases in 1987, (figure 10) surpassed the total impact of Group - I (2.6 mil DALYs Gr III to 2.4 mil DALYs Gr I) in 1993.[1] (figure 11)

[1] (Indeed, if we condsider cause-specific mortality statistics, motor vehicle accidents has continued, for the past 10 years, to be the leading cause of death in the young, working-age population, and the trend is increasing.)

Specific disease entities were then ranked by order of magnitude for each age group.

TABLE 4

TOP 5 CAUSES OF IMPACT FROM DISEASE, as measured by DALY's , 0-4 yr

ITEM	1987	T 0-4	1993	T 0-4
1	Childhood Cluster	311,461	Childhood Cluster	210,492
2	Perinatal	219,703	Perinatal	104,795
3	Respiratory Infections	136,596	Respiratory Infections	95,223
4	Diarrhoeal Disease	120,932	Abortion, Stillbirths & Congenital Dis.	90,363
5	Rheumatic	10,972	Pyrexia of Unknown Origin	63,338

At 0-4 years, while childhood cluster, perinatal disease and respiratory infections continued at the first three, two diseases fell off the top 5 list. Diarrheal diseases and nutritional defects were replaced by the combined categories of abortion, stillbirths & congenital diseases and pyrexia of unknown origin.

TABLE 5

TOP 5 CAUSES OF IMPACT FROM DISEASE, as measured by DALY's , 5-14 yr

ITEM	1987	T 5-14	1993	T 5-14
1	Childhood Cluster	215,036	Motor Vehicle Accidents	284,061
2	Motor Vehicle Accidents	144,729	Childhood Cluster	126,997
3	Respiratory Infections	100,998	Asthma	80,812
4	Dengue Hemorrhagic Fever	90,100	Diarrhoeal Disease	56,656
5	Pyrexia of Unknown Origin	72,052	Pyrexia of Unknown Origin	47,621

For the 5-14 age group, the most striking change was the almost doubling of the impact from motor vehicle accidents, from 144,729 DALYs in 1987, to 284,061 DALYs in 1993. Also, asthma replaced respiratory infections as the 2nd ranked disease.

TABLE 6

TOP 5 CAUSES OF IMPACT FROM DISEASES, as measured by DALY's , 15-44 yr

ITEM	1987	T 15-44	1993	T 15-44
1	Motor Vehicle Accidents	668,603	Motor Vehicle Accidents	1,182,155
2	Malignant Neoplasms	510,457	Malignant Neoplasms	709,804
3	Homicide and Violence	133,459	HIV	295,228
4	HIV	131,779	Self-Inflicted	126,425
5	Drug Addiction	114,163	Cardiovascular	125,588

The 15-44 year age group exhibited the highest impact from motor vehicle accidents of all age groups, at a remarkable increase from 668,603 DALYs in 1987, to 1,182,155 DALYs in 1993- which was more than the remaining four highest ranked diseases combined. The other diseases were HIV, more than doubling its impact from 131,779 DALYs in 1987 to 295,228 DALYs in 1993, homicide & violence and drug addiction, which fell off this age-specific list, but gained impact in other groups. Suicide, at 3rd became a new cause in 1993.

TABLE 7

TOP 5 CAUSES OF IMPACT FROM DISEASES, as measured by DALY's , 45-64 yr

ITEM	1987	T 45-64	1993	T 45-64
1	Malignant Neoplasms	249,402	Malignant Neoplasms	368,546
2	Ischaemic Heart Disease	102,086	Ischaemic Heart Disease	186,643
3	Cerebrovascular	64,857	Cerebrovascular	96,961
4	Motor Vehicle Accidents	63,717	Hypertensive	85,567
5	Diabetes Mellitus	59,069	Motor Vehicle Accidents	85,106

For the 44-64 age group, the leading 5 disease impact were entirely from non-communicable diseases and injuries, with the same composition of disease profiles for both years.These included ischaemic heart diseases, cerebrovascular diseases, motor vehicle accidents - which rose in total impact but fell slightly in rank, diabetes, and hypertension. Interestingly, all five categories exhibited an increase in absolute terms of impact, reflecting the increase in the time lived with a disability component.

Conclusion and Recommendations

The change in the ranking of total impacts from individual diseases reveal interesting results. The disblility adjusted life-years methodology allow for, not only a direct comparison between the traditionally ranked high mortality impact diseases and those lower mortality, but chronic and disabling diseases, but also gives their relative magnitude of impact- that is, empirical data on how far apart each consecutive disease ranking are from each other. The analysis of the changes in ranking of disease impact over the observed years, 1987 and 1993, also demonstrates the effects of an epidemiological transition.

TABLE 8

TOP 15 CAUSES OF IMPACT FROM DISEASE AND INJURIES, as measured by DALY's, all age groups , 1987 & 1993

RANK	DISEASE	1987	DISEASE	1993
1	Motor Vehicle Accidents	923,023	Motor Vehicle Accidents	1,589,952
2	Malignant Neoplasms	858,726	Malignant Neoplasms	1,170,746
3	Childhood Cluster	554,906	Childhood Cluster	357,892
4	Respiratory Infections	338,508	Ischaemic Heart Disease	347,521
5	Pyrexia of Unknown Origin	248,299	HIV	317,458
6	Diarrhoeal Disease	220,224	Cerebrovascular	260,253
7	Perinatal	219,831	Hypertensive	245,595
8	Ischaemic Heart Disease	209,543	Respiratory Infections	244,782
9	Cerebrovascular	192,288	Diabetes Mellitus	216,923
10	Hypertensive	175,485	Cirrhosis	197,042
11	Homicide and Violence	163,380	Diarrhoeal Disease	181,568
12	Malaria	152,874	Pyrexia of Unknown Origin	165,483
13	Tuberculosis	152,788	Asthma	164,608
14	Cirrhosis	146,378	Rheumatic	156,214
15	HIV	142,607	Homicide and Violence	145,867

The three highest ranked diseases in terms of total impact from both time lived with a disability and premature mortality in both 1987 and 1993 were the same order for both years. Leading the list was one striking category - motor vehicle accidents, which, by far, led the list at 923,023 DALYs and 1,589,952 in 1987 and 1993, respectively. The second ranked was from malignant neoplasms- which was a combined category of 21 types of cancer. The third was from the disease group - childhood cluster- which contained all the infectious diseases of childhood, including vaccine-preventable diseases.

However, from the third rank onwards, a clear evidence of changes in disease profile over time was apparent. In 1987, ranks four to seven were all from Group I diseases, with two being predominantly from childhood categories - respiratory infections- largely from childhood URI at fourth and diarrheal diseases at sixth. While in 1993, the corresponding ranks were mainly due to Group II, or non-communicable diseases, with heart diseases, cerebrovascular diseases, and hypertension, at 4^{th}, 6^{th}, and 7^{th} place, respectively, this was a rise up the list from 1987, when these diseases were at 8^{th}, 9^{th} and 10^{th}. However, during the two observed years, one disease exhibited a quickest increase in rank- HIV infection, which rose from 15^{th} in 1987, to 5^{th} in 1993. Another, to a lesser extent, was cirrhosis, from 14^{th} to 10^{th} . At the same time, several Group I diseases which were on the top 15^{th} list in 1987, did not appear on the list in 1993. These were, perinatal diseases, malaria and TB. Those that remained also fell in rank, with respiratory infections, pyrexia of unknown origin, and diarrheal diseases falling from 4^{th}, 5^{th} and 6^{th} in 1987, to 8^{th}, 12^{th} and 11^{th}, in 1993, respectively. Three new diseases also appeared on the bottom 15 of the 1993 list- asthma, rheumatic diseases, homicide and violence.

