Andhra Pradesh Burden of Disease and cost effectaveness study

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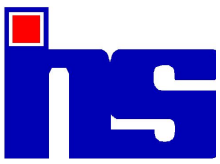

THE INSTITUTE OF HEALTH SYSTEMS

Andhra Pradesh Burden of Disease and Cost Effectiveness Study

Preliminary results of Disease Burden 24-3-1995 (NOT FOR QUOTATION)

I. Introduction

Despite considerable improvements in the health status of the communities during the past few decades,much more remains to be done. While communicable diseases are still Common in developing countires, the health systems need to cope up with the ageing populations suffering from non communicable degenerative diseases. Emergence of new illnessess like AIDS throw new challenges to the systems.

Any discussion of the health policy should start with scaling of a problem. Such Measurement is necessary as it aids in:

1. Setting health priorities: both preventive as well as curative
2. Identifying and targetting the health services to disadvantaged groups
3. Providing a comparable measure of output for different health interventions
4. Rationalising the medical educational curriculae
5. Setting direction for health research

Most of the assessments of relative importance of different diseases, so far, are based on how many deaths they cause. This has certain merits as death is an unambiguous event and the vital registration systems of many countries routinely provide the data required. Even this approach has lacunae as there are no consistent estimates of adult mortality in many developing countries as the available mortality estimates generally confine to infancy and childhood.

There are, however, many non fatal conditions which are responsible for greater losses of 'healthy life'. Disability has not been included in estimating the burden as it is considered a problem only in societies that had undergone epidemiological transition.

Hence there is an urgent need for a process through which every diseases or health problem would be evaluated in objective fashion so that the programmes which do not have ready advocates will not be ignored. With expanding role of cost-effectiveness in health care planning, the need for more comprehensive measurement of burden of disease has become more urgent.

So far, only one systematic effort was made to measure the burden of disease in Ghana for 48 causes. Recently, Christopher Murray et al have developed anew approach to qualify the burden of disease. This approach was used by the WHO and world Bank to estimate the global burden of disease, the results of which were presented in the World Development Report 1993. The unit used to measure the burden the study, the Disabiligy Adjusted Years of Life (DALYs), essentially combines:

- Duration of life lost due to premature death
- Loss of healthy life due to disability

This new indicator, the Disability Adjusted life year (DALY) uses the standard expect years of life lost (YLL) on model life table West level 26. The value of time lived at different aged is captured in calculating the DALYs using an exponential function which reflects the dependence of the young and the elderly on adults. The time lived with disability is made comparable with the time lost due to premature mortality. For this, six classes of severity of disability have been defined and each class was assigned a disability weight between 0 and 1 . Considering the fact that DALY measures the future loss, a social discount rate of three percent discount has been applied. Details of assumptions used in DALY estimation were summarised in global comparative assessments in the health sector edited by CJL Murray and AD Lopez[1]. This indicator satisfies many criteria required for an ideal indicator which are
summerised below.

II. Ideal Indicator of Health Status:

1. Comprehensive single index:

Money is unidimentional and hence it is desirable to have single unidimentional index if the process of choosing relative weights for different types of health outcomes is left entirely to the political or bureaucratic process, there is high likelihood that similar outcomes may be weighted differently at different times depending upon the political process. If a single indicator is constituted to assess the relative values of different health outcomes, the decision maker's black box is open to public scrutiny.

2. Should ensure social justice:

Any health outcome that affects social welfare in someway should be included in the indicator to assess the burden of disease. Characteristics of an individual affected by a health outcome should be restricted to age and sex. The incorporation of age in fact helps in considering the same individual at different phases of life cycle. Race, religion, income stature should not have place in constituting a health indicator.

3. Scope for comparability :

By treating all health outcomes alike, the burden of disease estimates help in comparing the disease estimates between several communities and the same community over time.

4. Individual as a unit of measure:

[1] Global Comparative Assessments in the Health Sector, Disease burden, expenditures and intervention packages edited by CSL Murry and AD Lopez WHO 1994

Many health indicators only measure disease incidence/death in a unit population in a unit time. The indicator should provide a more comprehensive picture of an individual by combining the time lived with disability combined with life lost due to premature mortality.

5. Incidence perspective:

Death rates are incidence rates and there is no alternative for mortality but for using incidence approach. In case of disability, both incidence and prevalence figures are in use. Particularly most of the community based data available in developing countries is in the form of prevalence data. The incidence perspective is more desirable to that of prevalence.

6. Ability to measure the effect of an intervention:

The index should also capture the effect of an intervention. An effective intervention should, bring down the incidence, probability of developing sequalae and death, duration of disability and severity of disability. Except the severity of disability, all other factors have been captured in this index. An intervention could be a public health or clinic based (treatment or rehabilitation).

III. DALY Estimation :

The key components in calculation of DALYs include:

- The potential years of life lost as a result of death at a given age
- Relative value of a year of healthy life lived at different ages
- Extent of time preference for human life and health or discount rate
- Disability weights used to convert life lived with disability to a common measure with premature death.

About 109 categories of disease (ICD9), which are responsible for more than 95% of all causes of death and disability, have been included in this study.

A. Duration of life lost due to premature death:

For each death, the number of years of life lost was defined as difference between the actual age at death and expectation of life at the age in a low mortality population. The western model life table used in the study gives an expectation of life at birth of 82.5 yrs and 80 yrs for females and males respectively. Thus, a female death at 40 yrs will represent a stream of lost which is equivalent to female expectation of life at are 40 or 43 yrs. Where available, records cause of death were used. When recorded information was not available, expert judgment was Sought.

B. Value of healthy year of life lived at each age:

Most societies attach more importance to a year of life lived by a young or middle age adult than to a year of life lived by a child or elderly person. So, age specific weights have been provided. It is, however, important to notice that though the first year of life receives a very low weight, the life of a new-born is valued according to the weights of all the years he or she is expected to live, that is, according the sum of future years. In the absence of discounting greatest loss of DALYs will be from premature deaths of infants death.

C. Time preference:

Societies typically prefer to have a given amount of consumption today rather than tomorrow. Since the estimates are being made for the current levels of death and disability, it is felt necessary to incorporate a social discount rate of 3% year so that future is valued exact as the present. Higher discount rates will reduce the total burden of disease and may also alter the relative importance of different diseases as they raise the importance of disability compared to mortality.

D. Disability weights:

In a scale of 0-1, if zero represents perfect health and I death, the disability weights need to be assigned in between. For measuring the severity, disabilities were classified into six classes based on the extent of sensory, motor and emotional deprivation. These weights have been assigned by a group of independent experts following the guidelines listed in the table.

Class	Description	Weight
I	Limited ability to perform at least one activity in one of the following areas: Recreating, education, procreation or occupation	0.096
II	Limited ability to perform most activities in of the following areas: recreating, education, procreation or occupation	0.220
III	Limited ability to perform activities in two or more of the following areas: recreating, education, procreation or occupation	0.400
IV	Limited ability to perform most activities in all the following areas: recreating, education, procreation or occupation	0.600
V	Needs assistance with instrumental activities of daily living such as meal preparation, shopping or housework	0.810
VI	Needs assistance with activities of daily living such as eating, personal hygiene or toilet use	0.920

IV. Genesis:

Subsequent to the Global Burden of Disease study, National Burden of disease studies have been planned to provide more insight to the burden of disease approach. The countries where national burden of disease studies have been initiated include: Mexico, Columbia, South Africa and India. While in other countries these studies have been planned at National level, in India-considering the vast population and reported diversity in disease pattern - it was felt appropriate to make estimations at state/regional level to begin with. This resulted in the genesis of the Andhra Pradesh Burden of disease and cost effectiveness of health intervention study. Supported by the world bank, this study has been undertaken by the Administrative staff college of India in technical collaboration with the Harvard centre for population and Development studies.

V. Area and people:

The State of Andhra Pradesh, located in the coastal south India extending on to the Deccan Plateau, is the fifth largest state in India with a population of 66.3 million[2]**.** The state has 23 districts spread over three distinct geographical regions which include coastal Andhra with large coastal plains and fertile deltas, Rayalaseema which is drought prone and interior dry Telangana region. While the coastal plains constitute the most developed part of the state, Telangana region is more backward in terms of social development. Lack of rains and chronic hunger is a common feature of Rayalaseema.

A large majority of the state's population (73%) reside in rural areas consisting of about 29,400 villages. About 27% of the state's population reside in 250 urban town and cities, a trend more or less common to the rest of the country. About 80% of the urban population is residing in 66 town having population more than 50,000 and the three corporations of Hyderabad, Vijayawada and Visakhapatnam.

About 15.9% of the population belong to scheduled castes while scheduled tribes constitute 6.3%. According to 1991 census, the estimated percentage of literate among population aged seven years and above was 45.11% (Males:56.2%; Females:33.7%) compared to the national average of 52.1%. The growth in the literacy rates between 1981-91 was to the extent of 9.45%. Though nearly 2/3rds of females above 7 years were illiterates in Andhra Pradesh, it is interesting to note that the percent growth in literacy during the past decade was more or less similar in both sexes (Males:9.4%;Females:9.55%). From a strong agricultural base, the state economy has, over the years, diversified into industry and science. The National Sample Survey Organisation's estimates of poverty during 1977-78 (32nd round) and 1983-84 (38th round) indicate that rural poverty in the declined from 45.45% to 38.67%. The corresponding decline in the urban poverty during the same period was from 37.02% to 29.4%.

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[2] 1991 census

Considering the variations in living conditions and access to health and related services, separate estimates have been made for urban and rural areas. The census definition of Urban areas was used to distinguish from the rural areas.

VI. Objectives:

- To estimate the burden caused by about 100 common diseases including injuries and accidents in Andhra Pradesh using the Disability Adjusted Life Years approach.
- To compare the disease burden of urban and rural areas AP and
- Study the cost effectiveness of about 200 health interventions using DALYs as measure of effectiveness

Methods:

The essential approach used in Andhra Pradesh Burden of Disease Study is to look around for relevant data, discuss with respective experts and to arrive at the preliminary set of estimates on mortality and disability for each disease. This is followed by a consistency check for validation of the estimates and next set of estimates. The entire process involved several rounds discussions and series of workshops involving disease experts, researchers, demographer and programme mangers.

As mentioned in the introduction the Disability Adjusted Life Years has two important components. They are

- Years of Life Lost (YLL) due to premature mortality
- Years of Life lived with Disability (YLD)

For estimation of YLL demographic data to age, sex and cause specific mortality rates are required while YLD requires epidemiological data on incidence, prevalence, severity and complications or sequelae. The epidemiological estimates are also used to check the consistency of demographic estimates and vice versa.

The estimates of burden are made for 1991 as it happens to be the Census year and hence provides true population distribution.

VII. Demographic Estimates:

A. Age specific mortality:

A preliminary workshop was conducted to identify the sources of mortality data. Two important sources of population distribution and age specific mortality listed were the 1991 Census and Sample Registration Scheme (SRS) data. In addition community based studies undertaken from Andhra Pradesh which provided information mortality were listed during the workshop.

The final population totals for AP from 1991 census are not yet available. However , the primary census abstract provides preliminary data on population by sex below 6 years and above 6 years separately for urban and rural areas. Enquiry with registrar General's office indicated that it may take one more year to complete the detailed analysis of 1991 AP Census data. Population distribution by single age intervals will be available then only. Hence ,as a first pass, the Sample Registration Scheme (SRS) estimates for urban and rural Andhra Pradesh have been used to develop life tables for males and females. The SRS data provides population and mortality rates for five year age intervals. Validation of SRS data using Horiuchi technique [3] had shown that the extent of under registration was not more than 5%.

A review of the large-scale studies under taken in the state revealed that the National

[3] Mortpak UN

Family Health Survey undertaken by ASCI (1991) provided information on children ever borne. When the actual population distribution is made available from Census data, the SRS estimates will be replaced by them.

B. Preliminary disease list preparation:

To begin with a preliminary disease list was prepared after reviewing the available data and discussing with the local disease experts and demographers. The diseases were broadly grouped under three categories. The group I included the pre-transition diseases: communicable, Maternal and perinatal. Considering the fact that nutrition deficiency disorders tend to be predominate in pre-transition period, we have included them to this group I. The Group II included non communicable and degenerative disorders while injuries and accidents were included in Group III. As the cause of death and disease pattern emerged this preliminary disease list was modified to ensure that it captures all the major causes of mortality and morbidity in AP. The final disease list is presented in annexure.

C. Cause of Death determination:

Like many developing countries the Vital Registration system in India is poor both in terms of coverage as well as content. The usual option in such situation is either to use cause of death models or to estimate the cause of death pattern using epidemiological approach. The model based estimates of cause of death may not capture the true cause of death pattern in developing countries as they are mostly based on past mortality patterns observed in developed countries. They are also influenced by changes in ICD revisions and diagnostic practices. In case of epidemiological estimates, adequate data may not available for all disease to make estimations. Another option is to make the cause of death estimates using data from sample registration schemes or disease surveillance systems. In India two schemes provide information on cause of death pattern. Survey of cause of Death provides cause of death information for broad cause groups in rural areas using Verbal Autopsy techniques while Medical Certification of Death provides physician certified cause of death information from selected hospitals.

1. Cause of death estimation for rural AP:

The survey of cause of Death (SCD)- started as Model Registration Scheme in 1960's by the registrar General, India -provides cause of death information in rural India. The objective of the scheme is to provide cause of death profile in rural India using 'lay reporting' method. IN each state sampling units are selected using standard guidelines to ensure representativeness. Each sampling unit covers between 300 to 500 rural residents. The state of Andhra Pradesh at present has 150 sampling units covering a population of 0.675 million which is about 15 of the total population.

The field work is carried out by trained para medical worker (called field agent) of the selected primary Health Centre. The field agents are trained in the verbal autopsy techniques and provided a set of

guidelines for classification of diseases by a non-medical list of causes of death prepared by the office of the Registrar General of India. This procedure involves isolation of major cause groups by way of elimination and final identification of specific cause in stages. The field work is restricted to the sample village. The field agent contacts the local resident informants regularly at short intervals to obtain information on births and death in the survey area. On the basis o f this information he or she visits the households where deaths were reported to have occurred and investigates the symptoms and conditions observed prior to death in order to determine the probable cause of death. Another staff member of the primary Health Centre, called the Recorder, conducts the base line survey and subsequently half yearly surveys to ensure that all deaths have been investigated. He also maintains a 'notional map' of the sample village and checks the births and deaths recorded by the field agent every month. The medical officer of the PHC scrutinses the deaths recorded by the field agent every month and investigates independently at least two deaths or 10% of deaths recorded to validate the information collected b y the field agent.

Constraints of SCD data:

a. Methodology:

The verbal autopsy is essentially based on two assumptions:

- Each disease will have unique set of symptoms at the time of death
- The attendants can provide detailed description of events that led to death

Both these assumptions may not always hold good. There could be overlap of symptoms or the attendants may not be in a position to provide the detailed description of symptoms at the time of death. Another important determinant in verbal autopsy technique is the ability of the interviewer.

b. Large number of unclassified deaths:

Under SCD the cause of death determination is done in a phased manner. Each death is initially classified under 10 major groups and then specific cause is determined. In case of deaths with inadequate information, the tendency of some health workers is to include the death in the major group without further probing. Even though these deaths were classified in a major group, it is difficult to include them in a specific cause group. Hence, we have included these deaths under "not classifiable" category.

We have undertaken preliminary analysis of SCD data from the state of AP for a period of six years (1988-93) . A total of 10,770 deaths (Males:5979;Females:4791) have been reported during this period. Out of these deaths 37.5% were included under the 'not classifiable' category two thirds of the deaths included under 'not classifiable' category and 25% of the total deaths were due to senility.

c. Cause of death information restricted to broad groups:

The SCD provides cause of death information only for 10 broad groups. Another constraint was that the methodology does not provide scope for classifying some of the causes which are described more on the basis of symptoms. Conditions such as jaundice, convulsions, congestive heart failure fall under this category. Similarly all cancers were included in a single group. Considering the fact that verbal autopsy technique is being used to obtain the cause of death information in SCD these constrains are quite plausible.

d. Improving the quality of SCD data:

We have tried to further improve the quality of SCD data. This is done in four stages.