The assessment of the total impact of diseases revealed several important findings. The impact profile, as broken down into pre-transitional (Group I) and post-transitional (Groups II & III) disease groupings yielded conclusive evidence of the ongoing phenomena of an epidemiological transition taking place. The previously high impact from infectious and maternal & child disease profiles is slowly being superceded by more chronic, non-communicable, as well as new infectious, diseases. This transition also manifests in an increasingly higher component source of the total impact being generated from non-fatal health outcomes, that is, from longer time lived with a disability[29]. Taking into consideration that the nature of most post-transitional disease profiles are intricately tied to behavior[30] (heart diseases, hypertension, smoking, AIDS etc.), this has important implications to policy orientation in terms of preventive, promotive, rehabilitative interventions as well as health communication and social marketing strategies.

One important finding warrants special mention, the exceedingly high impact due to injuries, namely, motor vehicle accidents. This singular cause has steadfastedly maintained its lead as the number one health problem, by far of any individual or group of disease. A general assessment of resources, both in and out of the health sector, allocated to policies directed at accident prevention to reverse this trend, is clearly needed.

A disease group which contributed a high degree of impact, but was not included in the list due to the inability to breakdown its disease component owing from grossly insufficient and unavailable data was mental illnesses. At present, a comprehensive survey to assess the extent of the magnitude and impact of mental illnesses in underway.

The new disease profiles also include one which, although it generally limits itself to the younger age categories, made it to the total impact from disease list. This was asthma, which also included respiratory-related allergies. The increasing prevalence of environmentally related conditions has been well-documented[31]. Since this study does not determine causality of disease. The area of environmental health also presents itself for further research.

In terms of the overall profile of disease impact, a trend analysis can also be performed to project the impact of disease for the future. Rather than a simple linear projection, the sensitivity of the individual disease variables requires the techniques of time series analysis. This can be undertaken in conjunction with epidemiological modeling of individual diseases to identify correlation and causality, such as risk factors, to determine intervention strategies. Research strategies in this area may be directed at delineating the dynamic changes inherent in the state of health an epidemiologic transition[32].

As a data base, the more than 10,000 data points used, processed, and generated from this study can serve as an important input to further studies. As suggested, this could represent an empirical estimate of health 'needs', in terms of impact, to be used to determine other need-sensitive studies. This may include demand surveys, utilization studies, estimates of the burden on individuals or households from ill-health, determination of essential package of services and interventions etc.

Finally, the results can also serve, in conjunction with the worldwide effort in quantitatively determining disease impact on societies, as a useful benchmark for international comparisons to which policy and decision makers could assess the magnitude of problems from disease, injuries, and states of ill-health. Perhaps, this could even translate into a substantive means of bargaining for increased allocation of resources to the health sector as a whole.

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FIGURE 1

IMPACT OF DISEASE FROM PREMATURE MORTALITY COMPONENT, BY DISEASE GROUPS, 1987 & 1993

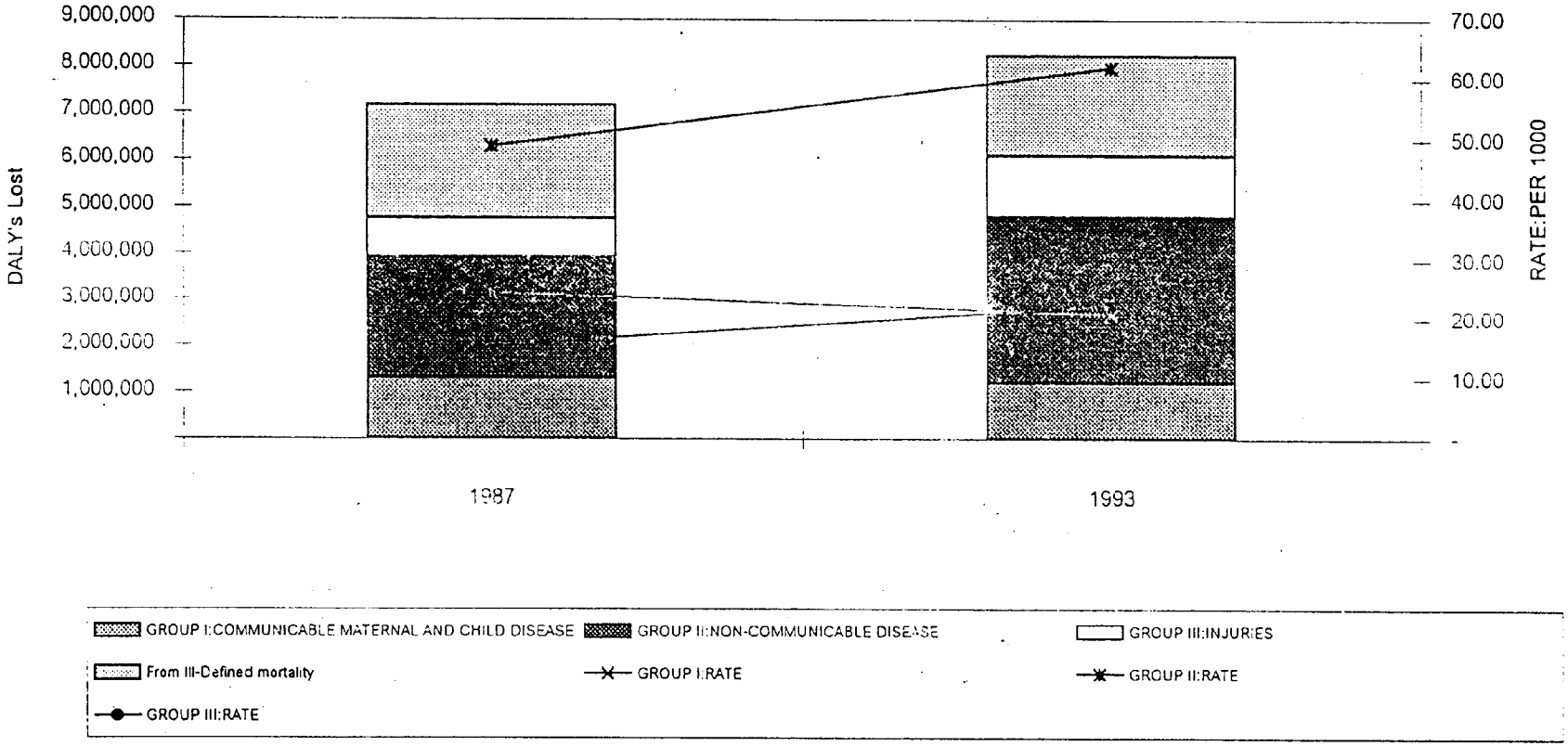

FIGURE 2

IMPACT OF DISEASE FROM TIME LIVED WITH A DISABILITY,

BY DISEASE GROUPS,

1987 & 1993

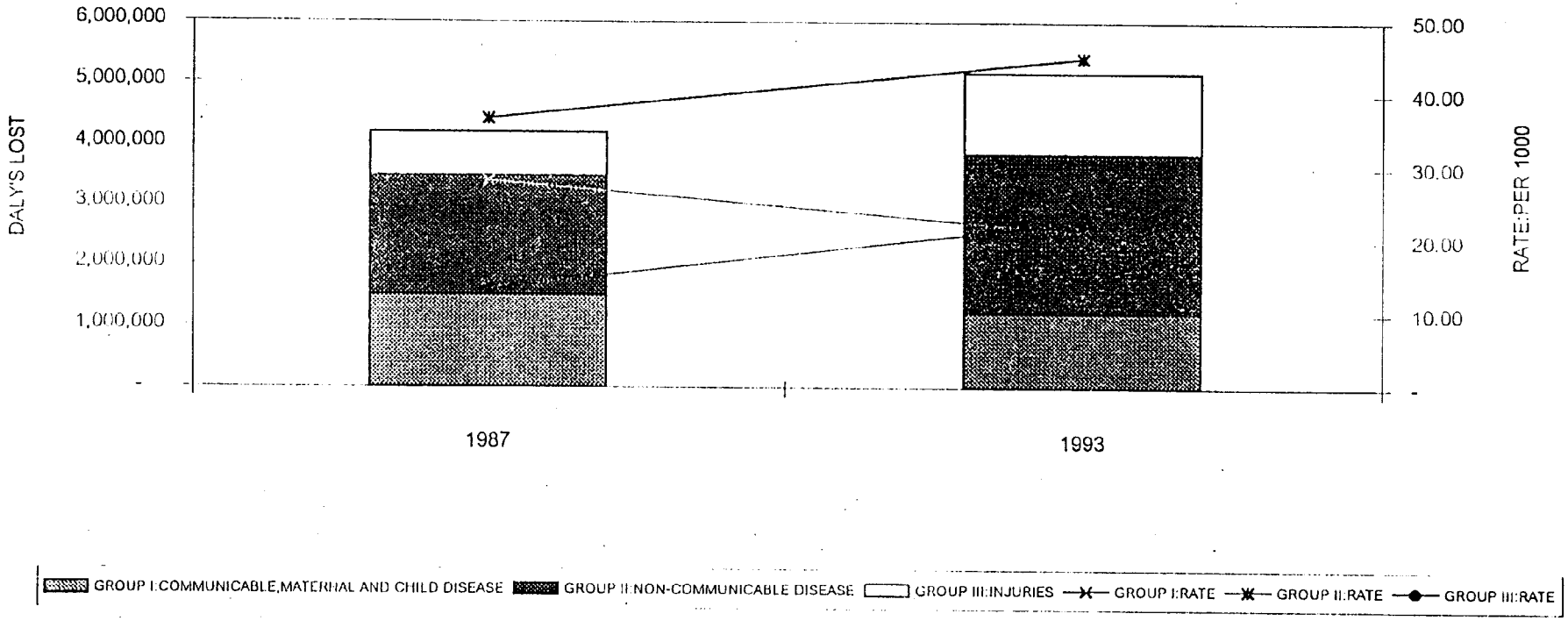

FIGURE 3

TOTAL IMPACT OF DISEASE, AS MEASURED BY DISABILITY ADJUSTED LIFE-YEARS,

BY DISEASE GROUPS, 1987 & 1993

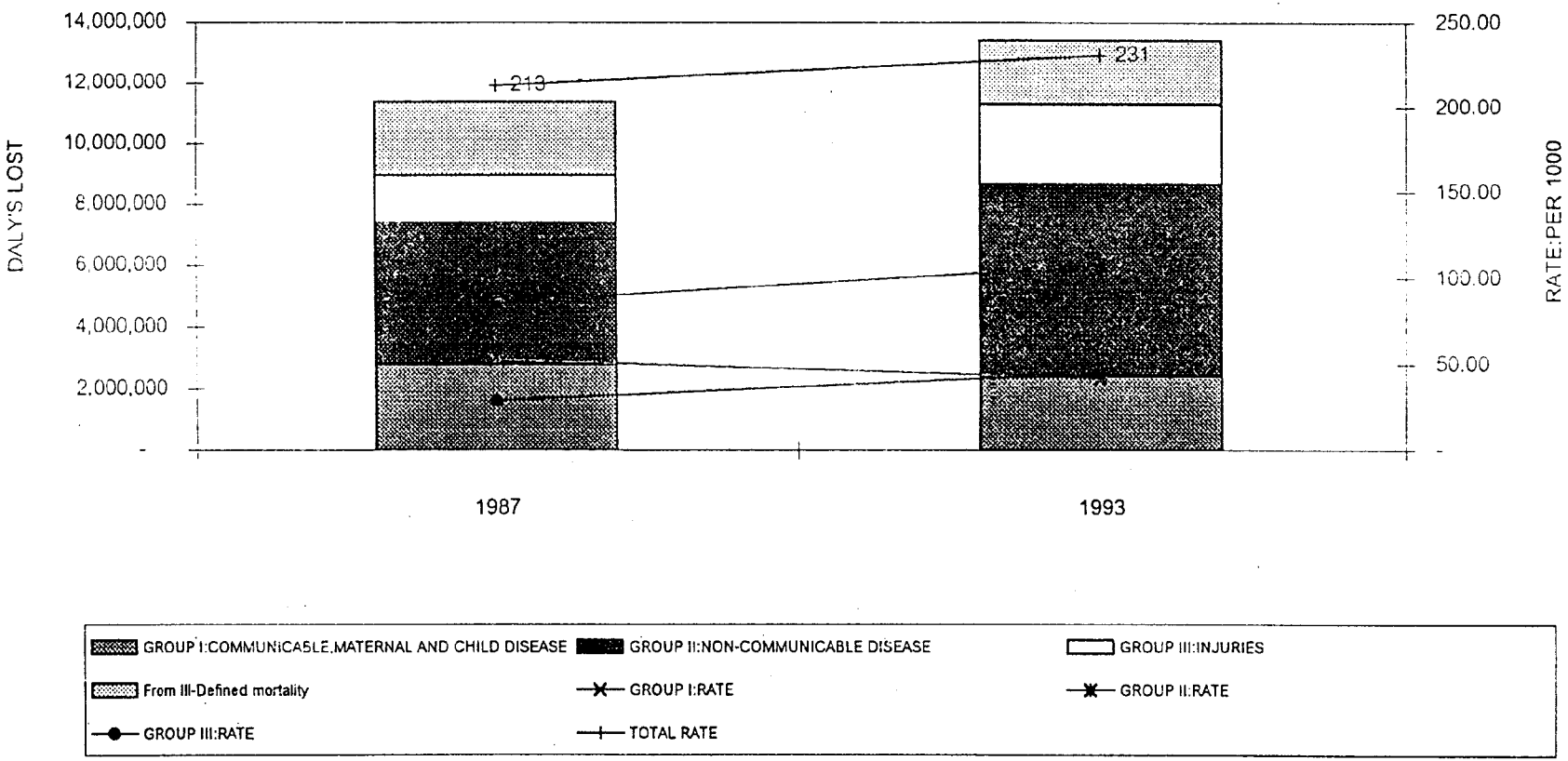

FIGURE 4

MORBIDITY VS MORTALITY COMPONENT SOURCES OF TOTAL IMPACT OF DISEASE,

AS MEASURED BY DALY'S, 1987 & 1993

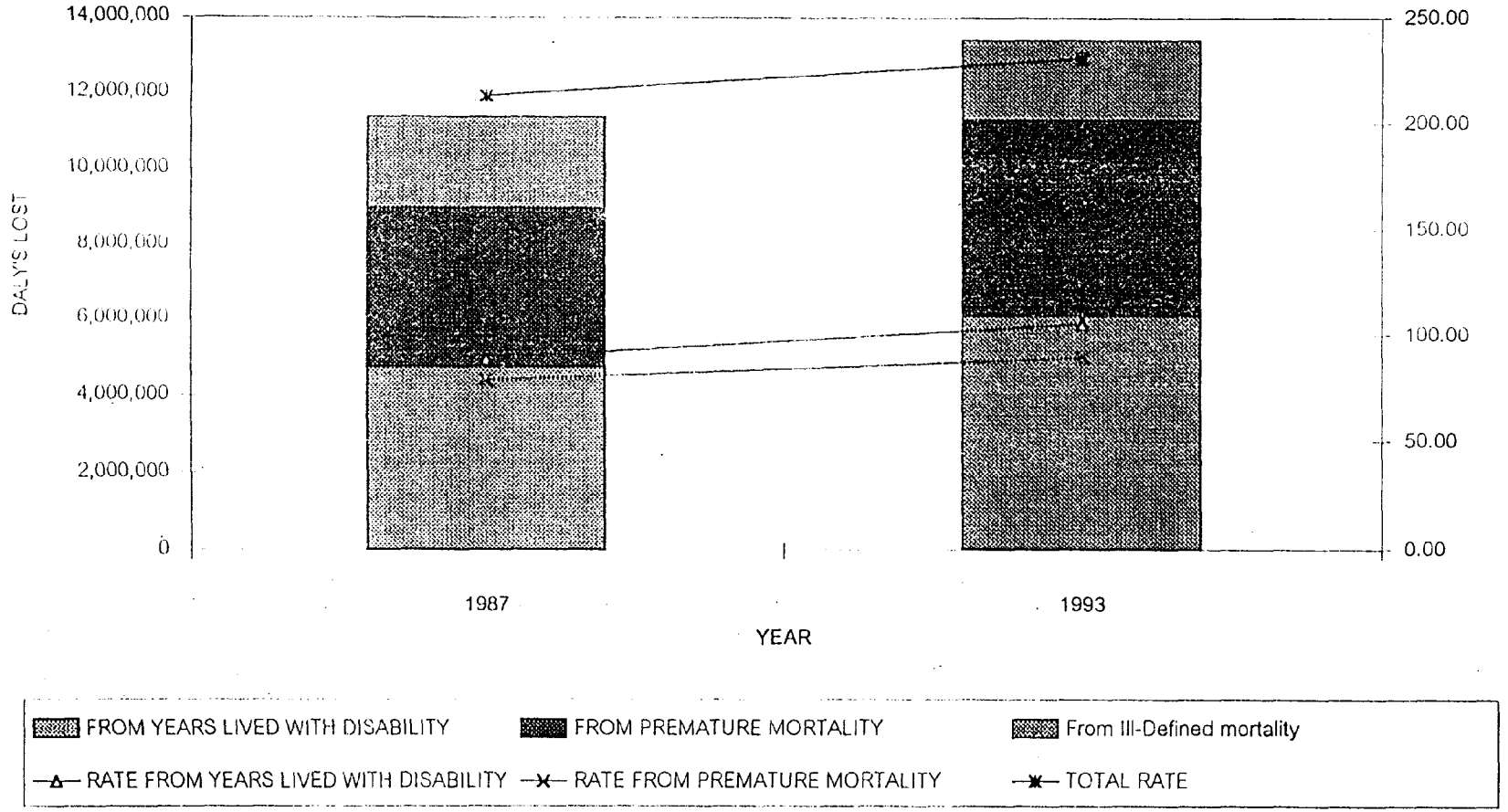

FIGURE 5

TOTAL IMPACT OF DISEASE AND INJURIES, as measured by Disability Adjusted Life Years, 1987 & 1993 comparisons

DALY's 1987,1993	T 0-4		T 5-14		T 15-44		T 45-64		T 65+		TT	
	1987	1993	1987	1993	1987	1993	1987	1993	1987	1993	1987	1993
I. Communicable, Maternal and Perinatal	998,277	606,983	551,745	307,312	880,700	1,110,849	301,809	318,203	83,055	99,014	2,815,586	2,442,361
A. Infectious and parasitic	601,760	377,541	464,326	249,840	623,196	816,035	274,082	289,109	75,618	86,018	2,038,982	1,818,544
B. Maternal	-	-	-	-	156,072	202,800	334	141	8	-	156,414	202,940
C. Perinatal	219,703	104,795	-	-	110	-	18	-	-	-	219,831	104,795
D. Pyrexia of Unknown Origin	88,040	63,338	72,052	47,621	78,700	44,822	8,341	7,845	1,165	1,856	248,299	165,483
II. Noncommunicable	307,800	264,812	469,954	552,962	2,497,849	3,511,381	1,063,224	1,526,499	242,502	365,718	4,581,329	6,221,372
A. Malignant Neoplasms	9,842	8,803	50,226	19,975	510,457	709,804	249,402	368,546	38,799	63,617	858,726	1,170,746
B. Diabetes Mellitus	63	375	281	338	44,332	112,503	59,069	84,816	10,972	18,891	114,717	216,923