- Initial review of cause of death description given for the unclassified deaths by medical experts.
- Field enquiry of 301 deaths included in not classifiable category during 1992-93 (all the deaths with records available covered)
- Separate survey of 139 deaths classified under 'senility' during 1994 by trained experienced investigators to get more detailed description on events that led to death and symptoms at the time of death.
- Review of the field data by committee of experts (Physician, Paediatrician and Public Health Specialist)

Out of a total 440 deaths subjected to expert opinion and field enquiry 436 (99%) could be classified. Based on this feedback we have added few more categories of diseases to the SCD list which are presented in annexure. For example , enquiry revealed that 'electric shock' is an important cause of death in rural males. Using this data an algorithm was developed to classify the deaths included in not classifiable category of SCD deaths.

e. Allocation of ICD coding and matching with APBD disease list:

As a first step we have allocated ICD codes for the SCD deaths whose cause of death description matched with the ICD 9 codes. The proportionate mortality for different causes thus obtained was applied to the estimated age and sex specific deaths for rural AP and matched with the APBD preliminary list of diseases. All the causes that were responsible for more than 0.1% of total deaths were then listed. For all the SCD cause descriptions which could not be classified and responsible for more than 0.1% of the total deaths an algorithm was developed for distribution to the most plausible group. Some of these examples include: Bronchitis and asthma which were reported together, convulsions, paralysis, jaundice etc. The details of the algorithms used are presented in the table.

2. Estimation Cause of death for Urban AP:

As a first step we have undertaken a preliminary analysis of vital registration data in urban area and found that content is poor. The registrar general of India operates another scheme 'The Medical Certification of Cause of Death (MCCD)'. Under this scheme the physician certified deaths from selected hospitals are analysed to provide cause of deaths pattern. This data is available in the form of three digit ICD 9 coding.

The basic question is to what extent the hospital data can represent the cause of death pattern in urban areas. The coverage of the urban deaths under this scheme in AP was found to be only one third.

A review of recent MCCD reports and personal visit of the project co-ordinator to RG's office revealed that in the neighbouring state of Maharashtra more than 80% of the urban deaths are medically certified. Considering the proximity of the states and genetic similarity of population, we have assumed that the cause of death pattern in urban Maharashtra closely resembles that of urban AP.

MCCD data from Maharashtra state covering a period of five years (1986-90) was obtained and aggregate cause specific proportionate mortality rate were calculated for APBD age groups separately for both sexes. These rates were applied to the estimated deaths for urban AP in each age and sex group to arrive at the first estimates of cause specific deaths in urban AP.

We first distributed the estimated deaths which matched with the APBD list of diseases. All the remaining deaths which are responsible for more than 0.1% of total deaths were distributed using an algorithm presented in the table.

VIII. Final APBD disease list:

After going through the list of major unclassified deaths in rural and urban AP, the disease list was finalised. Where ever felt necessary, new disease was added and some diseases were excluded . For example, Japanese encephalitis was added in communicable diseases while leishmaeniasis was excluded. Similarly electric shock and bites by venomous snakes were added in injuries and accidents. Since available cause of the death data can not distinguish between acute and persistent diarrhea, we have included all the diarrhoeas in one group. This decision was also influenced by the fact that interventions for diarrhoea - irrespective of the clinical forms - are similar.

IX. Epidemiological estimations of mortality and disability:

Epidemiological estimates on disability and mortality were made for each of the disease included in the list. Considering the fact that SCD data can provide only broad leads we have further validated the estimates for each disease using epidemiological approach. Similarly , we have also validated the estimates of cause of death in urban areas made on the basis of Maharashtra MCCD data.

A. Disease experts and literature review

For each of the disease included in the list experts have been identified through reference and contacting National laboratories. The first round of communication was sent to them which described the methodology with a request to provide first set of estimates on incidence, prevalence, case fatality and remission rates for their respective diseases. The experts wee also requested to quote the sources on which their estimates are based and give their opinion on quality of available data. This was followed by personal visits of a project team member to different parts of the state and some of the National laboratories to clarify any doubts and to get more information on available epidemiological data in the state/country.

Mean while, a detailed literature search was undertaken to get compile the epidemiological studies on each disease giving first preference to community based studies undertaken in AP. Information was also obtained from post graduate dissertations and small scale surveys undertaken in different parts of the state through departments of community medicine. If there are no good community based studies available from the state, studies undertaken in neighbouring states or at national level were considered. For example, in case of cancers, the reported incidence from Madras cancer registry was used for epidemiological estimates. If adequate information is not available even at National level, data from comparable studies in neighbouring countries was considered. For example, in case of chlamydia we could not get any community based studies from India and all the studies reviewed were hospital based. Hence, reported prevalence figures from Asian population in Singapore were used to arrive at the preliminary estimates. If no data is available from neighbouring countries, the GBD approach of using data from other comparable country was used. Use of hospital based studies was essentially restricted for estimation of case fatality and remission rates.

For all the diseases with National programmes surveillance data was obtained from the concerned programme manager. This information was particularly useful in estimations of vaccine preventable diseases as immunisation coverage significantly alters the disease pattern.

The details of quality of reviewed studies are presented in Table. As it is evident from the table that better epidemiological data is available for Group I diseases. The estimates for some of the Group II diseases hence were based on small scale studies and studies published from other countries. To make the approach used

more explicit we have provided two examples of epidemiological estimations which include Tuberculosis with good epidemiological data and Non Insulin Dependent Diabetes Mellitus with poor epidemiological data.

After first round of literature review, expert comments and programme data analysis a workshop was held. The participants included core expert, local disease experts, programme managers and public health specialists. The first set of epidemiological estimates of all chronic diseases made were subjected to consistency using the Harvard disease model (DISMOD) which uses the known relationships between incidence, prevalence, case fatality and remission [4].In case of acute diseases responsible for large number of deaths, consistency of epidemiological estimates were checked with the cause of death models.

B. Final estimates of cause of death:

A combination of sources were used to estimate the cause of death pattern. Firstly all estimations of injury and accidents based on survey reports for rural and urban areas were taken as such. Then the proportionate distribution of deaths in group I and group II from epidemiological approach was compared with that of survey data. In urban areas only marginal differences were noticed between the two sets of estimates. Hence, the survey distribution fro group I and II was taken as such while the distribution of deaths within each group was based on epidemiological estimations.

In case of rural areas, however, some inconstancies were noticed. As mentioned earlier the SCD data provides information only for broad cause groups and some of the cause of death descriptions such as convulsions, congestive heart failure, jaundice etc. Essentially describe symptoms which may occur due to many diseases. The major discrepancy was noticed in case of symptoms which may occur due to many diseases. The major discrepancy was noticed in case of Diarrhoea and ARI where the SCD data tended to under estimate the deaths particularly in 0-4yrs. The reported validity of verbal autopsy for childhood deaths varied considerably between studies. Studies in Kenya have shown that the sensitivity of verbal autopsy techniques was low for API[5]. The deaths estimated from epidemiological approach were also compared with model based estimates using persons cause of death models of countries with comparable mortality pattern. Preston[6] made an estimate o f cause specific mortality rate for 12 major causes of death using data from 48 Nations with a range of life expectancies from 27 to 77 yrs. From this data we have calculated proportionate mortality rates due to diarrhea for three countries which had general mortality rates comparable to India. All these estimates suggest a proportionate mortality due to diarrhoea was between 23-2d9% in the 0-4 years which is consistent with the epidemiological estimates. Studies on diarrhoea mortality report a cause specific

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[4] CJL Murray & A D Lopez; Quantifying disability: data methods and results; Bull of WHO 1994,72 (3) : 481-494

[5] Snow RW et al Childhood deaths in Africa: uses and limitations of verbal autopsies. Lancet 1992 340:351-55

[6] Samuel H preston:causes of Death, life tables for National Populations: seminar press 1972 ISBN 0-12-895550-3

mortality between 0.8 to 1.5/1000 among children in 5-14 and 0.4 to 2.5 per 1000 per year in case of adult[7] [8] [9].Hence, for diarrhoea and ARI we have based the estimates more epidemiological approach.

We have taken the mental mortality rates as reported from the survey data for both urban and rural areas. However, in case of perinatal mortality the SCD data seemed to be an over estimate. An estimation of neonatal mortality was made on the basis of observed relationship between the neonatal and post neonatal mortality[10] . The estimates suggested that perinatal mortality estimates based on survey data were higher in rural areas while in urban areas they matched fairly well. Considering these constraints we have essentially used the epidemiological approach to estimate the cause of death pattern in rural areas while estimates based SCD data were used as such for injuries & accidents, Maternal Mortality and for checking the total estimated deaths under broad groups such Gastrointestinal, Chronic respiratory disorders, Neuropsychirartric diseases etc.

X. Results:

A. Probabilities of dying:

The first round of estimates suggest that probability of dying in 0-14 years in AP is less compared to all India average for both sexes (Males: 13% Vs 15%; Females : 11% Vs 16%) . Both urban and rural AP fared better than all India average. This trend, however, altered for the later age groups. While marginal differences were noticed among males in 15-59 years (Males:AP: 28%; India 27%), no difference was noticed among females. In 60-69 years age group the probability of dying in AP was higher than that of all India averages for both sexes (Males:AP: 40%,India:32%;Females:AP :29%, India 26%).

Between the urban and rural areas, probabilities of dying were lower for all age groups in urban areas. Lower child mortality and higher adult mortality in AP compared to India suggest that health interventions targeted at children are more effective in AP. This also indicates that the demographic transition process is more advanced in AP compared to the National average.

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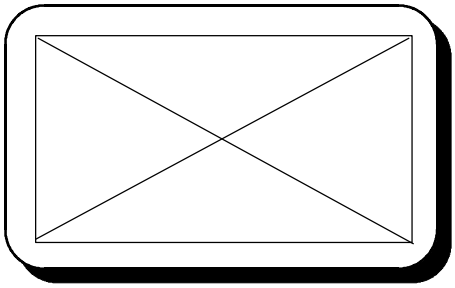
[7] EI Alamy MA et al. The incidence of diarrheal disease in a defined population of rural Egupt. American journal of Tropical Medicine and Hygiene, 35:1006-1012 1986

[8] Nazir HZM et al, the incidence of diarrhoeal diseass and diarroheal disease realted mortality in rural swampy low-land area pf south sumatra,Indonesia. J of tropical paediatrics, 31: 268-272.

[9] Shaikh k et al. Pattern of diarrhoea deaths during 1968-1987 in a demographic surveilance area in rural Bangladesh.J of diarrhoeal diseases research 8:147-154(1990)

[10] CJL Murray & jose luis Bobadiila; Epidemiological Transitions in the formerly socialistEconomies: Divergent patterns of mortality and causes of Death; Health Transition Working Paper series No.94.07 1994.

B. Cause of death



a. Cause of death pattern for all ages:

The estimated cause of death pattern for all age groups in urban and rural AP is presented in the figure. While Group I diseases predominated in rural areas, Group II diseases were responsible for higher mortality in urban areas. About 11% of deaths in rural and 8% in urban areas were due to injuries and accidents. In both rural and urban areas unintentional injuries constituted the majority of Group III deaths. The proportion of deaths constituted by intentional injuries was higher in rural areas compared to urban areas (28% Vs 7%). Eighty seven percent of estimated intentional deaths in rural areas were self inflicted compared to 37% in urban areas indicating a higher suicide rate among rural residents.

When the cause of death pattern in AP for all ages and both sexes was compared with that of India the proportion of deaths due to Group I (50.1% Vs 43.3%) and Group III (10.3% Vs 6.5%) diseases was higher in AP. Considering the lower probabilities of dying in 0-4 years in AP, where Group I diseases predominate, this trend is surprising.

b. Cause of death pattern by sex:

Similar trend was observed when cause of death pattern was compared between the sexes. While Group I deaths predominated among both sexes in rural areas, deaths due to Group II were higher in urban areas. In both areas proportionate distribution of deaths due to Group II was higher among females. This difference was more marked in case of urban area. This is quite plausible considering the fact that females are considered to be genetically stronger than males and hence less vulnerable to infectious diseases. One interesting feature is that proportionate mortality due to Group III deaths between the two sexes was more or less similar in rural areas while in urban areas males tended to have marginally higher mortality due to injuries and accidents compared to females.

c. Cause of death pattern by age:

0-4 years:

About 90% of the estimated deaths in this age group were due to Group I diseases. The proportions of deaths due to Group I diseases was higher in rural areas compared to urban areas (91% Vs 85%). The leading causes of death included perinatal conditions (M:27.4%, F:26.6%) ARI (M:22.2%, F:23.9%),

Diarrhoea (M:19.1%, F:18.9%) and Measles (M:6.6%, F:7.5%) in rural areas. Even in urban areas, excepting measles, the same causes were responsible for maximum number of deaths. The higher proportion of Group II deaths in urban areas was mainly due to congenital anomalies. While proportions of Group III deaths are comparable between rural and urban areas among male children, proportion of deaths due to injuries and accidents was higher among rural female children compared to their urban counterparts. Most common cause of the Group III deaths among the girl children was "fall". No such difference in Group III causes was noticed between the sexes in urban areas. It is difficult to say to what extent this is due to gender discrimination and female infanticide. This aspect, however, requires further in-depth studies.

5-15 years:

In this age group also the Group I causes of death predominated. While about a quarter of the estimated deaths in urban areas were due to Group II causes, only about a tenth of the total deaths were due to non communicable diseases in rural areas. The leading causes of Group I deaths were due to non communicable diseases in rural areas. The leading causes of Group I deaths included ARI, Anaemia, Diarrhoea and Measles in rural areas and ARI in urban areas. The proportion of deaths due to injuries and accidents in this age group was much higher in rural areas compared to urban areas (Males: 38% Vs 17%; Females:24%Vs 17%). The leading cause of accidents in rural areas was "Drowning" while in urban areas it was "Motor Vehicle Accidents".

15-45 years:

While the Group I diseases still predominated the cause of death at state level, the difference between the proportionate mortality due to Group I and Group II diseases was less marked in urban areas compared to rural areas. Among the estimated deaths the leading Group I cause of deaths in males was Tuberculosis in both rural and urban areas. In case of females also tuberculosis was estimated to be a leading cause among Group I deaths. However, in rural areas deaths due to maternal conditions contributed equal number of deaths. Marked difference in proportionate mortality due to maternal conditions was noticed between rural and urban areas (32.3% Vs 6.5%). The leading causes of Group II deaths among males included digestive disorders, cardiovascular diseases and cancers in both urban and rural areas. The leading Group II causes among females included cancers and cardiovascular diseases. The most common cancers among males were that of Mouth & oropharynx, Esophagus, Stomach and Lymphomas & Leukaemias. In females cancer of cervix, breast and oesophagus were more common.

Deaths due to injuries and accidents constituted a major cause of death in this age group. In rural areas higher proportion of deaths were caused by unintentional injuries among males compared to intentional injuries (18% Vs 12.7%). The leading cause of unintentional injury among males in rural areas was motor

vehicle accidents and while self inflicted predominated among intentional injuries. In case of rural females the proportionate mortality due to intentional injuries was higher than that of unintentional (13.2 Vs 11.7%). The leading causes of death were fires and self inflicted respectively among non intentional and intentional injuries. In urban areas the unintentional injuries predominated in both sexes (Males: 23.5% Vs 2.4%,Females: 31.6 % Vs 1.8%). Similar to rural areas, the Motor Vehicle Accident was the leading cause of death among intentional injuries in urban males. In case of females, however , fires were reported to be the leading cause . Thus fires emerge as a leading cause of Group III death among females irrespective of the place of residence. Some of the deaths reported under unintentional fires could be due to suicide or even homicide. It is, however, difficult obtain reliable information on exact cause of death in such circumstances.