C. Nutritional	43,937	33,049	25,837	20,293	2,955	18,786	2,029	4,753	144	921	74,903	77,803
D. Neurological	18,659	14,209	56,436	48,143	103,008	148,842	58,575	82,546	13,671	16,655	250,349	310,395
E. Mental Illness	5,905	3,587	24,706	19,411	157,946	145,874	5,180	7,690	458	825	194,195	177,386
F. Sense Organ	423	125	4,950	56	80,034	27,115	25,218	19,961	3,927	14,646	114,552	61,923
G. Cardiovascular	57,966	40,735	68,583	57,542	519,455	808,776	375,475	583,945	134,695	194,720	1,156,175	1,685,719
H. Respiratory	21,159	13,768	55,748	83,796	89,596	150,137	40,549	50,200	12,096	21,864	219,148	319,764
I. Digestive	40,993	30,665	36,439	28,667	206,064	230,803	139,872	152,262	18,329	22,417	441,696	464,813
J. Genito-Urinary	5,586	5,396	18,495	19,945	97,740	102,665	37,374	57,173	8,263	15,274	167,458	200,453
K. Musculo-Skeletal	438	125	338	675	60,160	100,555	36,664	68,762	3,131	6,163	100,731	176,281
L. Abortion, Stillbirths & Congenital Dis.	62,255	90,363	25,323	21,883	66,094	73,704	1,036	1,341	77	87	154,785	187,378
M. Oral Health	-	-	-	-	73	-	70	-	15	-	159	-
N. Deformities	9,320	8,464	48,610	23,840	164,514	169,759	14,106	20,605	1,145	2,107	237,695	224,774
III. Injuries	101,380	98,561	201,593	395,189	1,118,351	1,933,853	125,178	172,899	9,786	18,052	1,556,287	2,618,553
A. Unintentional	98,440	93,118	222,906	383,564	897,900	1,689,467	94,732	142,392	6,963	15,000	1,320,940	2,323,541
B. Intentional	2,440	2,190	12,462	11,174	219,055	242,292	30,200	30,208	2,182	2,922	266,338	288,787
TOTAL Defined	1,407,457	970,357	1,223,292	1,255,463	4,496,900	6,556,082	1,490,211	2,017,601	335,342	482,783	8,953,202	11,282,285
IIII. ICD 9:780-799 (Symptoms, Signs and Ill-defined condition)	503,295	235,163	170,052	70,025	387,045	350,283	345,771	295,067	1,012,417	1,183,787	2,418,580	2,134,324

FIGURE 6

IMPACT OF DISEASE AND INJURIES FROM MORBIDITY, as measured by Years Lived with Disability- YLD,1987

YLD 1987	T 0-4	T 5-14	T 15-44	T 45-64	T 65+	TT
I. Communicable, Maternal and Perinatal	360,853	344,373	554,509	41,189	4,717	1,305,641
A. Infectious and parasitic	183,109	272,320	330,755	32,848	3,553	822,584
1. Tuberculosis	3,488	167	37,562	8,963	687	50,868
2. STD's Excluding HIV	15	49	2,544	20	4	2,632
3. HIV	5,673	334	131,779	4,820	-	142,607
4. Diarrhoeal Disease	64,002	31,571	22,579	3,495	543	122,190
5. Childhood Cluster	57,968	125,873	21,601	989	106	206,536
6. Meninggococcal Disease	2,862	4,241	2,592	194	20	9,908
7. Hepatitis	86	199	1,035	69	6	1,395
8. Malaria	736	22,264	65,608	5,513	345	94,466
9. Tropical Cluster	505	1,718	1,181	149	13	3,566
10. Leprocy	11	272	1,374	324	45	2,026
11. Trachoma	-	-	-	-	-	-
12. Intestinal Parasites	-	-	-	-	-	-
13. Other Skin Disease	0	1	4	0	0	6
14. Respiratory Infections	47,761	85,631	42,898	8,313	1,783	186,385
B. Maternal	-	-	145,055	-	-	145,055
1. Hypertensive Disease of Pregnancy	-	-	31,252	-	-	31,252
2. Hemmorrage (Postpartum)	-	-	25,167	-	-	25,167
3. Abortion	-	-	33,298	-	-	33,298
4. Infection and Septicemia	-	-	30,266	-	-	30,266
5. Obstructed Labor	-		25,07[illegible]			[illegible]71
C. Perinatal	89,704	-	-	-	-	89,704
1. Intra-Uterine Growth Retardation	25,823	-	-	-	-	25,823
2. Preterm Birth	63,881	-	-	-	-	63,881
D. Pyrexia of Unknown Origin	88,040	72,052	78,700	8,341	1,165	248,299
II. Noncommunicable	122,497	356,529	1,740,874	362,439	33,447	2,615,786
A. Malignant Neoplasms	2,335	35,703	388,456	92,545	8,455	527,494
B. Diabetes Mellitus	-	-	33,866	38,506	6,081	78,453
C. Nutritional	43,812	25,781	2,405	1,625	114	73,736
D. Neurological	1,518	37,129	52,071	23,882	2,729	117,328
E. Mental Illness	5,905	24,706	157,946	5,180	458	194,195
F. Sense Organ	235	4,894	79,924	25,218	3,927	114,198
G. Cardiovascular	2,288	15,783	100,643	56,049	2,757	177,521
H. Respiratory	1,703	50,569	68,810	18,228	4,726	144,036
I. Digestive	21,411	25,293	119,026	30,521	2,916	199,167
J. Genito-Urinary	3,584	13,485	59,987	5,862	1,129	84,047
K. Musculo-Skeletal	-	-	59,499	35,786	3,062	98,347
L. Abortion, Stillbirths & Congenital Dis.	5,763	24,084	65,543	1,001	61	96,453
M. Oral Health	-	-	-	-	-	-
N. Deformities	9,320	48,610	164,514	14,106	1,145	237,695
III. Injuries	42,261	135,903	601,299	53,858	1,202	834,523
A. Unintentional	42,261	134,981	598,114	53,448	1,202	830,006
1. Motor Vehicle Accidents	39,297	126,772	558,061	49,921	964	775,015
2. Poisoning	2,964	8,208	40,053	3,527	238	54,991
3. Falls	-	-	-	-	-	-
4. Fires	-	-	-	-	-	-
5. Drowning	-	-	-	-	-	-
6. Occupational	-	-	-	-	-	-
B. Intentional	-	922	3,185	410	-	4,518
1. Self-Inflicted	-	922	3,185	410	-	4,518
2. Homicide and Violence	-	-	-	-	-	-
3. War	-	-	-	-	-	-
TOTAL Defined	525,611	836,805	2,896,682	457,486	39,366	4,755,950

FIGURE 7

IMPACT OF DISEASE AND INJURIES FROM MORBIDITY, as measured by Years Lived with Disability - YLD's, 1993

YLD 1993	T 0-4	T 5-14	T 15-44	T 45-64	T 65+	TT
I. Communicable, Maternal and Perinatal	185,329	198,448	739,412	71,836	13,444	1,208,468
A. Infectious and parasitic	118,355	150,826	495,867	63,991	11,588	840,627
1. Tuberculosis	2,841	1,050	49,242	21,289	3,400	77,822
2. STD's Excluding HIV	26	46	4,661	87	6	4,826
3. HIV	10,150	304	295,228	11,776	-	317,458
4. Diarrhoeal Disease	39,046	52,603	27,436	14,420	3,371	136,878
5. Childhood Cluster	22,312	59,561	16,584	725	105	99,288
6. Meninggococcal Disease	1,427	1,724	1,568	182	25	4,926
7. Hepatitis	44	382	787	69	8	1,290
8. Malaria	473	10,235	38,184	3,748	230	52,870
9. Tropical Cluster	8,121	14,076	27,262	53	10	49,522
10. Leprosy	-	129	1,016	318	53	1,516
11. Trachoma	-	-	-	-	-	-
12. Intestinal Parasites	-	-	-	-	-	-
13. Other Skin Disease	0	5	34	6	2	47
14. Respiratory Infections	33,915	10,712	33,862	11,318	4,378	94,184
B. Maternal	-	-	198,723	-	-	198,723
1. Hypertensive Disease of Pregnancy	-	-	62,314	-	-	62,314
2. Hemmorhage (Postpartum)	-	-	43,500	-	-	43,500
3. Abortion	-	-	37,227	-	-	37,227
4. Infection and Septicemia		-	38,919			38,919
5. Obstructed Labor			16,763			16,763
C. Perinatal	3,636	-	-	-	-	3,636
1. Intra-Uterine Growth Retardation	2,310	-	-	-	-	2,310
2. Preterm Birth	1,326	-	-	-	-	1,326
D. Pyrexia of Unknown Origin	63,338	47,621	44,822	7,845	1,856	165,483
II. Noncommunicable	89,206	468,245	2,381,610	599,506	62,471	3,601,038
A. Malignant Neoplasms	1,984	8,605	518,908	127,522	13,602	670,622
B. Diabetes Mellitus	-	-	95,573	49,824	9,224	154,621
C. Nutritional	32,987	20,181	18,271	4,085	830	76,354
D. Neurological	1,697	34,352	78,146	46,500	5,584	166,279
E. Mental Illness	3,587	19,411	145,874	7,690	825	177,386
F. Sense Organ	-	-	27,078	19,963	14,639	61,680
G. Cardiovascular	2,886	16,056	196,828	153,779	7,328	376,877
H. Respiratory	1,443	79,687	112,237	19,725	8,542	221,634
I. Digestive	19,154	22,981	135,905	54,369	5,356	237,766
J. Genito-Urinary	3,206	15,892	48,973	8,895	1,944	78,911
K. Musculo-Skeletal	-	-	99,197	67,620	5,965	172,781
L. Abortion, Stillbirths & Congenital Dis.	5,156	21,883	73,704	1,341	87	102,171
M. Oral Health	-	-	-	-	-	-
N. Deformities	8,464	23,840	169,759	20,605	2,107	224,774
III. Injuries	26,242	264,371	944,995	61,034	3,974	1,300,616
A. Unintentional	26,242	263,272	924,742	60,000	3,784	1,278,040
1. Motor Vehicle Accidents	21,521	250,400	845,827	53,629	3,190	1,174,568
2. Poisoning	4,721	12,873	78,915	6,371	594	103,472
3. Falls	-	-	-	-	-	-
4. Fires	-	-	-	-	-	-
5. Drowning	-	-	-	-	-	-
6. Occupational	-	-	-	-	-	-
B. Intentional	-	1,099	20,253	1,034	191	22,576
1. Self-Inflicted	-	1,099	20,253	1,034	191	22,576
2. Homicide and Violence	-	-	-	-	-	-
3. War	-	-	-	-	-	-
TOTAL Defined	300,777	931,063	4,066,017	732,376	79,889	6,110,122