45-59 years:

In both rural and urban areas the Group II deaths predominated in this age group. It is however, interesting to notice that still a third of total deaths from rural areas were estimated to be due to Group I conditions both among males and females while in urban areas about a quarter of deaths in this age group were estimated to be due to Group I conditions. The most common Group I cause of death was Tuberculosis among males and females irrespective of their place of residence. Among Group II conditions IHD, cancers and Cirrhosis were estimated to be the leading causes among males in both rural and urban areas. Among females Cancers, Cerebro Vascular Accident and IHD were the leading causes of death. Group III deaths were more or less uniformly distributed. In rural females deaths reported under the category of "Self Inflected" tended to be higher.

60 + years:

Majority of the deaths in this age group were estimated to be due to Group II conditions . The proportion of Group I deaths among rural males was higher than urban males (25% Vs 22%) while no such difference was observed among females. Tuberculosis, Respiratory Infections and Diarrhoea were the leading Group I cause of deaths in this age group. Among Group II diseases, Ishaemic Heart Disease, Cerebro Vascular Accidents, Cancers, COPD and Cirrhosis Liver were the leading causes of death among males. More or less similar trends were noticed among females except for lower estimates of deaths due to Cirrhosis. In urban males also deaths due to cirrhosis were less.

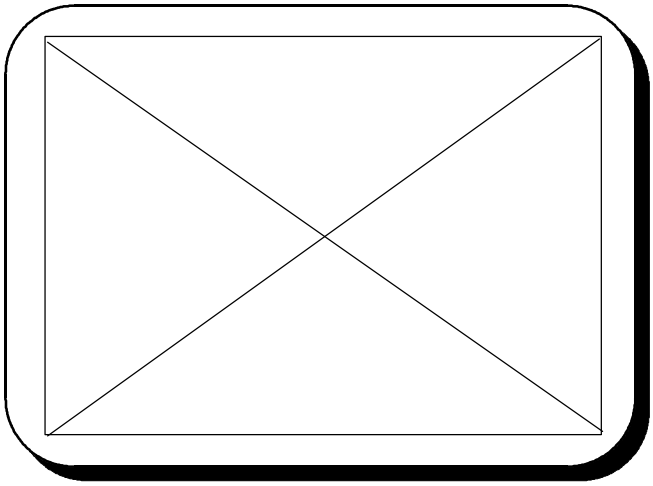
C. Disability Adjusted Life Years Lost in APs:

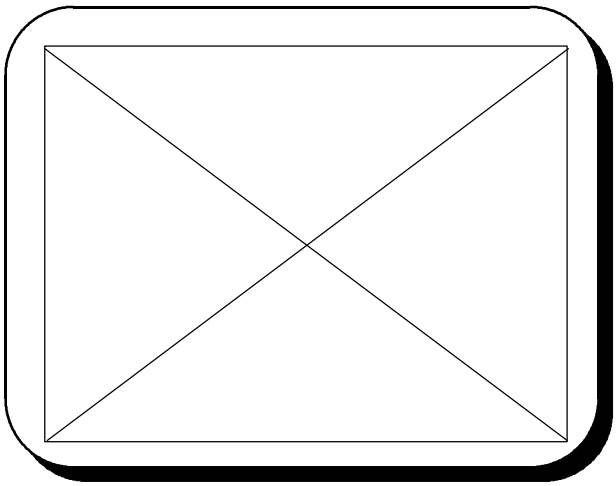
1. Total DALYS lost:

The preliminary estimates indicated that 17,657,518 total DALYs were lost in Andhra Pradesh during the year 1991. Out of the total DALYs lost 14,037,909 (79.5%) were estimated to be from rural areas and the rest (20.5%) were contributed from residents of urban areas. Considering the fact that rural population

constituted 73% of the total State's population it is evident that disease burden is higher among rural residents. About 52% of the total DALYs lost were contributed by males and the rest by females.

2. DALYs lost per 1000 population:

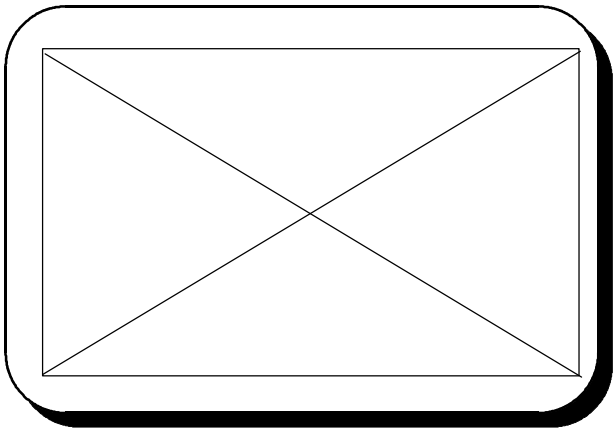


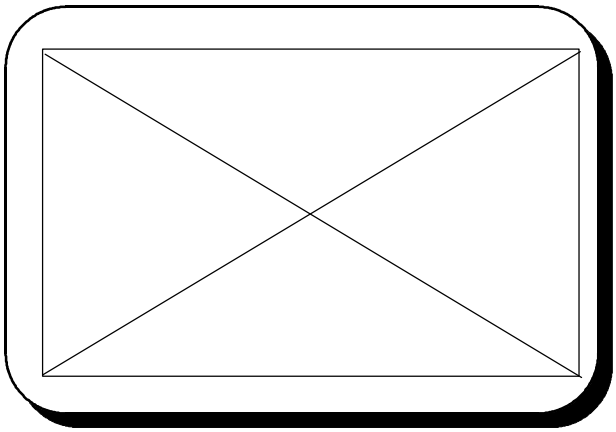


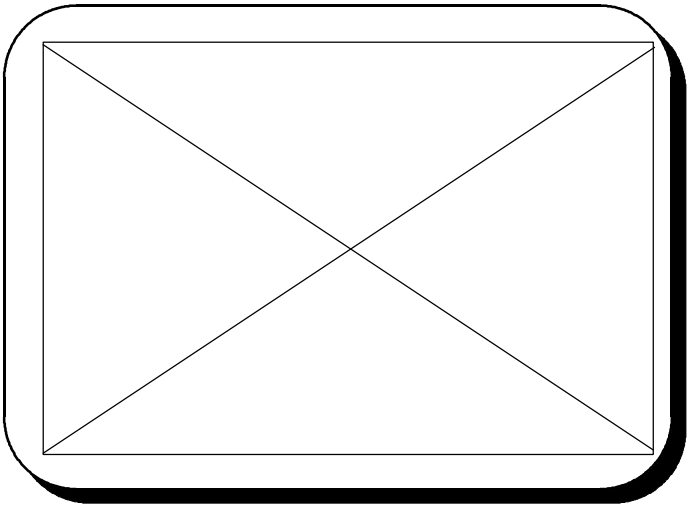
3. DALYs lost due to YLL:

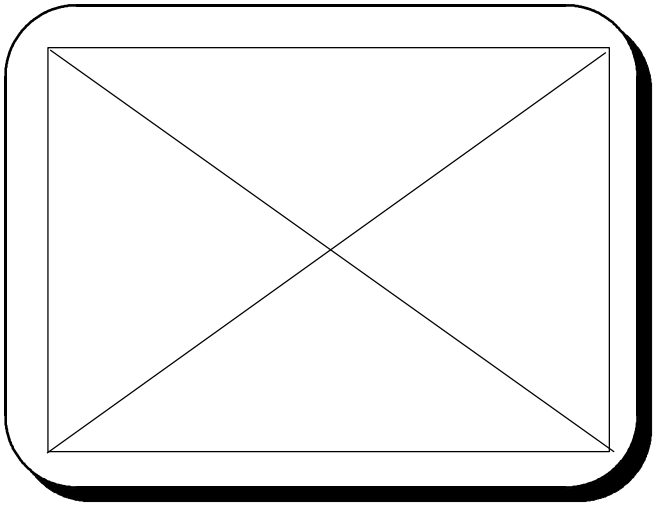
At the aggregate level DALYs lost due to YLL were responsible for two thirds (68.2%)of total DALYs lost. In both rural an d urban areas YLL contributed a majority of total DALYs lost. However, the proportion of DALYs lost due to YLL was higher in rural AP compared to urban AP (69.3% Vs 63.6%). Between the sexes, males lost higher DALYS due to YLL in both rural and urban areas (Rural : Males:72%,Females: 66.5%; Urban: Males: 67.3%, Females:59.18%).

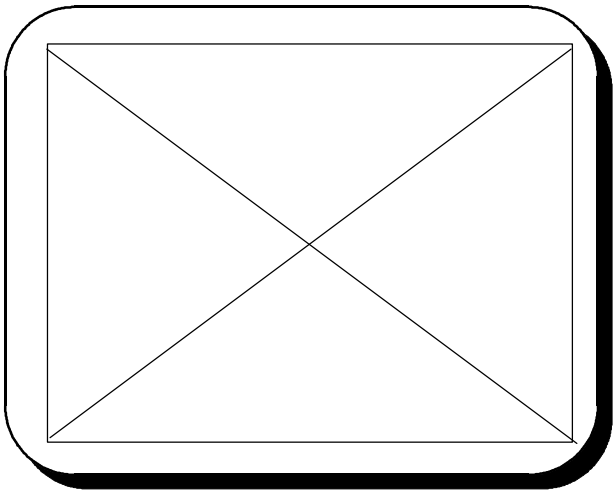
4. DALYs lost by major Groups:

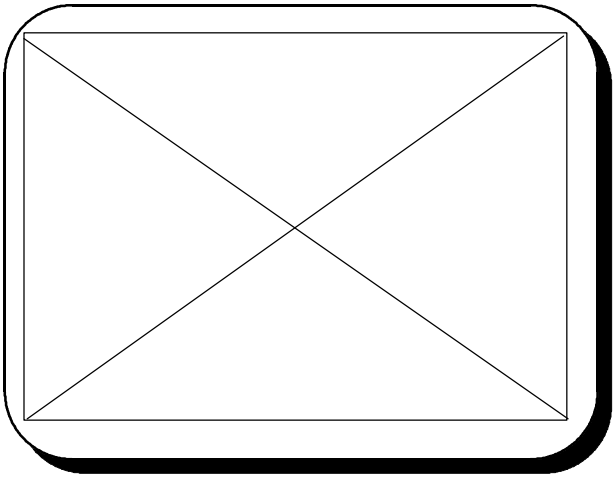












XI. Leading causes of DALY loss

As shown in the figures the major causes of DALY loss in Group I diseases include Tuberculosis, peri natal and diarrhoea. Females residing in rural areas lost nearly double the DALYs/1000 population due to Maternal conditions compared to their urban counterparts.

DALYs lost due to Measles, Tetanus were lower in urban areas which could be attributed to better immunisation coverage and cleaner delivery practices. DALYs lost due to diarrhoea in urban areas were nearly half that of areas indicating better access to safe water and sanitation.

XII. Summary and conclusions:

Life Table for AP Rural Male										
x	n	Mx	ax	qx	Px	Ix	dx	Lx	Tx	ex
0	1	0.08	0.3	0.07	0.93	100000	7396.17	94822.68	5725792.3	57.26
1	4	0.01	0.3	0.03	0.97	92603.83	2972.01	363282.49	5630969.62	60.81
5	5	0	0.5	0.01	0.99	89631.82	803.07	446151.4	5267687.13	58.77
10	5	0	0.5	0.01	0.99	88828.74	795.88	442154.03	4821535.73	54.28
15	5	0	0.5	0.01	0.99	88032.87	1223.89	437104.6	4379381.7	49.75
20	5	0	0.5	0.02	0.98	86808.97	1718.99	427947.4	3942277.09	45.41
25	5	0	0.5	0.02	0.98	85089.98	1392.5	421968.68	3512529.7	41.28
30	5	0	0.5	0.02	0.98	83697.49	1903.16	413729.55	3090561.02	36.93
35	5	0.01	0.5	0.03	0.97	81794.33	2099.36	403723.26	2676831.47	32.73
40	5	0	0.5	0.02	0.98	79694.97	1928.9	393652.61	2273108.21	28.52
45	5	0.01	0.5	0.05	0.95	77766.07	4015.2	378792.37	1879455.6	24.17
50	5	0.01	0.5	0.07	0.93	73750.87	5022.4	356198.38	1500663.23	20.38
55	5	0.02	0.5	0.1	0.9	68728.48	6918.54	326346.04	1144464.85	16.65
60	5	0.05	0.5	0.21	0.79	61809.94	1347.54	276430.86	818118.81	13.24
65	5	0.06	0.5	0.27	0.73	48762.4	13142.54	210955.67	541687.95	11.11
70	5	0.11	@NA	1	0	35619.87	35619.87	330732.27	330732.27	9.29

Life Table for AP Urban Male										
x	n	Mx	ax	qx	px	lx	dx	Lx	Tx	ex
0	1	0.07	0.3	0.06	0.94	100,000	6,217.12	95,648.02	6,147,638.88	61.48
1	4	0.01	0.4	0.03	0.97	93,782.88	2,369.25	369,445.31	6,051,990.86	64.53
5	5	0	0.5	0	1	91,413.63	455.93	455,928.31	5,682,545.55	62.16
10	5	0	0.5	0	1	90,957.7	363.1	453,880.73	5,226,617.24	57.46
15	5	0	0.5	0	1	90,594.59	451.84	451,843.36	4,772,736.52	52.68
20	5	0	0.5	0.01	0.99	90,142.75	1,119.79	447,914.29	4,320,893.16	47.93
25	5	0	0.5	0.01	0.99	89,022.96	753.49	443,231.09	3,872,978.87	43.51
30	5	0	0.5	0.01	0.99	88,269.47	965.65	438,933.22	3,429,747.78	38.86
35	5	0	0.5	0.01	99	87,303.82	1,256.79	433,377.11	2,990,814.56	34.26
40	5	0.01	0.5	0.04	0.96	86,047.02	3,374.39	421,799.14	2,557,437.45	29.72
45	5	0.01	0.5	0.03	0.97	82,672.63	2,683.91	406,653.38	2,135,638.31	25.83
50	5	0.02	0.5	0.07	0.93	79,988.72	5,819.46	385,394.94	1,728,984.93	21.62
55	5	0.02	0.5	0.11	0.89	74,169.26	8,429.52	349,772.49	1,343,589.99	18.12
60	5	0.03	0.5	0.15	0.85	65,739.74	10,104.47	303,437.52	993,817.51	15.12
65	5	0.05	0.5	0.24	0.76	55,635.27	13,170	245,251.35	690,379.99	12.41
70	5	0.1	@NA	1	0	42,465.27	42,465.27	445,128.63	445,128.63	10.48

Life Table for AP Rural Female										
x	n	Mx	ax	qx	px	lx	dx	Lx	Tx	ex

0	1	0.08	0.3	0.07	0.93	100000	7125.89	95011.88	6072352.14	60.72
1	4	0.01	0.4	0.02	0.98	92874.11	2194.09	366230.63	5977340.27	64.36
5	5	0	0.5	0.01	0.99	90680.02	902.29	451144.39	5611109.64	61.88
10	5	0	0.5	0.01	0.99	89777.73	626.25	447323.03	5159965.25	57.47
15	5	0	0.5	0.01	0.99	89151.48	1327.32	442439.11	4712642.22	52.86
20	5	0	0.5	0.02	0.98	87824.16	1394.03	435635.73	4270203.11	48.62
25	5	0	0.5	0.02	0.98	86430.13	1541.87	428295.98	3834567.38	44.37
30	5	0	0.5	0.01	0.99	84888.26	928.66	422119.66	3406271.4	40.13
35	5	0.01	0.5	0.03	0.97	83959.6	2400.03	413797.93	2984151.74	35.54
40	5	0	0.5	0.02	0.98	81559.57	1814.68	403261.17	2570353.81	31.52
45	5	0.01	0.5	0.03	0.97	79744.9	2240.8	393122.49	2167092.64	27.18
50	5	0.01	0.5	0.05	0.95	77504.1	4111.92	377240.68	1773970.15	22.89
55	5	0.02	0.5	0.08	0.92	73392.18	5543.7	353101.64	1396729.46	19.03
60	5	0.02	0.5	0.11	0.89	67848.48	7711.15	319964.53	1043627.83	15.38
65	5	0.04	0.5	0.2	0.8	60137.33	11845.85	271072.05	723663.29	12.03
70	5	0.11	@NA	1	0	48291.49	48291.49	452591.24	452591.24	9.37

Life Table for AP Rural Female										
x	n	Mx	ax	qx	px	lx	dx	Lx	Tx	ex
0	1	0.05	0.3	0.05	0.95	100000	4550.3	96814.79	6707644.78	67.08
1	4	0	0.4	0.01	0.99	95449.7	1030.25	379326.22	6610829.99	69.26
5	5	0	0.5	0	1	94419.45	282.83	471390.19	6231503.77	66
1	5	0	0.5	0	1	94136.62	141.1	470330.36	5760113.58	61.19
15	5	0	0.5	0.01	0.99	93995.52	842.17	467872.18	5289783.23	56.28
20	5	0	0.5	0.01	0.99	93153.35	649.8	464142.26	4821911.05	51.76
25	5	0	0.5	0.01	0.99	92503.55	737.08	460675.06	4357768.79	47.11
30	5	0	0.5	0.01	0.99	91766.47	640.12	457232.05	3897093.73	42.47
35	5	0	0.5	0.01	0.99	91126.35	861.61	453477.72	4439861.68	37.75
40	5	0	0.5	0.01	0.99	90264.74	853.46	449190.05	2986383.96	33.08
45	5	0	0.5	0.01	0.99	89411.28	1331.19	443728.43	2537193.91	28.38
50	5	0.01	0.5	0.03	0.97	88080.09	2859.46	433251.81	2093465.48	23.77
55	5	0.01	0.5	0.07	0.93	85220.63	5723.93	411793.34	1680213.67	19.48
60	5	0.03	0.5	0.12	0.88	79496.7	9843.87	372873.85	1248420.33	15.7
65	5	0.05	0.5	0.21	0.79	69652.83	14395.86	312274.53	875546.48	12.57
70	5	0.1	@NA	1	0	55256.98	55256.98	563271.95	463271.95	10.19

Region	Sex	5q0	45q15
Rural	Male	0.1037	0.2979
	Female	0.0932	0.23895
Urban	Male	0.0859	0.2744
	Female	0.0558	0.1543

Quality of data available for APBD estimates I

Group	Disease	India	AP
Communicable	Tuberculosis	***	***
	STD excluding HIV	**	
	HIV	**	
	Diarrhoea	***	***
	Childhood cluster	**	**
	Meningitis	*	*
	Japanese Encephalitis	***	***
	Hepatitis	**	**
	Enteric Fever	*	*
	Malaria	***	***
	Filaria	***	***
	Leprosy	***	***
	Tranchoma	**	*
	Intestinal Parasites	**	**
	Acute Resp.Infections	***	***
Meternal	Maternal	*	*
Perinatal	Perinatal	*	*
Nutritional	PEM	***	***
	Anaemia	***	***
	IDD	***	***
	Vita. A deficiency	***	***
*** Good community based studies; ** Community based studies; * Hospital Based data			

Quality of data available for APBD estimates II

Group	Disease	India	AP
Cancers	Cancers	**	*
Endocrinal	Diabetes	***	**
Neuro-psychiatire	Major Affective Disorders	**	
	Bipolar Affective Disorders		
	Psychosis	**	
	Epilepsy	**	
	Alcoholism	*	
	Drug dependence	*	
	Dementias		
Sense organs	Cataract	***	
	Glaucoma	*	
Cardiovasular	Rheumatic Heart disease	***	***
	Ischaemic heart disease	**	
	Cerebrovascular disease	*	
	Peri Endo Myocarditis and cardiomyopathics	*	
Chronic Respiratory	COPD	*	
	Asthma	*	
Digestive	Peptic Ulcer	*	
	Cirrhosis of liver	*	
	Hernia	*	
	Appendicitis	*	
Genitourinary	Nephritis & Nephrosis	**	*
	BPH	*	
Muskulo Skeletal	Rheumatoid arthritis	*	
	Osteoarthritis	*	
Congenital	Congenital	*	
Oral Health	Dental carries	***	***
	Periodontal disease	***	***
	Eduntulism	*	*
***Good community based studies; ** Community based studies; * Hospital Based data			

ESTIMATION OF CAUSE DEATH IN RURAL AP

Distribution of as reported by SCD AP (1988-93)					
SCD CODE	CAUSE OF DEATH	Males	Females	All	Not class.
100	ACCIDENTS & INJURIES NOT: CLASSFIABLE	66	39	105	105
111	SNAKE BITE	53	36	89	
112	SCORPION BITE	8	3	11	
113	RABIES	19	14	33	
121	DROWNING	71	55	126	
122	FALL FROM HEIGHT	38	24	62	
123	VEHICULAR ACCIDENTS	128	42	170	
124	BURNS	20	46	66	
130	SUICIDE	162	122	284	
140	HOMICIDE	22	10	32	
151	EXCESSIVE HEAT	8	15	23	
152	EXCESSIVE COLD	0	0	0	
153	NATURAL CALAMITY	10	13	23	
200	MATERNAL : NOT CLASSIFIABLE	0	25	25	25
210	ABORTION	0	9	9	
221	TOXEMIA	0	13	13	
222	ANAEMIA	0	13	13	
231	BLEEDING OF PREGNANCY	0	28	28	
232	MAL POSITION OF CHILD	0	8	8	
233	PUERPERAL SEPSIS	0	5	5	
300	FEVERS: NOT CLASSIFIABLE	225	223	448	448
311	MALARIA	8	6	14	
321	INFLUENZA	14	22	36	
331	TYPHOID	33	36	69	
400	DIGESTIVE DISORDERS : NOT CLASSIFIABLE	35	28	63	63
411	GASTRO-ENTERITIS	71	108	179	
412	CHOLERA	4	5	9	
413	FOOD POISONING	22	9	31	
414	DYSENTERY	59	66	125	
421	PEPTIC ULCER	64	28	92	
431	ACUTE ABDOMEN	87	73	160	
500	COUGHS: NOT CLASSIFIABLE	22	25	47	47
511	TUBERCULOSIS OF LUNGS	432	196	628	
513	BRONCHITIS & ASTHMA	578	346	924	
521	PNEUMONIA	31	20	51	
530	WHOOPING COUGH	6	4	10	
600	CNS DISORDERS : NOT CLASSIFIABLE	24	16	40	40
610	PARALYSIS	344	259	603	
620	MENINGITIS	20	21	41	
630	CONVULSIONS	76	64	140	
700	CONGESTIVE & OTHER HEART DISEASES	156	99	255	255
710	ANAEMIA	87	98	185	
730	HEART ATTACK	489	232	721	
800	OTHER MEDICALLY CERTIFIED DEATHS	28	17	45	
811	CIRRHOSIS & CHRONIC LIVER DISEASES	42	24	66	
812	JAUNDICE	151	92	243	
821	CHICKENPOX	0	1	1	
822	MEASLES	8	21	29	
823	LEPROSY	23	8	31	
831	TETANUS	8	13	21	
841	POLIOMYELITIS	2	3	5	
851	MENTAL DISEASE	18	21	39	

861	CANCER	189	251	440	
871	DIABETES	55	28	83	
881	HYPERPLASIA OF PROSTATE	15	9	24	
882	URAEMIA	32	12	44	
890	OBSTRUCTED HERNIA	4	0	4	
900	INFANT DEATHS : NOT CLASSIFIABLE	213	176	389	389
910	PRE MATURITY	174	146	320	
922	CONGENITAL MALFORMATION	15	7	22	
923	BIRTH INJURY	12	4	16	
931	RESPIRATORY INFECTIONS OF THE NEW BORN PERINATAL	87	79	166	
932	CORD INFECTION	13	13	26	
933	DIARRHOEA OF NEW BORN	41	49	90	
1000	SENILITY	1357	1313	2670	2670
	Total	5979	4791	10770	4042

Details of Unclassified deaths from SCD subjected to expert opinion and field enquiry

SCD code	Description	No. Subjected for EO & F E	No. Classified
1.00	Accidents and injuries not classifiable	27	27
2.00	Maternal not classifiable	6	6
3.00	Fevers not classifiable	107	107
4.00	Digestive disorders not classifiable	12	12
5.00	Coughs not classifiable	10	10
6.00	CNS disorders not classifiable	4	4
7.00	Congestive and other heart diseases	53	53
8.00	Burns	11	11
9.00	Causes peculiar to infancy not classifiable	71	68
10.00	Senility	139	136
Total		440	434

Algorithms used to classify the Scd estimated deaths responsible for>0.1%

SCD codes	Deaths	%	Cum %	Diseases	Solution
1.13	31.61	0.29%	0.29%	RABIES	Added to Group la total
1.51	32.15	0.30%	0.59%	EXCESSIVE HEAT	Aded to Unintentional Injuries (Group IIIa) total
1.53	22.33	0.21%	0.80%	NATURAL CALAMITY	Added to Unintentional Injuries (Group IIIa) total
4.31	179.89	1.67%	2.47%	ACUTE ABDOMEN	Added to Digestive (Group II i) total
5.13	1,321.68	12.28%	14.75%	BRONCHITIS & ASTHMA	To follow the distribution of Bronchitis & asthma from 26 countries
6.1	1,217.91	11.34%	26.09%	PARALYSIS	>45 yrs to include in Stroke, <45 to distribute in meningitis and encephalitis as per ICD distribution
6.3	158.21	1.48%	27.57%	CONVULSIONS	<15 as per ICD distribution in meningitis & encephalitis, 15-45: epilepsy, 45-60:50% epilepsy, 50% stoke, >60: Stroke
8.12	267.49	2.48%	30.05%	JAUNDICE	To distribute <5 yrs. Under hepatitis and for the remaining age groups to follow ICD age wise distribution of Hepatitis, Cirrhosis & Cancer Liver
8.51	114.26	1.06%	31.11%	MENTAL DISEASE	To include in 'Neuropsychiatric total
8.61	831	7.74%	38.86%	CANCER	To include in Cancer total

ESTIMATION OF CAUSE OF DEATH IN URBAN AP

Algorithms used to classify the MCCD estimated deaths responsible for>0.1% in Urban AP

ICD Codes	Deaths	%	Cum%	Disease discription	Solution
71	1,092	0.16%	0.16%	Rabies	To move over to Group Ia total
161	1,378	0.21%	0.37%	Malignant neoplasm of larynx	To add to the APBD lise
200,202,203	505	0.08%	0.45%	All other Malignant neoplasm of lymphatic and haempoietic tissue	To combine with Hogdkins and Leukaemias
190-199	5,860	0.88%	1.33%	Malignant neoplasm of other na dunspecified sites	To proportionately distribute to all listed cancer sites including 'other cancers'
264-269	4,242	0.64%	1.97%	All other Nutritional deficiencies	To move over to Group IIE totals
286-289	658	0.10%	2.07%	All ther diseases of blood and blood forming organs	Total move over to Group IIE totals
290	801	0.12%	2.19%	Senile and personnel, organic psychotic conditions	To move over to dementias including Alzheimers
302,-316	1,100	0.17%	2.36%	All other Mental disorders	To add to Group IIF (Neuropsychiatric) for the present and to develop some algorithm to get Alzheimers
323-339,341-344,346-359	10,949	1.65%	4.01%	All other diseases of Nervous System	To add to Group IIF (Neuropsychiatric) for the present and to develop some algorithm to get deaths due to alcoholism and drug dependence
402-404	2,154	0.32%	4.33%	Hypertensive heart Diseases	To add to APBD list
401,405	4,545	0.68%	5.02%	All other Hypertensive Diseases	To add to Hypertensive diseases list
415-429	40,846	6.16%	11.17%	Diseases of Pulmonary Circulation and other forms of heart disease	To add to the Group IIG(Cariovascular Total) for the present and develop appropriate algorithm on the basis of autopy series from India
444	838	0.13%	11.30%	Arterial embolism and thrombosis	To add to the Group IIG (Cardiovascular Total) for the present and develop appropriate algorithm on the basis of autopy series from India
411-443,446-448	1,413	0.21%	11.51%	Other diseases of Arteries, Arterioles & capillaries	To add to the Group IIG (Cardiovasular Total) for the present and develop appropriate algorithm on the basis of autopy series from India
455	718	0.11%	11.62%	Haemorrhoids	To add to the Grou IIG (Cardiovasularo Total) for the present and develo9 appropriate algorithm on the basis of autopy series from India
445,449,450,456-459	982	0.51%	11.77%	All other diseases of Circulatory system	To add to the Group IIG (Cardiovasular Total) for the present and develop appropriate algorithm on the
490-496	19,367	2.92%	14.69%	Bronchitis, Chronic and unspecified emphysema and asthama	To use alogorythem developed on the basis of observed relationship between bronchitis and asthma in 26 developed countries
511	725	0.11%	14.80%	Pluerisy	To move to Group IIH (Respiratory) for the present
488,489,497-510,512-519	9,638	1.45%	16.25%	All other Diseases of Respiratory system	To move to Group IIH (Respiratory) for the present
560	2,481	0.37%	16.62%	Intestinal obstruction without Mention of Hernia	To add to the APBD list
567	2,103	0.32%	16.94%	Peritonitis	To add to the APBD list
530,534,536-539,554-55	12,466	1.88%	18.82%	All other diseases of the other parts of the digestive system	To move to Group II J (Genito Urinary) total

9, 561-566, 568-57,0,572,573,576-579					
591,593,595-599	715	0.11%	22.94%	Senility without mention of psychosis	To follow the standard algorithm already developed under GBD to distribute to Group I&II
780-796,798,799	44,754	6.74%	29.68%	All other sign symptoms and ill defined conditions	To follow the standard algorithm already developed under GBD to distribute to Group I & II
E900-E909, E911-E918, E921,E923-E929	4,072	0.61%	30.30%	All other accidents including late effects	To add to Group Iia (unintentional for the present
E980-E981	7,711	1.16%	31.46%	Injury undetermained whether accidentally or purposely inflicted	To proportionately distribute to Group IIIa & IIIb deaths
E970-E979	1,136	0.17%	31.63%	All other types of violence	To add to the Group Iib total and include under War/legal intervention

Proportionate distribution of deaths in different groups in AP and India

Placce	Group	ALL	ALLM	ALLF	M0	M5	M15	M30	M45	M60	M70	F0	F5	F15	F30	F45	F60	F70
Rural AP	Group I	0.52	0.52	0.52	0.91	0.54	0.43	0.5	0.34	0.25	0.26	0.91	0.65	0.49	0.54	0.32	0.19	0.21
	Group II	0.37	0.37	0.38	0.05	0.08	0.21	0.25	0.55	0.69	0.71	0.05	0.11	0.23	0.25	0.58	0.68	0.75
	Group III	0.11	0.11	0.11	0.04	0.38	0.36	0.25	0.11	0.06	0.03	0.04	0.24	0.28	0.22	0.1	0.13	0.04
Urban AP	Group I	0.42	0.43	0.41	0.85	0.57	0.39	0.39	0.28	0.22	0.22	0.89	0.58	0.39	0.39	0.25	0.21	0.21
	Group II	0.49	0.48	0.51	0.11	0.26	0.35	0.35	0.64	0.75	0.75	0.08	0.24	0.28	0.28	0.67	0.76	0.76
	Group III	0.08	0.09	0.08	0.04	0.17	0.26	0.26	0.08	0.03	0.03	0.02	0.17	0.33	0.33	0.08	0.03	0.03
AP	Group I	0.05	0.05	0.05	0.9	0.55	0.42	0.48	0.33	0.25	0.26	0.91	0.65	0.48	0.52	0.31	0.2	0.21
	Group II	0.4	0.39	0.4	0.06	0.11	0.24	0.27	0.57	0.7	0.71	0.06	0.12	0.24	0.25	0.6	0.6	0.7
	Group III	0.1	0.11	0.1	0.04	0.34	0.34	0.25	0.1	0.05	0.03	0.03	0.23	0.29	0.23	0.09	0.1	0.04
India	Group I	0.43	0.42	0.45	0.85	0.52	0.33	0.33	0.22	0.12	0.12	0.82	0.56	0.46	0.45	0.19	0.09	0.09
	Group II	0.5	0.51	0.5	0.13	0.24	0.31	0.44	0.71	0.85	0.85	0.15	0.26	0.28	0.41	0.77	0.89	0.89
	Group III	0.07	0.07	0.06	0.02	0.24	0.36	0.23	0.07	0.02	0.02	0.03	0.18	0.26	0.14	0.04	0.01	0.02