FIGURE 8

IMPACT OF DISEASE AND INJURIES FROM PREMATURE MORTALITY, as measured by Life Years Lost YLL's, 1987

YLL 1987	T 0-4	T 5-14	T 15-44	T 45-64	T 65+	TT
I. Communicable, Maternal and Perinatal	637.424	207.372	326.191	260.620	78.337	1.509.945
A. Infectious and parasitic	418.652	192.005	292.441	241.234	72.065	1.216.398
1. Tuberculosis	2.690	2.815	35.366	49.720	11.331	101.921
2. STD's Excluding HIV	626	56	294	158	23	1.157
3. HIV	-	-	-	-	-	-
4. Diarrhoeal Disease	56.930	14.804	13.478	10.106	2.716	98.034
5. Childhood Cluster	253.493	89.163	4.223	1.230	259	348.370
6. Meminggococcal Disease	3.566	3.434	5.509	1.353	343	14.205
7. Hepatitis	-	-	37	-	-	37
8. Malaria	9.509	12.215	30.445	5.659	580	58.408
9. Tropical Cluster	-	-	184	457	84	725
10. Leprocy	63	56	294	439	84	936
11. Trachoma	-	-	-	-	-	-
12. Intestinal Parasites	250	169	257	53	15	744
13. Other Skin Disease	-	-	-	-	-	-
14. Respiratory Infections	88.835	15.367	22.623	19.034	6.264	152.123
B. Maternal	-	-	11.018	334	8	11.359
C. Perinatal	130.000	-	110	18	-	130.127
D. Pyrexia of Unknown Origin	-		-	-	-	-
II. Noncommunicable	185.303	113.424	[illegible]	[illegible]	[illegible]	[illegible]
A. Malignant Neoplasms	7.507	14.523	122.000	156.857	30.345	331.232
B. Diabetes Mellitus	63	281	10.467	20.563	4.891	36 264
C. Nutritional	125	56	551	404	31	1.167
D. Neurological	17.141	19.307	50.938	34.693	10.941	133.021
E. Mental Illness	-	-	-	[illegible]	-	-
F. Sense Organ	188	56	110	-	-	354
G. Cardiovascular	55.678	52.800	418.812	319.425	131.938	978.654
H. Respiratory	19.456	5.179	20.786	22.320	7.371	75.112
I. Digestive	19.581	11.145	87.038	109.352	15.413	242.529
J. Genito-Urinary	2.002	5.010	37.753	31.512	7.134	83.411
K. Musculo-Skeletal	438	338	661	879	69	2.384
L. Abortion, Stillbirths & Congenital Dis.	56.492	1.238	551	35	15	58.331
M. Oral Health	-	-	73	70	15	159
N. Deformities	-	-	-	-	-	-
III. Injuries	59.119	65.690	517.051	71.319	8.584	721.764
A. Unintentional	56.179	87.925	299.786	41.284	5.761	490.934
1. Motor Vehicle Accidents	4.317	17.957	110.542	13.796	1.396	148.008
2. Poisoning	938	675	4.076	879	38	6.607
3. Falls	438	844	3.489	396	160	5.823
4. Fires	1.752	1.689	2.387	211	153	6.191
5. Drowning	31.593	37.714	32.245	4.640	748	106.939
6. Occupational	-	-	-	-	-	-
B. Intentional	2.440	11.539	215.870	29.790	2.182	261.821
1. Self-inflicted	-	5.348	82.411	9.385	1.297	98.441
2. Homicide and Violence	2.440	6.192	133.459	20.405	885	163.380
3. War	-	-	-	-	-	-
TOTAL Defined	881.846	386.487	1.600.218	1.032.725	295.975	4.197.251
IIII. ICD 9:780-799 (Symptoms, Signs and Ill-defined condition)	503.295	170.052	387.045	345.771	1.012.417	2.418.580

DRAFT - DO NOT QUOTE PRIOR TO AUG 19TH

FIGURE 9

IMPACT OF DISEASE AND INJURIES FROM PREMATURE MORTALITY, as measured by Life Years Lost YLL's, 1993

YLL 1993	T 0-4	T 5-14	T 15-44	T 45-64	T 65+	TT
I. Communicable, Maternal and Perinatal	421,654	108,865	371,437	246,366	85,570	1,233,893
A. Infectious and parasitic	259,186	99,014	320,169	225,118	74,431	977,918
1. Tuberculosis	751	844	29,931	26,732	8,324	66,582
2. STD's Excluding HIV	188	169	367	123	38	885
3. HIV	-	-	-	-	-	-
4. Diarrhoeal Disease	17,517	4,053	14,800	6,573	1,747	44,690
5. Childhood Cluster	188,180	67,435	1,873	879	237	258,604
6. Meninggococcal Disease	3,566	1,632	11,789	1,810	366	19,164
7. Hepatitis	-	-	-	-	-	-
8. Malaria	2,628	5,179	21,374	3,867	404	33,451
9. Tropical Cluster	-	-	-	-	-	-
10. Leprocy	-	-	294	141	15	450
11. Trachoma	-	-	-	-	-	-
12. Intestinal Parasites	-	-	73	141	-	214
13. Other Skin Disease	-	-	-	-	-	-
14. Respiratory Infections	61,309	9,851	47,192	21 108	11,140	150,599
B. Maternal	-	-	4,076	141	-	4,217
C. Perinatal	101,160	-	-	-	-	101,160
D. Pyroxia of Unknown Origin	-	-	-	-	-	-
II. Noncommunicable	175,606	84,716	1,129,771	926,993	303,247	2,620,334
A. Malignant Neoplasms	6,819	11,371	190,897	241,024	50,015	500,124
B. Diabetes Mellitus	375	338	16,930	34,992	9,667	62,302
C. Nutritional	63	113	514	668	92	1,449
D. Neurological	12,512	13,791	70,696	36,046	11,071	144,116
E. Mental Illness	-	-	-	-	-	-
F. Sense Organ	125	56	37	18	8	243
G. Cardiovascular	37,849	41,486	611,949	430,166	187,393	1,308,842
H. Respiratory	12,324	4,109	37,900	30,475	13,322	98,131
I. Digestive	11,511	5,685	94,897	97,893	17,061	227,047
J. Genito-Urinary	2,190	4,053	53,692	48,279	13,330	121,543
K. Musculo-Skeletal	125	675	1,359	1,142	198	3,500
L. Abortion, Stillbirths & Congenital Dis.	85,207	-	-	-	-	85,207
M. Oral Health	-	-	-	-	-	-
N. Deformities	-	-	-	-	-	-
III. Injuries	72,319	130,818	988,857	111,665	14,077	1,317,937
A. Unintentional	66,877	120,292	764,725	82,392	11,216	1,045,501
1. Motor Vehicle Accidents	10,448	33,661	336,328	31,477	3,472	415,385
2. Poisoning	500	394	5,252	879	92	7,116
3. Falls	938	675	5,472	1,670	320	9,076
4. Fires	1,564	1,351	9,585	352	244	13,096
5. Drowning	32,907	45,707	48,661	7,118	1,511	135,903
6. Occupational	-	-	-	-	-	-
B. Intentional	2,190	10,076	222,039	29,175	2,732	266,211
1. Self-Inflicted	-	56	106,172	12,338	1,778	120,344
2. Homicide and Violence	2,190	10,020	115,867	16,837	954	145,867
3. War	-	-	-	-	-	-
TOTAL Defined	669,580	324,399	2,490,065	1,285,225	402,895	5,172,163
IIII. ICD 9:780-799 (Symptoms, Signs and Ill-defined condition)	235,163	70,025	350,283	295,067	1,183,787	2,134,324