CJL Murray & Ad Lopez; Global and regionalcause of death patterns in 1991; Bull of the WHO, 1994,72 (3):447-480

Estimated deaths by age, sex and cause in Rural AP																	
N	**Disease**	**ALL**	**ALLM**	**ALLF**	**M0**	**M5**	**M15**	**M30**	**M45**	**M60**	**M70**	**F0**	**F5**	**F15**	**F30**	**F45**	**F60**	**F70**
0	SUM	512,103	277,246	234,857	66,198	10,148	23,545	21,582	45,782	59,834	50,157	60,208	9,223	21,682	17,819	31,913	40,220	53,792
1	I.Communicabl, Maternal&Perinatal	266,194	144,722	121,572	60,343	5,527	10,141	10,887	15,578	15,159	13,098	55,068	6,034	10,718	9,544	10,223	7,733	11,352
2	A. Infec.& Parasitic	141,094	82,989	58,821	25,533	3,600	8,947	9,606	13,578	9,335	8,066	22,368	3,409	6,174	5,497	7,705	3,956	5,807
3	1. Tuberculosis	47,250	32,225	15,733	279	716	5,503	5,904	11325									
4	2. STD's Excl. HIV	1,682	625	1,027	27	4	334	358	16	2	1	23	7	643	573	17	2	2
5	a. Syphilis	1,294	623	663	26	4	334	358	15	2	1	22	6	403	359	17	2	2
6	b. Chlamydia	250	0	235	0	0	0	0	0	0	0	0	1	155	138	0	0	0
7	c. Gonorrhea	139	2	129	1	0	0	0	0	0	0	1	0	85	76	0	0	0
9	3. HIV	35	26	10	6	1	5	14	3	0	0	6	1	0	1	0	0	0
10	4. Diarrheal Dis.	41,557	21,958	19,547	12,613	686	801	859	730	1,448	1,251	11,366	756	774	690	654	1,028	1,509
11	5. Chilldhood Clus	26,002	13,696	12,269	8,202	822	604	645	274	127	110	7,484	963	584	518	245	90	132
12	a. Pertussis	3,685	1,955	1,726	1,453	38	0	0	0	0	0	1,309	43	0	0	0	0	0
13	b. Polio	518	288	231	216	2	3	0	0	0	0	177	2	3	0	0	0	0
14	c. Dipheria	168	88	79	60	5	0	0	0	0	0	54	6	1	0	0	0	0
15	d. Measles	13,597	6,883	6,665	4,541	518	0	0	0	0	0	4,501	629	0	0	0	0	0
16	e. Tetanus	8,035	4,483	3,567	1,933	257	600	645	274	127	110	1,443	284	580	517	245	90	132
17	6. Meningitis	7,033	4,408	2,689	1,428	679	480	515	219	140	121	1,773	355	325	290	105	33	48
18	7. Hepatitis	5,623	3,345	2,310	1,441	150	320	344	377	178	154	924	96	320	285	244	127	187
19	8 Malaria	1,675	988	696	153	105	246	264	112	38	33	110	94	191	171	81	21	31
20	9.Tropical Cluster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	a Filariasis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	10. Leprosy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	11. Trachoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	12. Intes. Helminths	334	158	174	0	34	35	37	26	5	4	0	45	56	50	16	3	4
25	a. Ascaris	92	46	45	0	24	0	0	0	0	0	0	30	0	0	0	0	0

26	b. Tricharis	58	28	30	0	10	3	3	4	0	0	0	15	2	2	3	0	0
27	c. Hookworm	185	84	99	0	0	32	34	22	5	4	0	0	54	48	13	3	4
28	13 Japanese encephalitis	1,627	1,071	577	546	80	72	77	45	28	24	298	45	41	36	21	23	33
29	B. Respiratory Infe	61,916	31,821	29,923	14,664	1,008	998	1,070	1,157	5,251	4,537	14,656	1,408	871	776	1,179	3,194	4,689
30	1. ARI	61,290	31,507	29,615	14,421	1,008	998	1,070	1,157	5,251	4,537	14,413	1,408	871	776	1,179	3,194	4,689
31	2. Otitis Media	625	314	308	243	0	0	0	0	0	0	243	0	0	0	0	0	0
32	C. Maternal Cond.	5,728	0	5,401	0	0	0	0	0	0	0	0	0	3,463	3,084	195	0	0
33	1. Hemmorhage	240	0	227	0	0	0	0	0	0	0	0	0	226	31	0	0	0
34	2. Sepsis	672	0	633	0	0	0	0	0	0	0	0	0	631	87	0	0	0
35	3. Eclampsia	80	0	76	0	0	0	0	0	0	0	0	0	76	10	0	0	0
36	4. Hypertension	169	0	159	0	0	0	0	0	0	0	0	0	158	22	0	0	0
37	5. Obst. Labor	337	0	318	0	0	0	0	0	0	0	0	0	317	43	0	0	0
38	6. Abortion	638	0	602	0	0	0	0	0	0	0	0	0	600	82	0	0	0
39	D. Perinatal Cond.	43,876	23,508	20,348	18,159	0	0	0	0	0	0	16,028	0	0	0	0	0	0
40	E. Nutritional	13,581	6,403	7,079	1,986	920	197	211	843	573	495	2,016	1,216	210	187	1,145	583	855
41	1. PEM	3,526	1,697	1,807	1,009	31	64	69	37	121	104	1,137	68	39	34	23	85	125
42	2. Iodine Defi.	271	151	121	35	7	14	15	31	25	21	36	16	17	15	5	9	14
43	3. Vitamin A	475	257	218	199	0	0	0	0	0	0	0	172	0	0	0	0	0
44	4. Anemias	9,309	4,299	4,933	743	882	119	127	775	427	369	670	1,132	154	137	1,116	488	716
45	II. Noncommunicable	190,694	102,059	88,535	3,184	778	4,858	5,354	25,080	41,202	35,592	2,933	994	4,998	4,405	18,602	27,259	40,245
46	A. Malig. Neoplasms	27,685	14,591	13,056	131	102	1,119	1,200	5,637	4,381	3,785	45	48	1,456	1,378	6,396	2,008	3,164
47	1. Mouth & Orpharynx	2,049	1,418	663	0	0	103	110	584	432	374	0	0	74	66	299	121	177
48	2. Esophagus	3,385	2,070	1,340	0	0	152	163	902	596	515	0	0	147	131	591	252	371

49	3.stomach	2,816	2,005	862	0	0	161	172	782	623	538	0	0	102	91	437	130	190
50	4,colon/rectum	1,306	742	568	0	1	34	36	318	239	207	1	1	23	21	253	133	195
51	5.liver	1,145	805	360	2	3	47	51	434	185	160	1	2	23	21	162	76	111
52	6.pancreas	705	474	240	0	0	22	23	197	157	136	0	1	21	19	118	43	63
53	7.trach/ bronchus/lung	3,207	2.82	500	1	1	122	131	1,365	817	706	1	1	13	12	279	95	139
54	8.Melanoma	86	51	36	0	1	2	2	17	18	16	1	0	3	3	15	7	10
55	9. Breast	2,374	0	2,239	0	0	0	0	0	0	0	0	0	316	281	1,319	214	314
56	10. Cervix	3,970	0	3,743	0	0	0	0	0	0	0	0	0	451	402	2,122	453	664
57	11. Corpus Uteri	293	0	276	0	0	0	0	0	0	0	0	0	36	32	71	72	106
58	12. Ovary	530	0	500	0	0	0	0	0	0	0	1	1	38	115	271	12	233
59	13. Prostate	225	242	0	0	0	1	1	40	142	49	0	0	0	0	0	0	0
60	14. Bladder	240	137	103	0	0	8	5	44	58	20	0	0	1	1	18	61	26
61	15. Lymphoma	915	639	297	97	56	182	126	119	78	27	20	8	39	24	50	79	33
62	16. Lrynx	441	306	144	0	0	23	16	155	81	28	0	0	9	5	50	48	20
63	B. Other Neoplasm	102	62	41	8	5	21	15	8	7	3	3	0	9	5	7	6	5
64	C. Diabetes Melltus	2,227	1,242	991	2	3	64	44	371	540	186	0	1	19	11	152	608	255
65	D. Other Endocrine	0	0	0	2	1	7	5	10	7	3	0	0	3	2	8	14	6
66	E. Neuro-Psychiatric	1,557	961	613	73	43	186	172	194	243	83	75	13	92	35	37	219	93
67	1. MAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	2. BAD	7	4	3	0	0	1	0	1	1	0	0	0	0	0	1	1	1
69	C. Psychoses	257	169	92	0	1	25	17	67	44	15	0	1	6	4	10	52	22
70	4. Epilepsy	440	261	182	8	5	107	118	9	28	9	4	2	73	24	6	15	8
71	5. Alcohol	82	76	10	0	0	25	17	28	7	2	0	0	2	1	3	1	0

	Dependence																
72	6. Alzheimer's and other dementia	612	342	272	65	37	22	15	78	101	35	71	11	9	6	16	111	47
73	7. Parkinson's Disease	148	100	51	0	0	0	0	11	62	21	0	0	0	0	2	39	16
75	8. Drug Dependence	12	9	3	0	0	6	4	0	0	0	0	0	1	1	0	0	0
77	F. Sense Organ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	1. Glaucoma related Blindness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	2. Cataract related Blindness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
80	G. Cardiovascular Diseases	34,796	17,483	17,115	261	69	617	424	4,465	8,324	2,862	234	67	368	227	2,173	10,594	4,435
81	1. Rheumatic Heart Disease	2,981	874	2,002	10	8	85	58	277	318	103	13	9	79	49	465	955	400
82	2. Ischemic Heart Disease	14,397	8,736	6,292	3	1	304	210	2,379	4,145	1,426	1	0	47	29	645	4,344	1,818
83	3. Cerebrovasular Disease	11,882	5,268	6,446	52	21	194	134	927	2,809	966	39	17	133	82	704	4,175	1,748
84	4. PEMC	4,996	2,605	2,376	195	40	34	23	882	1,052	362	180	40	109	68	360	1,119	469
85	H. Chronic Respiratory Diseases	3,454	2,041	1,437	158	113	94	65	394	888	306	109	35	72	44	280	577	242
86	1. COPD	2,680	1,678	1,034	110	21	34	23	335	842	290	73	7	16	10	216	517	216
87	2. Asthma	774	362	403	48	92	61	42	59	46	16	36	28	56	34	65	60	25
88	I. Diseases of the Digestive System	5,178	3,734	1,577	211	45	661	455	1,512	718	247	86	16	170	105	418	410	171
89	1. Peptic Ulcer	932	624	325	4	3	114	78	242	142	49	5	2	38	23	82	95	40

	Disease																	
90	2. Cirrhosis of the Liver	3,107	2,323	875	32	12	417	287	1,065	411	141	29	10	98	61	267	194	81
91	J. Diseases of the Genito - Urinary System	1,798	1,073	739	47	122	91	63	244	358	123	21	52	54	40	122	216	90
92	1. Nephritis / Nephrosis	1,636	898	739	47	121	91	63	241	236	81	21	52	64	40	122	216	90
93	2. Benign Prostatic Hypertrophy	163	175	0	0	0	0	0	3	122	42	0	0	0	0	0	0	0
94	K. Diseases of the Musculo-Skeletal System	33	14	18	0	0	2	1	1	8	3	0	0	1	1	9	3	1
95	1. Rheumatoid Arthritis	33	14	18	0	0	2	1	1	8	3	0	0	1	1	9	3	1
96	2. Osteoarthritis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	L. Congenital Abnormalities	1,480	788	690	947	63	66	46	4	1	0	544	25	50	32	15	1	1
98	M. Oral Health	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
99	1. Dental Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	2.PeriodontalDis.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	3. Edentulism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	III. Injuries	10,019	5,869	4,150	639	344	1,822	1,288	1,102	503	172	308	157	1,463	894	554	545	230
103	A. Unintentional	9,294	5,414	3,880	594	332	1,654	1,170	1,036	468	160	269	149	1,384	847	512	506	213
104	1. Motor Vehicle Accidents	1,623	1,211	412	127	59	352	249	256	125	43	31	19	83	51	99	91	38

105	2. Poisonings	349	245	104	42	23	72	51	40	13	4	19	9	35	21	14	4	2
106	3. Falls	697	488	209	44	27	120	85	94	88	30	23	10	27	16	32	71	30
107	4. Fires	2,882	816	2,066	120	48	280	198	115	41	14	88	62	930	569	177	169	71
108	5. Drowning	418	314	104	45	39	100	70	43	13	4	16	8	32	19	9	14	6
109	6. Electric Shock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	B. Intentional	725	455	270	45	12	168	118	66	35	12	39	8	78	47	42	39	17
111	1. Self-inflicted	267	176	91	3	1	77	55	27	10	3	1	2	42	25	13	6	2
112	2. Homicide and Violence	312	179	133	33	5	43	30	36	24	8	29	2	19	11	26	32	14
113	3. Legal	146	100	46	9	6	47	33	3	1	0	9	4	17	11	3	1	0

Estimated deaths by age, sex and cause in Urban AP																		
N	**DISEASE**	**ALL**	**ALLM**	**ALLF**	**M0**	**M5**	**M15**	**M30**	**M45**	**M60**	**M70**	**F0**	**F5**	**F15**	**F30**	**F45**	**F60**	**F70**
0	SUM	119,719	66,663	53,506	16,577	2,010	7,029	4,966	14,210	16,276	5,595	12,963	902	4,374	2,678	6,839	17,804	7,496
1	1Communicable, Material	50,712	28,804	21,907	14,130	1,142	2,726	1,926	3,983	3,645	1,253	11,561	525	1,694	1,039	1,736	3,766	1,585
2	A. Infec & Parasitic	21,882	13,805	8,250	4,022	683	2,334	1,647	3,450	2,156	749	3,071	246	1,051	646	1,232	1,873	788
3	1. Tuberculosis	8,058	5,990	2,246	50	147	1,464	1,042	2,754	1,533	520	34	63	429	263	806	1,039	437
4	2. STD's Excl.HIV	483	185	287	8	2	117	84	5	2	1	7	1	168	103	18	3	1
5	a. Syphilis	385	184	197	7	2	117	84	5	2	1	6	1	111	68	18	3	1
6	b. Chlamydia	58	0	53	0	0	0	0	0	0	0	0	0	34	21	0	0	0
7	c. Gonorrhea	41	2	36	1	0	0	0	0	0	0	1	0	23	14	0	0	0
9	3. HIV	10	7	3	2	0	0	3	1	0	0	2	0	0	0	0	0	0
10	4. Diarrhoeal Dis.	6,561	3,548	2,990	2,337	158	177	112	149	217	91	1,895	72	126	81	128	333	140
11	4. Childhood Clus	2,094	1,148	941	623	105	143	100	63	22	8	490	49	110	66	54	32	14
12	a. Pertussis	404	220	183	175	11	0	0	0	0	0	141	6	0	0	0	0	0
13	c. Polio	111	64	47	54	1	1	0	0	0	0	38	0	1	0	0	0	0
14	c. Diptheria	27	14	12	9	1	2	0	0	0	0	8	1	2	0	0	0	0
15	d. Measles	518	282	234	210	26	0	0	0	0	0	170	12	0	0	0	0	0
16	e. Tetanus	1,034	567	465	175	66	140	100	63	22	8	232	30	108	66	54	32	14
17	6. Meningitis	956	609	355	220	130	85	60	37	19	6	163	28	45	27	17	9	4
18	7. Hepatitis	594	402	201	74	25	94	67	107	63	21	29	4	49	30	44	61	26
19	8. Malaria	70	41	29	5	7	14	10	6	2	1	4	2	8	5	4	2	1
20	9. Tropical Cluster	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	a. Filariasis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	10. Leprosy	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	11. Trachoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	12. Intes. Helminths	61	34	26	0	9	10	7	7	2	1	0	4	7	4	7	1	0

25	a. Ascaris	17	10	8	0	7	0	0	0	0	0	0	3	0	0	0	0	0
26	b. Trichuris	10	6	4	0	2	1	1	1	0	0	0	1	0	0	1	0	0
27	c. Hookworm	33	19	15	0	0	9	6	6	2	1	0	0	6	4	6	1	0
28	13. Japanese encephalitis	542	359	189	204	37	28	20	21	13	4	104	9	13	8	10	20	8
29	B. Respiratory Infections	15,636	8,123	7,418	4,530	386	350	250	396	1,389	471	4,074	222	241	148	384	1,728	727
30	1. A R I	15,467	8,035	7,338	4,455	386	350	250	396	1,389	471	4,007	222	241	148	384	1,728	727
31	2. Otisis Media	169	88	80	75	0	0	0	0	0	0	67	0	0	0	0	0	0
32	C. Maternal Cond.	480	0	445	0	0	0	0	0	0	0	0	0	286	173	6	0	0
33	1. Hemmorhage	104	0	97	0	0	0	0	0	0	0	0	0	91	9	0	0	0
34	2. Sepsis	69	0	64	0	0	0	0	0	0	0	0	0	60	6	0	0	0
35	3. Eclampsia	35	0	32	0	0	0	0	0	0	0	0	0	30	3	0	0	0
36	4. Hypertension	17	0	16	0	0	0	0	0	0	0	0	0	15	2	0	0	0
37	5. Obst. Labor	35	0	32	0	0	0	0	0	0	0	0	0	30	3	0	0	0
38	6. Abortion	66	0	61	0	0	0	0	0	0	0	0	0	58	6	0	0	0
39	D. Perinatal Cond.	10,831	5,945	4,859	5,095	0	0	0	0	0	0	4,081	0	0	0	0	0	0
40	E. Nutritional	1,883	931	935	483	72	42	29	138	100	33	335	57	116	72	114	165	70
41	1. P E M	812	490	326	306	18	20	14	49	41	14	176	4	15	9	21	84	35
42	2. Iodine Defi.	69	38	31	11	3	5	3	11	7	2	10	2	5	3	2	5	2
43	3. Vitamin A	199	100	98	85	0	0	0	0	0	0	82	0	0	0	0	0	0
44	4. Anemias	803	304	480	81	52	17	12	78	53	17	66	50	96	59	92	76	32
45	IINoncommunicable	58,988	31,990	26,999	1,808	524	2,481	1,753	9,125	12,128	4,170	1,094	219	1,217	745	4,549	13,494	5,681
46	A. Malig. Neoplasms	8,292	4,559	3,743	100	59	672	463	1,922	1,035	356	22	9	369	243	1,328	845	384
47	1. Mouth & Oropharynx	636	467	187	0	0	50	34	208	128	44	0	0	30	18	76	13	5
48	2. Esophagus	1,056	652	415	0	0	70	48	304	168	58	0	0	35	22	144	118	49
49	3. Stomach	925	662	285	0	0	79	54	279	185	64	0	0	26	16	1,123	64	27
50	4.Colon/Rectum	407	253	159	0	0	16	11	100	90	31	0	0	6	4	64	50	21
51	5. Liver	370	266	113	2	2	22	15	150	54	19	0	0	6	4	41	37	15
52	6. Pancreas	229	154	79	0	0	11	8	71	47	16	0	0	5	3	30	22	9
53	7.Trachea/Bronch	868	765	146	0	0	208	143	446	0	0	0	0	3	2	66	43	18

	us/ Lung																
54	8. Melanoma and Other Skin	28	16	12	0	0	1	1	6	5	2	1	0	1	0	4	3	1
55	9. Breast	873	0	805	0	0	0	0	0	0	0	0	0	103	64	277	160	67
56	10. Cervix	814	0	751	0	0	0	0	0	0	0	0	0	90	55	310	108	45
57	11. Corpus Uteri	83	0	77	0	0	0	0	0	0	0	0	0	6	4	16	32	14
58	12. Ovary	184	0	170	0	0	0	0	0	0	0	1	0	9	21	69	6	33
59	13. Prostate	225	242	0	0	0	1	1	40	142	49	0	0	0	0	0	0	0
60	14. Bladder	240	137	103	0	0	8	5	44	58	20	0	0	1	1	18	61	26
61	15. Lymphoma	915	639	297	97	56	182	126	119	78	27	20	8	39	24	50	79	33
62	16. Larynx	441	306	144	0	0	23	16	155	81	28	0	0	9	5	50	48	20
63	B Other Neoplasm	102	62	41	8	5	21	15	8	7	3	3	0	9	5	7	6	3
64	C Other Endocrine	0	0	0	2	1	7	5	10	7	3	0	0	3	2	8	14	6
65	D Other Endocrine	0	0	0	2	1	7	5	10	7	3	0	0	3	2	8	14	6
66	ENeuro-Psychiatric	1,557	961	613	73	43	186	172	194	243	83	75	13	92	35	37	219	93
67	1. MAD	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
68	2. BAD	7	4	3	0	0	1	0	1	1	0	0	0	0	0	1	1	1
69	3. Psychoses	257	169	92	0	1	25	17	67	44	15	0	1	6	4	10	52	22
70	4. Epilepsy	440	261	182	8	5	107	118	9	28	9	4	2	73	24	6	15	8
71	5.Alcohol Dependence	82	76	10	0	0	25	17	28	7	2	0	0	2	1	3	1	0
72	6. Alzheimer's and other dementia	612	342	272	65	37	22	15	78	101	35	71	11	9	6	16	111	47
73	7. Parkinson's Disease	148	100	51	0	0	0	0	11	62	21	0	0	0	0	2	39	16
75	8.Drug Dependence	12	9	3	0	0	6	4	0	0	0	0	0	1	1	0	0	0
77	F. Sense Organ	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
78	1. Glucoma related Blindness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
79	2. Cataract related Blindness	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

80	G.Cardiovasular Diseases	34,796	17,483	17,115	261	69	617	424	4,465	8,324	2,862	234	67	368	227	2,173	10,594	4,435
81	1.Rheumatic Heart Disease	2,981	874	2,002	10	8	85	58	277	318	109	13	9	79	49	465	955	400
82	2.Ischemic Heart Disease	14,937	8,736	6,292	3	1	304	210	2,379	4,145	1,426	1	0	47	29	645	4,344	1,818
83	3.Cerebrovascular Disease	11,882	5,268	6,446	52	21	194	134	927	2,809	966	39	17	133	82	704	4,175	1,748
84	4. PEMC	4,996	2,605	2,376	195	40	34	23	882	1,052	362	180	40	109	68	360	119	469
85	H Chronic Respiratory Diseases	3,454	2,041	1,437	158	113	94	65	394	888	306	109	35	72	44	280	577	242
86	1. COPD	2,680	1,678	1,034	110	21	34	23	335	842	290	73	7	16	10	216	517	216
87	2.Asthma	774	362	403	48	92	61	42	59	46	16	36	28	56	34	65	60	25
88	I. Diseases of the Digestive System	5,178	3,734	1,577	211	45	661	455	1,512	718	247	86	16	170	105	418	410	171
89	1.Peptic Ulcer Disease	932	624	325	4	3	114	78	242	142	49	5	2	38	23	82	95	40
90	2. Cirrhosis of the Liver	3,107	2,323	875	32	12	417	287	1,065	411	141	29	10	98	61	267	194	81
91	J. Diseases of the Genito-Urinacy System	1,798	1,073	739	47	122	91	63	244	358	123	21	52	64	40	122	216	90
92	1.Nephritis/ Nephrosis	1,636	898	739	47	121	91	63	241	236	81	21	52	64	40	122	216	90
93	2.Benign Prostatic Hypertrophy	163	175	0	0	0	0	0	3	122	42	0	0	0	0	0	0	0
94	KDiseasesoftheMusculo-Skeletal System	33	14	18	0	0	2	1	1	8	3	0	0	1	1	9	3	1
95	1.Rheumatoid Arthritis	33	14	18	0	0	2	1	1	8	3	0	0	1	1	9	3	1
96	2.Osteoarthritis	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
97	L.Congenital Abnormalities	1,480	788	690	947	63	66	46	4	1	0	544	25	50	32	15	1	1
98	M Oral Health	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

99	1.Dental Caries	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
100	2.Periodontal Dis.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
101	3.Edentulism	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
102	II Injuries	10,019	5,869	4,150	639	344	1,822	1,288	1,102	503	172	308	157	1,463	894	554	545	230
103	A Unintentional	9,294	5,414	3,880	594	332	1,654	1,170	1,036	468	160	269	149	1,384	847	512	506	213
104	1.Motor Vehicle Accidents	1,623	1,211	412	127	59	352	249	256	125	43	31	19	83	51	99	91	38
105	2.Poisonings	349	245	104	42	23	72	51	40	13	4	19	9	35	21	14	4	2
106	3.Falls	697	488	209	44	27	120	85	94	88	30	23	10	27	16	32	71	30
107	4.Fires	2,882	816	2,066	120	48	280	198	115	41	14	88	62	930	569	177	169	71
108	5.Drowning	418	314	104	45	39	100	70	43	13	4	16	8	32	19	9	14	6
109	6.Electric Shock	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
110	B. zinyrnyionsl	725	455	270	45	12	168	118	66	35	12	39	8	78	47	42	39	17
111	1.Self-inflicted	267	176	91	3	1	77	55	27	10	3	1	2	42	25	13	6	2
112	2.Homicide and Voilence	312	179	133	33	5	43	30	36	24	8	29	2	19	11	26	32	14
113	3.Legal	146	100	46	9	6	47	33	3	1	0	9	4	17	11	3	1	0

DIABETES MELLITUS

Diabetes mellitus is a common endocrinal disease resulting in several complications. Our estimates are for Non-insulin dependent diabetes (NIDDM) which accounts for 80-90% of all diabetes world-wide. While insulin dependent diabetes (IDM) is considered to be Relatively rate in most developing countries the epidemiology of third form of diabetes, the malnutrition related diabetes mellitus is poorly understood. The WHO case definition of diabetes is based on biochemical criteria.

Case of Diabetes				
Nature of sample	Glucose (mg/dl)			
	Whole Blood		Plasma	
	Venous	Capillary	Venous	Capillary
Fasting	>120	>120	>140	>140
2 hr after glucose load	>180	>200	>200	>200
WHO 1985; Technical Report Series No. 727				

A. ICD Codes:

The ICD9 classifies the Diabetes Mellitus as adult onset type and juvenile onset Type. The corresponding code for Diabetes ICD9 is 250. The tenth revision introduced a new coding system which distinguishes between insulin dependent (E10), non insulin dependent (E11), malnutrition related diabetes(E12), other specified (E13) and unspecified (E14) Diabetes. Gestational diabetes is recorded elsewhere. As per ICD norms if a mention of Diabetes is made in part I of death certificate, it should be considered as the underlying cause.

B. Natural History:

The details of natural history of diabetes and its complications are presented in a tabular form in next page.

Natural History	**Description**	**Out come**	**Source of information**
Risk Factors	Genetic, Environmental	Parental history Diet (>fat), Lifestyles (<Phy.activity) Obesity	Migrant studies, Studies in low income urban areas
Incidence	Between 30-69 yrs. there is a straight line relationship of log odds of NIDDM to age with a slope of 0.066 year-1. Low and high prevalence populations varies only in constant terms used in model	Age specific incidence pattern	Review article of Paul McKngue

Prevalence	Among adults prevalence rates increased wtih age. Prevalence was less among famales	Age and sex specific prevalence rates	Community based surgeys undertaken in different parts of India
Remission Nil			
Treatment	Percent receiving treatment	About 50% of the cases deteted were known cases	Hospital based studies
Complications	Specific	>Incidence of blindness >Incidence of nephropathy >Diabetic foot	Follow-up studies, Hospital based studies
	Not specific	>Myocardial infarction >Stroke	Follow-up studies, Hospital based studies
Mortality	Case fatality	Age and sex specific case fatality rates	Estimating case fatality on the basis of known prevalence and reported deaths due to diabetes
	RR	Influence of increased RR on age and sex specific mortlity rates	Follow-up studies undertaken at Fiji

C. Review of studies undertaken in India:

Diabetes prevalence studies undertaken in India					
Author	Year	Place	Population	Screening	Prevalence (%)
Patel et al	1,959	Bombay	18243 volunteers	Post prandial glycosuria	2.4
Ganguly et al	1,964	Lucknow	1445 rural hh survey	Post prandial glycosuria	2.3
Ahuja et al	1,966	Delhi	1027 volunteers	PP glycosuria and bl. glucose	6.2
Berry et al	1,966	Chandigarh	3846 urban hh survey	PP glycosuria	2.9
Satyanarayana	1,966	Hyderabad	21396 volunteers	PP glycosuria	4.1
Dutta et al	1,968	Pondicherry	2694 urban hh survey	PP glycosuria	0.7
Ahuja et al	1,972	New Delhi9	1639 urban hh survey	Post glucose blood sugar	2.7
Jayarao et al	1,972	Hyderabad	2006 rural hh survey	Post prandial glycosuria	2.4
ICMR	1972-75	6 urban centres	19077 hh survey	Post glucose blood sugar	2.1
		5 rural centres	15177 hh survey	Post glucose blood sugar	1.5
Tripathy et al	1,979	Koraput	2296 tribal volunteers	Post glucose blood sugar	0.9
Patel	1,986	Bhadran, Gujarat	3374 rural hh survey	Post prandial glycosuria	3.8
Verma et al	1,986	Delhi	6878 hh survey	Inquiry for known diabetes	3.1
Rao et al	1,987	Eluru AP	3579 hh survey	Inquiry for known diabetes	2.4
Murthy et al	1,984	Tenali AP	Urban		4.7
Ramachandran et al	1,992	Madras	Urban		8.2
			Rural		2.4

Several studies have been undertaken in India to know the prevalence of diabetes. The criteria used to define a case of diabetes varied from verbal enquiry for known diabetes to WHO suggested case definition for diabetes. Hence, it is difficult to compare the prevalence rates reported by these studies.

The largest survey covering 34,194 persons above the age of 14 years was undertaken by the Indian council of Medical Research (1972-75). The case definition used by the ICMR study is those with blood glucose values more than 130mg/dl in the capillary blood after oral administration of 50g of glucose. So far this is the largest survey undertaken in the country and considered to be representative. The other studies demonstrated increasing prevalence with age. Males were more frequently affected with a sex ration of 1:0:6 or even less among females. The estimated average duration of disease is about 8.1 years[11]

D. Estimation of prevalence and mortality due to diabetes:

Prevalence:

Survey undertaken by Jayarao et al in rural Hyderabad estimated a prevalence of 2.4% which is higher than the ICMR aggregated rural prevalence. Since Jaya Rao's study is undertaken in AP and covered 2006 households we have considered it to be representative of rural AP. We have taken the prevalence reported by Jaya Rao's study as such for rural AP.