FIGURE 10

TOTAL IMPACT OF DISEASE AND INJURIES, as measured by Disability Adjusted Life Years, 1987

DALY's 1987	T 0-4	T 5-14	T 15-44	T 45-64	T 65+	TT
I. Communicable, Maternal and Perinatal	998,277	551,745	880,700	301,809	83,055	2,815,586
A. Infectious and parasitic	601,760	464,326	623,196	274,082	75,618	2,038,982
1. Tuberculosis	6,179	2,987	72,928	58,682	12,018	152,788
2. STD's Excluding HIV	641	105	2,838	178	27	3,789
3. HIV	5,673	334	131,779	4,820	-	142,607
4. Diarrhoeal Disease	120,932	46,375	36,057	13,600	3,259	220,224
5. Childhood Cluster	311,461	215,036	25,824	2,219	366	554,906
6. Meninggococcal Disease	6,428	7,675	8,100	1,547	363	24,113
7. Hepatitis	86	199	1,072	69	6	1,432
8. Malaria	10,245	34,479	96,053	11,172	925	152,874
9. Tropical Cluster	505	1,718	1,364	606	97	4,291
10. Leprocy	74	328	1,668	763	129	2,962
11. Trachoma	-	-	-	-	-	-
12. Intestinal Parasites	250	169	257	53	15	744
13. Other Skin Disease	0	1	4	0	0	6
14. Respiratory Infections	136,596	100,998	65,520	27,346	8,047	338,508
B. Maternal	-	-	156,072	334	8	156,414
C. Perinatal	219,703	-	110	18	-	219,831
D. Pyrexia of Unknown Origin	88,040	72,052	78,700	8,341	1,165	248,299
II. Noncommunicable	307,800	469,954	2,497,849	1,063,224	242,502	4,581,329
A. Malig nt Neoplasms	9,842	50,226	512,457	249,302	38,799	861,726
B. Diabetes Mellitus	63	281	44,332	59,069	10,972	114,717
C. Nutritional	43,937	25,837	2,955	2,029	144	74,903
D. Neurological	18,659	56,436	103,008	56,575	13,671	250,349
E. Mental Illness	5,905	24,706	157,946	5,180	458	194,195
F. Sense Organ	423	4,950	80,034	25,218	3,927	114,552
G. Cardiovascular	57,966	68,583	519,455	375,475	134,695	1,156,175
H. Respiratory	21,159	55,748	89,596	40,549	12,096	219,148
I. Digestive	40,993	36,439	206,064	139,872	18,329	441,696
J. Genito-Urinary	5,586	18,495	97,740	37,374	8,263	167,458
K. Musculo-Skeletal	438	338	60,160	36,664	3,131	100,731
L. Abortion, Stillbirths & Congenital Dis.	62,255	25,323	66,094	1,036	77	154,785
M. Oral Health	-	-	73	70	15	159
N. Deformities	9,320	48,610	164,514	14,106	1,145	237,695
III. Injuries	101,380	201,593	1,118,351	125,178	9,786	1,556,287
A. Unintentional	98,440	222,906	897,900	94,732	6,963	1,320,940
1. Motor Vehicle Accidents	43,613	144,729	668,603	63,717	2,361	923,023
2. Poisoning	3,903	8,884	44,130	4,406	276	61,598
3. Falls	438	844	3,489	896	160	5,828
4. Fires	1,752	1,689	2,387	211	153	6,191
5. Drowning	31,593	37,714	32,245	4,640	748	106,939
6. Occupational	-	-	-	-	-	-
B. Intentional	2,440	12,462	219,055	30,200	2,182	266,338
1. Self-Inflicted	-	6,270	85,596	9,795	1,297	102,958
2. Homicide and Violence	2,440	6,192	133,459	20,405	885	163,380
3. War	-	-	-	-	-	-
TOTAL Defined	1,407,457	1,223,292	4,496,900	1,490,211	335,342	8,953,202
IIII. ICD 9:780-799 (Symptoms, Signs and Ill-defined conditior	503,295	170,052	387,045	345,771	1,012,417	2,418,580

FIGURE 11

TOTAL IMPACT OF DISEASE AND INJURIES, as measured by Disability Adjusted Life Years, 1993

DALY's 1993	T 0-4	T 5-14	T 15-44	T 45-64	T 65+	TT
I. Communicable, Maternal and Perinatal	606,983	307,312	1,110,849	318,203	99,014	2,442,361
A. Infectious and parasitic	377,541	249,840	816,035	289,109	86,018	1,818,544
1. Tuberculosis	3,591	1,894	79,173	48,021	11,724	144,404
2. STD's Excluding HIV	214	215	5,028	210	44	5,711
3. HIV	10,150	304	295,228	11,776	-	317,458
4. Diarrhoeal Disease	56,563	56,656	42,239	20,293	5,119	181,568
5. Childhood Cluster	210,492	126,997	18,457	1,504	342	357,892
6. Meninggococcal Disease	4,993	3,356	13,357	1,993	391	24,090
7. Hepatitis	44	382	787	69	8	1,290
8. Malaria	3,101	15,413	59,558	7,514	635	86,321
9. Tropical Cluster	8,121	14,076	27,262	53	10	49,522
10. Leprosy	-	129	1,310	459	68	1,966
11. Trachoma	-	-	-	-	-	-
12. Intestinal Parasites	-	-	73	141	-	214
13. Other Skin Disease	0	5	34	6	2	47
14. Respiratory Infections	95,223	20,562	81,054	32,425	15,517	244,782
B. Maternal	-	-	202,800	141	-	202,940
C. Perinatal	104,795	-	-	-	-	104,795
D. Pyrexia of Unknown Origin	63,338	47,621	44,822	7,845	1,856	165,483
II. Noncommunicable	264,812	552,962	3,511,381	1,526,499	365,718	6,221,372
A. Malignant Neoplasms	8,803	19,975	709,804	368,546	63,617	1,170,746
B. Diabetes Mellitus	375	338	112,503	84,816	18,891	216,923
C. Nutritional	33,049	20,293	18,736	4,753	921	77,803
D. Neurological	14,209	48,143	148,842	82,546	16,655	310,395
E. Mental Illness	3,587	19,411	145,874	7,690	825	177,386
F. Sense Organ	125	56	27,115	19,981	14,646	61,923
G. Cardiovascular	40,735	57,542	808,776	583,945	194,720	1,685,719
H. Respiratory	13,768	83,796	150,137	50,200	21,864	319,764
I. Digestive	30,665	28,667	230,603	152,262	22,417	464,613
J. Genito-Urinary	5,396	19,945	102,665	57,173	15,274	200,453
K. Musculo-Skeletal	125	675	100,555	68,762	6,163	176,281
L. Abortion, Stillbirths & Congenital Dis.	90,363	21,883	73,704	1,341	87	187,378
M. Oral Health	-	-	-	-	-	-
N. Deformities	8,464	23,840	169,759	20,605	2,107	224,774
III. Injuries	98,561	395,189	1,933,853	172,699	18,052	2,618,553
A. Unintentional	93,118	383,564	1,689,467	142,392	15,000	2,323,541
1. Motor Vehicle Accidents	31,969	284,061	1,182,155	85,106	6,662	1,589,952
2. Poisoning	5,221	13,267	84,167	7,249	685	110,589
3. Falls	938	675	5,472	1,570	320	9,076
4. Fires	1,564	1,351	9,585	352	244	13,096
5. Drowning	32,907	45,707	48,561	7,118	1,511	135,903
6. Occupational	-	-	-	-	-	-
B. Intentional	2,190	11,174	242,292	30,208	2,922	288,787
1. Self-Inflicted	-	1,155	126,425	13,372	1,968	142,920
2. Homicide and Violence	2,190	10,020	115,867	16,837	954	145,867
3. War	-	-	-	-	-	-
TOTAL Defined	970,357	1,255,463	6,556,082	2,017,601	482,783	11,282,285
IIII. ICD 9:780-799 (Symptoms, Signs and Ill-defined condition)	235,163	70,025	350,283	295,067	1,183,787	2,134,324

FIGURE 12

DISEASE LIST (as derived from Global Burden of Disease Study)

I. Communicable, Maternal and Perinatal

A. Infectious and parasite
- 1. Tuberculosis
- 2. STD's Excluding HIV
  - a. Syphilis
  - b. Gonorrhea
  - c. Chancroid
  - d. N.S.U/C
  - e. STD Other and Unspecified
- 3. HIV
- 4. Diarrhoeal Disease
  - a. Acute Diarrhea
  - b. Dysentery
  - c. Food Poisoning
  - d. Enteric Fever
- 5. Childhood Cluster
  - a. Pertussis
  - b. Polio
  - c. Diphteria
  - d. Measles
  - e. Tetanus
  - f. Mumps
  - g. Rubella
  - h. Chicken Pox
  - i. Other Vaccine Sensitivity
  - j. Scarlet Fever
  - (k. Dengue Hemorrhagic Fever)
- 6. Meningococcal Disease
  - a. Encephalitis
  - b. Miningitis
- 7. Hepatitis
- 8. Malaria
- 9. Tropical Cluster
  - a. Rabies
  - b. Conjunctivitis
  - c. Reye's Syndrome
  - d. Tropical Ulcer
  - e. Anthrax
  - f. Yaws Infection
  - g. Leptospirosis
  - h. Trachomes
- 10. Leprosy
- 11. Trachoma
- 12. Intestinal Parasites
- 13. Other Skin Disease
  - a. Herpes zoster
- 14. Respiratory Infections
  - a. Pneumococcus
  - b. Hemophilus Influenzae

B. Maternal
- 1. Hypertensive Disease of Pregnancy
- 2. Hemmorrhage (Postpartum)
- 3. Abortion
- 4. Infection and Septicemia
- 5. Obstructed Labor

C. Perinatal
- 1. Intra-Uterine Growth Retardation
- 2. Preterm Birth

D. Pyrexia of Unknown Origin

II. Noncommunicable

A. Malignant Neoplasms
- 1. Mouth and Oropharynx
- 2. Esophagus
- 3. Stomach
- 4. Colon / Rectum
- 5. Liver
- 6. Pancreas
- 7. Trachea / Bronchus / Lung
- 8. Melanoma and Other Skin
- 9. Breast
- 10. Cervix
- 11. Uterus
- 12. Ovary
- 13. Prostate
- 14. Bladder
- 15. Lymphoma
- 16. Leukemia
- 17. Larynx
- 18. Thyroid Gland
- 19. Oral Cavity
- 20. Nasopharynx
- 21. Brain

B. Diabetes Mellitus

C. Nutritional
- 1. Micronutrient Deficiencies (Iodine, Vit A, etc.)
- 2. Protein-Calorie Malnutrition
  - a. 1st degree
  - b. 2nd degree
- 3. Anemia

D. Neurological
- 1. Cerebrovascular
- 2. Epilepsy

E. Mental Illness
- 1. Psychoses
- 2. Alzheimer's/Other Dementias
- 3. Mental Retardation
- 4. Drug Addiction

F. Sense Organ
- 1. Glaucoma
- 2. Cataracts
- 3. Refractive Error
- 4. Other

G. Cardiovascular
- 1. Rheumatic
- 2. Hypertensive
- 3. Ischaemic Heart Disease
- 4. Peripheral Vascular
- 5. Hypercholesterol
- 6. Other

H. Respiratory
- 1. COPD
- 2. Asthma

I. Digestive
- 1. Peptic Ulcer Disease
- 2. Hernia
- 3. Cirrhosis
- 4. Appendicitis,Intestinal Obstruction
- 5. Pancreatitis

J. Genito-Urinary
- 1. Renal Failure
- 2. Renal Stone
- 3. Nephritis/Nephrosis
- 4. Benign Prostatic Hypertrophy

K. Muscular-Skeletal
- 1. Joint Pain
- 2. Osteoarthritis
- 3. Laxisme
- 4. Low-back Pain
- 5. Rheumatoid Arthritis

L. Congenital
- 1. Cleft Lip/Cleft Palate

M. Oral Health

N. Deformities
- 1. Paraplegia
- 2. Quadriplegia
- 3. Blindness
- 4. Deafness

III. Injuries

A. Unintentional
- 1. Motor Vehicle Accidents
- 2. Poisoning
  - a. Insecticide Poisoning
  - b. Drug Poisoning
  - c. Mushroom Poisoning
  - d. Lead Poisoning
  - e. Accidental Poisoning By Petroleum Product
  - f. Accidental Poisoning By Persons
  - g. Cassava Poisoning
  - h. Snake Bite
  - i. Methylmercury Arsenic Poisoning
- 3. Falls
- 4. Fires
- 5. Drowning
- 6. Occupational

B. Intentional
- 1. Self-Inflicted
- 2. Homicide and Violence
- 3. War

IV. ICD 9 780-799 (Symptoms, Signs and Ill-defined conditions)
- ICD 9 780 (General symptoms)
- ICD 9 781 (Nervous, MS)
- ICD 9 782
- ICD 9 783
- ICD 9 784
- ICD 9 785 (Cardiovascular)
- ICD 9 786 (Respiratory)
- ICD 9 787 (Digestive)
- ICD 9 788 (Genito-Urinary)
- ICD 9 789 (Musculoskeletal pelvis)
- ICD 9 790
- ICD 9 791
- ICD 9 792
- ICD 9 793
- ICD 9 794
- ICD 9 795
- ICD 9 796
- ICD 9 797 (Senility)
- ICD 9 798 (Sudden death)
- ICD 9 799 (Other ill-defined)