Even though this is higher than the ICMR estimates for rural India, a recent study (Ramachandran et al) in rural Tamil Nadu suggests that the prevalence in rural areas are around 2.4%. We have assumed that crude prevalence of diabetes among rural males above 14 yrs will be 2.4%. In case of females GBD estimates used the same prevalence as males. However, studies undertaken in India suggest that the prevalence of diabetes among females is lesser than males. Hence we have applied and adjustment factor of 0.75 on the estimated incidence of males get the corresponding values for the females.

Considering the reported higher prevalence in urban areas we have assumed that both incidence and prevalence in urban AP are higher than the rural areas. The ICMR survey suggested that prevalence of diabetes is 1.4 times higher in urban areas. By applying a factor of 1.4 to the reported prevalence of this study we have estimated the prevalence of diabetes in

[11] PV Rao; Risk factor analysis in diabetes mellitus as related to social progress in India populations 1994

urban AP. This gave a prevalence of this study we have estimated the prevalence of diabetes in urban AP. This gave a prevalence of 3.4% which is slightly higher than the ICMR estimates of urban areas but closer to small scale studies undertaken in urban AP and Madras. We have assumed that urban males above 14 years will have a crude NIDDM prevalence of 3.4%. Considering reported lower prevalence among females an adjustment factor of 0.75 was applied for the estimated incidence among males to arrive at the corresponding rates for females.

Mortality:

We have taken the APBD estimated deaths in urban areas for males and females as such. The CSMR rates are closely comparable with the GBD India estimates. In case of rural areas we have noticed that in case of males in 60+age group the SCD estimates gave a cause specific mortality rate of 4 per thousand which we felt is an over estimate. Hence, we have assumed that the CSMR in rural males above 60 yrs in rural areas would closer to that of urban areas. Since the incidence and prevalence in rural areas are lesser than urban areas this Assumption gives higher case fatality in rural areas which is quite plausible. For other age groups we have used the SCD estimated death numbers as such which are close to CSMR of urban areas.

E. Estimation of incidence and consistency check:

The above estimates on prevalence, cause specific mortality and remission were used to estimate the incidence rates and duration of diabetes through DISMOD. Through an iterative process the incidence and case fatality rates were adjusted to achieve the estimated prevalence and reported deaths. The results of the outputs from DISMOD are presented in the table.

Estimates of age and sex specific incidence and prevalence of Diabetes from DISMOD

Age group	Annual Incidence rate/1000				Annual prevalence rate/1000			
	Rural Male	Rural Female	Urban Male	Urban Female	Rural Male	Rural Female	Urban Male	Urban Female
15-44	0.38	0.26	0.71	0.54	5.47	3.77	10.44	7.88
45-59	7.49	5.25	13.22	10.22	64.61	45.52	118.43	92.16
60	11.37	8.38	16.9	14.19	211.59	154.29	375.14	300.25
Crude rates	1.84	1.39	2.53	2.14	24.11	18.48	34.06	29.95

Estimates of cause specific mortality due to diabetes from DISMOD

Age group	Annual Incidence rate/1000				Annual prevalence rate/1000			
	Rural Male	Rural Female	Urban Male	Urban Female	Rural Male	Rural Female	Urban Male	Urban Female
15-44	0.02	0.01	0.02	0.01	187	124	76	54
45-59	0.31	0.19	0.31	0.2	952	588	308	193

60	1.84	1.41	1.8	1.4	2,863	2,374	683	661

F. Estimation of disability:

The complications of diabetes could be specific affecting eyes, kidneys and feet. These complications include retinopathy and other changes in eye like cataract, diabetic nephropathy and neuropathic ulcer in the legs and feet leading to prolonged immobilisation and sometimes amputation. These complications do not occur in non diabetics. In addition, the non specific complications of diabetes include the conditions such as increased risk from stroke and ischemic heart disease. In hospital based studies undertaken in India. 72% of the hospitalised diabetics died due to the vascular complications. Renal disease is an important cause of death[12] the incidence of major complications due to diabetes increases exponentially with increasing duration of diabetes.

1. Blindness:

Follow-up study in Wisconsin USA showed that 4% of diabetic patients develop blindness[13]. Another study in UK had estimated the incidence of blindness in diabetics to be Around 5/1000 person years[14].

2. Renal failure:

In a cohort study undertaken in Germany the cumulative risk of developing renal failure requiring transplant was 2% after 15 years of diabetes, 5% after 20 years of diabetes and 10% after approximately 25 years of diabetes[15].

3. Diabetic foot:

Development of neuropathic ulcers is one of the commonest complications of diabetes. These lesions require prolonged immobilisatioon and nursing care. In a study undertaken in elderly diabetic patients in UK the prevalence of foot ulcers was 3%. US national data for

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[12] PV Rao risk factor analysis in Diabetes Mellitus as related to social progress in Indian populations new Delhi 1994.

[13] Moss SE et al ; the incidence of vision loss in a diabetic population; s 95:1340-1348

[14] Cohen DL et al ; A population based study of the incidence of complications associated with type2 diabetes in the elderly. Diabetic Med.. 1991; 8 928-933.

[15] Diabetes drafting group. Prevalence of small vessel and large vessel diseases in diabetic patients from 14 centres. The WHO multinational study of vascular disease in diabetics. Diabetolgia 1985; 28; 615-640

1987 show that lower extremity amputations for non traumatic conditions is about 8 per 1000 diabetic individuals.

4. Diabetes as a risk factor for other diseases:

Estimates of routine US data for diabetes and follow up study undertaken in Chile[16] Suggest that diabetes is an important risk factor for many diseases.

Diabetes as a risk factor	
Disease / complication	Relative Risk
Coronary heart disease	2-5
Stroke	2-3
Tuberculosis	6
Blindness	20
End Stage Renal disease	25
Amputation	40

The estimates of disability weights are based on all these factors. For the sake of comparability the same disability weights used for the GBD estimates have been used for study also.

[16] Olmos P et al. Tuberculosis and diabetes mellitus: a longitudinal retrospective study in a teaching hospital. Rev Med. chill 1989; 117:979-983

TUBERCULOSIS

Tuberculosis is one of the major infectious diseases in India. A wealth of epidemiological data is available in the country due to significant contributions made by two pioneering institution the national Tuberculosis Institute(NTI) and the tuberculosis Research centre (TRC). In addition to the wide ranging studies undertaken by these institutions, longitudinal studies have been undertaken by Pamra et al in New Delhi and Fromot miller et al in Andhra Pradesh.

G. Natural History

Tuberculosis is caused by Mycobacterium tuberculosis, which most commonly affects the lungs. The infection is usually transmitted from persons with pulmonary tuberculosis to other persons by droplets. Rarely the infection is through the digestive tract due to consumption of contaminated milk containing mycobacterium bovis from cows suffering from tuberculosis. The bacilli reaching the lungs and in the corresponding lymph nodes. In most instances both the lesions of the primary complex heal spontaneously leaving dormant bacteria which may get reactivated during the later part of the life. Thus, the clinical diseases may occur weeks to years after primary infection. The usual incubation period from infection to primary lesion is between 4-12 weeks. Allergy and immunity against tuberculosis are produced with in 6-8 weeks. This results in formation of granulomas around the focus of bacilli. The most important aspect of the natural history of the tuberculosis is that infection may lead to relatively small proportion of cases at a later date. Occasionally, in case of new borne and small children, the infection may progress resulting in serious forms of tuberculosis such as milliary tuberculosis or tuberculosis meningitis.

XIII. Steps for the estimation:

The following steps have been followed to estimate the incidence, duration and case fatality rates of tuberculosis in Andhra Pradesh.

1. A detailed review of epidemiological studies on Tuberculosis was undertaken and core experts was identified
2. Case definition for tuberculosis was arrived at the workshop

3. The age specific incidence pattern of tuberculosis, but not necessarily the magnitude was determined using the data from longitudinal studies
4. A review of trends of tuberculosis over the last 30 years was undertaken which suggested that only marginal changes in TB infection rate.
5. Adjustment factors for screening method were arrived after establishing relationship of true prevalence to different screening methods.
6. Adjustment factor for extrapulmonary tuberculosis were arrived after establishing relationship between prevalence of pulmonary tuberculosis and extrapulmonary tuberculosis.
7. Prevalence of pulmonary tuberculosis in AP was estimated from published studies by adjusting for deficiency in screening method and extrapulmonary tuberculosis.
8. Prevalence of pulmonary tuberculosis in AP was estimated from unpublished studies by adjusting for deficiency in screening method and extrapulmonary tuberculosis
9. Adjusted estimates from published and unpublished studies were compared and arriving at are compared and mean estimate for current prevalence of tuberculosis in rural areas of AP was arrived at.
10. Estimates of age specific remission (or duration) and case fatality rates are arrived from the Madanapalli study which was adjusted for improved remission rates reported from recent study which evaluated the district TB control programme.
11. Cause specific mortality rates for TB were estimated from SCD and MCCD data sets.
12. The age sex specified incidence pattern (step2), remission and case fatality rate (step11) are used as inputs to DISMOD. By an iterative process the incidence rates were adjusted to match close to the estimated prevalence and cause specific mortality for urban and rural AP.

A. Case definition

1. Pulmonary tuberculosis:

In epidemiological surveys a case of pulmonary tuberculosis is identified on the basis of smear positivity (either on direct microscopy or culture) and or x-ray abnormality suggestive of tuberculosis. All the cases diagnosed on the basis of x-ray abnormality need not be due to tuberculosis. More over, reliability and validity of x-ray readings has been demonstrated to be low by various epidemiological studies. The population based longitudinal studies undertaken by tuberculosis research centre (BCG trial), and national tuberculosis Institute have included only the bacillary cases for arriving at the incidence of tuberculosis. Hence, we have decided to include only the bacillary cases for estimation of incidence and prevalence of pulmonary tuberculosis among the adults in A.P.

The BCG trial, after undertaking a detailed review, has defined bacillary case of tuberculosis as:

a) cases positive on two cultures b) cases positive on one culture only and c) cases positive on smear only, excluding those showing 1-3 Acid fast Bacilli on entire smear

The BCG trial classified an individual whose sputum is positive on smear and negative on culture as a bacillary case of tuberculosis. The case definitions used by ICMR - National sample survey and NTI did not classify smear positives who are negative on culture as cases of tuberculosis. We have used the BCG trial definition for the bacillary cases for the following reasons. There could be two reasons for failure of a smear diagnosed as positive to yield culture. If the time lag is longer the chances of getting a negative culture will be more even in the presence of bacilli. The second factor is the strength of NaoH used for preparing the sputum for culture. There is a difference in defining a case in clinical practice and epidemiological studies. While a clinician can wait and repeat the sputum examination at a later date as his concern is whether to treat the case or not, an epidemiologist has to necessarily decide whether to include such cases in estimating the disease burden. Since the definition of the bacillary case already excludes the sputum samples demonstrating 1-3 bacilli in the entire smear, it is less likely that there is a reading error in smear examination. Hence, it is desirable to include the smear positive and culture negative cases for epidemiological estimates.

2. Extra pulmonary tuberculosis:

All cases diagnosed on clinical and or x-ray as suffering from active extra pulmonary tuberculosis have been included in this group.

B. Age sex distribution of Tuberculosis incidence:

In India four studies provide information on incidence of tuberculosis. These include tuberculosis prevention Trial undertaken by Tuberculosis Research Centre(TRC), Madras,NTI Study near Bangalore (1961-68)[17], Frimodt Muller's study in Madanapalle[18] (1950-55) and pamra's study in Delhi[19]. A summary of these studies is presented in the Table.

Review of Tuberculosis incidence studies undertaken in India				
Study	BCG trial	NTI	Madanapalli	Pamra
Year	1,968	1961-68	1950-55	1962-70
Study location	Tamil Nadu	Karnataka	Andhra Pradesh	Delhi
Area	Chingleput district	119 randomly selected villages	Population residing within 10 miles of	Urban Population under surveillance

[17] Tuberculosis in a rural population of south India: a five year epidemiological study, NTI, Bangalore; Bull WHO 1974, 51.pp. 473-487

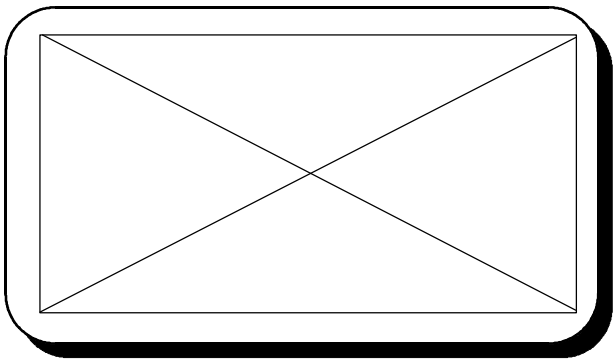
[18] J.Frimodt Muller; A community wide tuberculosis study in a south Indian rural population, 1950-55; Bull WHO 1960,22.

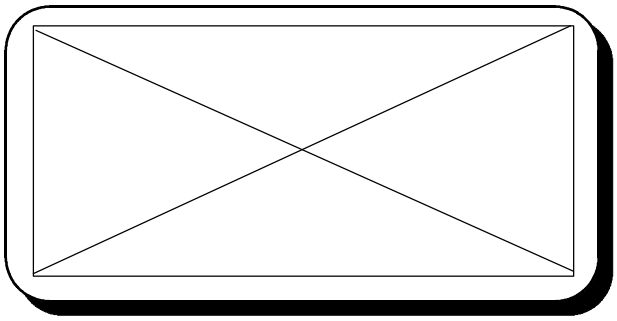
[19] S.P. Pamra et al; changes in prevalence and incidence of pulmonary tuberculosis in Delhi in recent years; Ind .J. Tuberculosis vol., No.2. pp.57-64.

		from three taluks of Bandlore district	Madanapalli town including accessible villages and small towns	of New Delhi Tuberculosis centre
Population covered	360,000	62,000	60,000	300,000
Duration	7.5	5	6	8
No. Of follow-up rounds	3	3	4	3
Duration between two follow-up rounds (yrs.)	2.5	1.5-2	0.7-1.6	2-2.5
Eligibility criteria	>10 yrs X ray	> 5 yrs X ray	All individuals aged> 5yrs	> 5 years
Methodology	Initial X ray. X ry read by two readers From individuals whose films interpreted as abnormal by either of two readers specimens of sputum collected. Sputum subjected to direct microscopy and two cultures	Initial X ray X ray read by two independent readers From individuals whose films interpreted as abnormal by two, any of two and technically inadequate two sample of sputum collected. Sputum subjected to direct microscopy and culture	Initial MMR Film read by one experienced reader X ray abnormals subjected for larger X ray and smear direct microscopy Sputum culture only for admitted cases	Initial X ray X ray read by two independent readers From Individuals whose films interpreted abnormal by either of readers sputum samples collected Sputum subjected for direct microscopy and culture.
Definition of a case	Eligible individual with a normal X-ray at the intake and becomes culture positive either with normal or abnormal X-ray	Eligible individual who was culture negative with normal or abnormal X ray in all the preceding surveys and who becomes culture positive with X ray abnormality in current survey	Fresh cases detected after an initial normal MMR. Separate analysis done for vacillary (direct smear) and X ray abnormals.	Fresh case among previously X ray negative. Separate analysis done for bacillary (direct smear & culture) and X ray abnormals.
Crude incidence	131-366	131-176	16-49	90-100

In majority of the studies reviewed (except pamra's study) the incidence tended to increase with age. This is in sharp contrast with the total absence of peak in young adulthood (between 25-30 yrs) generally noticed in the west. This brings out the issue to what extent the new cases occurring in the later parts of adult life are due to new infection or due to flare up of old endogenous infection acquired earlier. An attempt was made to address this issue by Fimodt Moller using the Madanapalli data. He observed that 66% of the new cases has tuberculin reaction of 10mm or more earlier there by suggesting that majority of the new cases could be due to reactivation of old infection. Review of NTI data by VV Krishnamurthy

et al[20] also had shown that 72% of the new cases came from a reservoir of previously infected population. Since a large reservoir of infected cases came from a reservoir of previously infected population. Since large reservoir of infected cases are existing in the community, it is not surprising to notice that most of the incidence cases occur with advancing age when the resistance of an individual is likely to go down there by resulting in reactivation of existing infection. Though pamra's study shows a peak in the younger age groups, the study covered a population residing in urban slums of Delhi which is more likely to be biased towards younger and fit individuals. Hence, we have decided to follow the incidence pattern and need not necessarily the magnitude of TRC, NTI and Madanapalli studies.





Though Madanapalle study was from A.P. The population covered in each age group is small and nearly four decades have passed since the survey. Pamra's study is also confined to a small urban population of 30,000 which is influenced by urban migration. In the NTI study the incidence was calculated from difference noticed between two prevalence surveys

[20] VVKrishna Murthy et al. Incidence of Tuberculosis among newly infected population and the relation to the duration of infected status; Indian J Tuberculosis Vol. XXIII No.1

and hence missed the new cases occurring between the surveys which either got cured or died. The TRC study, population known as BCG trial, covered a large population and also ensured that new cases appearing between the surveys are not missed. It is also more recent and hence provides a more realistic estimate of incidence. We have used the age and sex distribution of incidence cases reported from the BCG trial.

C. Trends of Tuberculosis:

It is difficult to get correct data on occurrence of new cases of adult tuberculosis from the same area repeatedly. Hence, repeated estimation of prevalence of tuberculosis infection among children by performing a tuberculin test is commonly used as a proxy to know whether there is any change in the incidence of tuberculosis. Prevalence of tuberculosis infection obtained through repeated tuberculin testings in children, over a period of time, is recognised to be a reliable indicator of tuberculosis incidence and its trend in a community[21].this is considered to be independent of efficiency of tuberculosis control programme. A WHO study group[22] has recommended that such survey can be undertaken once in five years.

Recently the TRC has undertaken a study which followed up two panchayat unions covered in the BCG trial and repeated tuberculin testing among the children aged 1-9 yrs. Tuberculin testing was done twice at intervals of 10 and 15 yrs[23]. The results of the study have clearly shown that risk of tuberculosis infection remained unchanged over a period of 15 yrs. Risk of new infection experienced by a child aged 1-9 yrs. In 1984 was same as that experienced by his counterpart 15 yrs. Earlier. Studies carried out in Karnataka (NTI) and in other parts of the country have also suggested that the tuberculosis incidence remained more or less constant over a twelve year period (1961-73)[24]. No decline in prevalence of infection was noticed among the children aged 0-9 yrs over a period of five years (1974-79) in a study undertaken by Chakraborty et al in Bangalore district of Karnataka state[25] . In another study undertaken at Delhi[26]no appreciable change in tuberculosis situation was noticed over a period of 15yrs (1962-77). In the state of Andhra Pradesh no such longitudinal studies were undertaken to assess the tuberculosis situation. However, considering the similarities in

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[21] Styblo.k. Recent advances in epidemiological research in tuberculosis. Adv. Tuberc. Res.20; 1980. 1.

[22] WHO Report of the south East Asian Research study group on tuberculosis 1981 p.11.

[23] Mayurnath S. Et al. Prevalence study of tuberculosis infection over fifteen years in a rural population in chingleput district (south India); Indian J Med...Res.(A) 93, March 1991, pp 74-80.

[24] Goyal SS et al Tuberculosis trends in an urban community. Indian J Tuberc 25 (1978) pp.

[25] Chakraborthy A.K et al, Tuberculosis in rural population of south India: Report on five surveys. Indian J Tuberc. 29(1982), pp152

[26] Goyal SS et al Tuberculosis trends in an urban community. Indian J Tuberc 25 (1978) pp.

population characteristics, socio-economic situation and geographical proximity of A.P. To Tamil Nadu and Karnataka, we have assumed that the tuberculosis situation in A.P. Also remained constant.

D. Adjustment for screening methods:

The yield of the tuberculosis cases in population based surveys is determined by the type of screening method adopted. Conventionally two screening methods are used to detect a case of tuberculosis in the surveys. These screening methods are summarised herewith.

1. Initial screening of all eligible persons is done with x-ray. All those with x-rays read as abnormal are subjected to sputum and /or culture examination. This approach will miss the sputum positive cases which do not exhibit any radiological abnormalities.
2. The second approach, which is currently being followed in the national programme, identifies the symptomatics first. The symptomatics are then subjected to sputum examination followed by an x-ray. Since all the cases suffering from tuberculosis need not be symptomatic, this approach will miss the asymptomatic cases.
3. A third screening method was followed in the Bhadrachalam. The symptomatics identified by door to door survey were first subjected to x-ray. Only the symptomatics having abnormal x-rays were subjected to on spot sputum microscopy. This screening method will miss the cases among asymptomatics and also symptomatic x-ray normals.

If we can estimate a relationship of the cases to different screening method. It will be possible to derive the true estimate of prevalence from almost all studies. The TRC study in North Arcot district in Tamil Nadu[27] provides useful data to estimate this relationship . The results of this study help to estimate the missing cases. About 25688 individuals were included in the study out of whom sputum samples were collected from 6007 on the basis of symptomatic status or x-ray abnormality.

E. The 205 sputum positive cases detected in North Arcot study give a prevalence of 800 per 100,000. If only x rays are used for screening 144 cases would have been identified which gives a prevalence of 560/100,000. Similarly if screening is confined only for symptomatics it would yield 135 cases which gives a prevalence of 526/100,0000. Thus, either methods of screening would miss about a third of the existing tuberculosis cases. About a half of the smear positive cases did not show any bacilli on direct microscopy and were detected on the basis of positive culture. About 15% of the smear positive cases, though positive on direct microscopy, did not yield any positive

[27] Tuberculosis prevalence survey in North Arcot District, Annual Report of TRC 1990 pp 107-118

culture. Based on these relationships we have arrived at adjustment factors to correct for cases missed by each of the screening method. This approach helps in arriving at more accurate estimates of tuberculosis prevalence.

Adjustment factor for type of screening procedure		
Screening method	No. of +ve cases	Adjustment factor
Symptomatic survey followed by smear examination	73	2.8
Symptomatic survey followed by smear examination and culture	112	1.8
X-ray survey followed by smear examination for X-ray abnormals	133	1.5
Symptomatic survey followed by X-ray and smear examination for X-ray abnormals	47	4.4
Symptomatic survey followed by X-ray, smear examination & culture for X-ray abnormals	71	2.9
Total smear and culture positive cases	205	
Total population	25,688	
Total smear & culture positive cases/Cases detected by screening method		

F. Establishing relationship between pulmonary and extrapulmonary tuberculosis:

Very little population based data is available on the prevalence of extrapulmonary tuberculosis. The intensified case detection camp held in Bhadrachalam(A.P.) In 1982 shows that out of the total pulmonary (bacillary) and extrapulmonary cases detected, 15% were constituted by persons suffering from extrapulmonary tuberculosis. An analysis of all tuberculosis patients attending different departments at Gandhi Hospital, Hyderabad[28]indicated that 16% of the total cases were extrapulmonary. This, however, may not reflect the community situation. The pulmonary tuberculosis patients are more likely to receive domicilliary treatment and only more complicated cases tend to come to hospitals. On the contrary, higher proportion of extrapulmonary tuberculosis patients will attend hospitals. We may not be far off from truth if we assume that one out of three cases of pulmonary

[28]Personal communication from Dr. Eswariah, state TB officer, Govt. Of Andhra Pradesh

tuberculosis will attend hospital. In case of extrapulmonary tuberculosis we can assume that either all the affected or at least half of the affected will attend hospital. We have taken average of these two and applied this relationship to arrive at the adjustment factor for extrapulmonary tuberculosis.

Adjustment factor for Extra pulmonary tuberculosis			
Place	Pulmonary	Extra pulmonary cases	Total cases
Hospital	84	16	100
Community with higher prevalence of extrapulmonary TB	252	32	284
Community average	252	16	268
Adjustment factor for extrapulmonary tuberculosis	252	24	276
Total cases were assumed to be 100			
Pulmonary cases in hospital X 3			
Extra pulmonary cases in hospital X 2			

G. Review of studies on TB prevalence in A.P.

Out of the published studies, the national sample survey undertaken by ICMR in 1953-58 is a large scale survey and has followed a well standardised protocol. Recently two population based surveys were undertaken in the districts of Khammam and Medak by the TB control programme officers. The emphasis of the Khammam study was on tribal population while the Medak study covered the rural population. We have summerised these studies herewith. We, however, restricted the data from these studies only to population above 15 yrs. The reasons for this were the pulmonary tuberculosis is less common below 15 yrs. And such analysis helps to make the data comparable with other studies.

1. ICMR National sample survey (1955-59):

The first major attempt to assess the magnitude of tuberculosis in the community was undertaken by ICMR in 1955-59. The survey covered a population of 116,539,000 aged above five years. Two zones (Hyderabad & Madanapalle) out of the total six zones covered in the study included parts of A.P. Each zone was further stratified in to city, towns and villages. Entire population residing at the selected sampling unit was listed. All those above the age of five years constituted the eligibles and were subjected to a miniature radiogram. Each x-ray film was read by two independent readers. A sample of the abnormals was sent to a central reader for consistency check. Bacteriological examination (on spot specimen) was carried out in all cases which were considered abnormal by one or both readers. The material collected for bacteriological examination consisted of sputum (two slides) for direct smear examination,

sputum (2tubes) for culture. If sputum was not available laryngeal swabs (2tubes) were collected for culture. The group that undertook the survey in Madanapalli zone was involved in the tuberculosis control activities for a long time. Hence, the bacillary case yield was noticed to be higher compared to Hyderabad zone. The reported prevalence of bacillary cases in Madanapalle zone was 1144/100000 in towns and villages respectively

2. Tuberculosis prevalence survey in Rural Medak district 1992:

To assess the prevalence of tuberculosis in the rural community a survey was undertaken in Medak district during the year 1992. The study also aimed to understand the epidemiological pattern of the disease and assess extent of utilisation of health services available for TB control.

The study was undertaken in thirty three villages selected by random sampling method. A door to door survey was undertaken covering all the residents aged above five years in the selected villages to identify chest symptomatics. NTI protocol which is standardised for health workers bias was used for symptomatic survey. The proportion of symptomatics above the age of 15 yrs. Reported in the study is comparable to that of North Arcot and Raichur studies undertaken by TRC. On the spot sputum was collected and a single sputum examination done to detect Acid Fast Bacillus (AFB) by Zeihl Nelson's stain. No culture or concentration techniques have been used. During the second phase chest symptomatics identified were subjected to MMR. The MMR was read by a single reader trained at National Tuberculosis Institute(NTI).

A total of 48,223 individuals were listed from the 31 villages covered. The total population above 15 yrs was 30,863. Out of the population above 15 yrs. 1196 symptomatics were identified. Out of the chest symptomatics identified 847 (70.82%) could be subjected for sputum examination and successful MMRs could be taken for 662(55%). A total of 50 smear positive cases were detected. This gives a prevalence rate of 162/100,000 for sputum positive cases. The prevalence rates were higher among males (males female ration=7:3).

Summary of Medak study findings		
Description	**Number**	**Percent**
Total population enumerated	48,223	
Population above 15 yrs.	30,863	100
Chest symptomatics listed	1,196	3.88
No. of symptomatics subjected to sputum examination	847	70.82*
Prevalence of smear positives	50	0.16
No. of MMRs technically adequate	631	52.76*
MMR Positives	129	0.42

Extra pulmonary tuberculosis	2	0
* Expressed as percent of symptomatics listed		

3. Intensified TB case finding in Bhadrachalam Division, Khammam District (1982):

An intensified case finding activity was undertaken in Bhadrachalam division of Khammam district in 1982 by the TB control programme of A.P. Initial enumeration of population was done to list the population aged above five years. A door to door survey was undertaken by the paramedics to identify the chest symptomatics among the listed population. The symptomatics listed were subjected to MMR. The x-rays were read by one reader trained at NTI. Only the individuals diagnosed to be having abnormal x-rays were subjected to sputum examination which included direct microscopy of on the spot sputum sample. Out of the total 1,46,449 population surveyed, 92,263 individuals above the age of fifteen years were listed. The screening for symptomatics yielded 5,189 symptomatics. Out of the symptomatics listed 5,183 were subjected for MMR. Among the individuals subjected for MMR , 1465 were diagnosed as radiologically abnormal. Out of the 1465 radiologically abnormal individuals identified, sputum examination was done for 1267 and 473 persons were detected to be smear positives. The study gives a prevalence rate of 513/100,000. Out of the detected cases the male female ratio was around 2:1. The prevalence of tuberculosis among tribals and non tribals was similar.

Summary of Bhadrachalam study findings		
Description	Number	Percent
Total population	146449	
Population above 15 yrs.	92263	100
Chest symptomatics listed	5189	5.62
No.of symptomatics subjected to MMR	5183	99.9*
MMR Positives	1465	1.59
No. Of symptomatics subjected to on spot sputum exam	1267	24.42*
Sputum positives	473	0.51
Extra pulmonary tuberculosis	84	0.09
* percent of symptomatics listed		

4. Prevalence of Tuberculosis after adjusting for screening methods in rural AP:

Prevalence of Tuberculosis/1000 population		
Survey	Before adjustment	After adjustment
ICMR Sample Survey	850	1642
Medak survey	162	706
Bhadrachalam survey	513	2832

5. Estimates for current prevalence of tuberculosis:

Out of the three studies, Medak study is most recent. The ICMR sample survey was conducted nearly four decades back when there was no National programme for tuberculosis control and anti tuberculosis drugs were not freely available. This makes it inconsistent with the burden of disease methodology which estimates the burden at the current operational efficiency of the intervention programme. The Bhadrachalam study was undertaken in tribal area. As the tribal population constitutes about 6% of the total population of the state, the results of this study can not be applied for the entire state. The population residing in tribal areas are included in the rural population in census data. The rural population constitutes about 73% of the total state's population. Out of the rural population, 8.65% was constituted by scheduled tribes. We have arrived at the mean prevalence of tuberculosis for rural population by applying prevalence rates of Medak study to the non tribal rural population (91.35%) and prevalence rates of Bhadrachalam to the tribal population (8.65%).

Estimated prevalence of TB in rural A.P. =(706 X 0.9135) + (2832 X 0.0865)

=890/100,000 adults

This estimate is close to the results of recent survey undertaken by TRC at Raichur district in Karnataka[29] (1090/100,000 population).

6. Deriving age & sex specific incidence of Tuberculosis in rural and urban A.P. Using DISMOD

The burden of disease methodology requires estimation of age specific incidence and duration of disability to estimate the DALYS. In addition, the consistency of the epidemiological estimates need to be checked. A disease model built on known relationships between different epidemiological parameters by the Burden of Disease Unit (DISMOD) helps in achieving these objectives. The model requires instantaneous remission and case fatality rates of the disease to be used as inputs. Estimation of these instantaneous rates requires follow-up studies. Out of three studies undertaken in rural south India, Madanapalli study was from Andhra Pradesh. It also provides age specific data on remission and case fatality. The results of the study are presented in the table...

Out come of the newly diagnosed cases on Tuberculosis from Madanapally study							
Age group	Initial cases	1st Year			5th year		
15-24	167	14	54	99	40	34	93

[29] Tuberculosis prevalence in Raichure District. Annual report of Tuberculosis Research Institute (ICMR) 1989 pp 12-131.

25-34	337	22	129	186	93	78	166
35-44	298	26	110	162	108	52	138
45-54	210	29	86	95	90	33	87
55	144	99	53	72	74	26	44

Out come of the newly diagnosed cases on Tuberculosis from Madanapally study (percent)							
Age group	Initial cases	1 st Year			5th year		
		Mortality rate	Persistence rate	Remission rate	Mortality rate	Persistence rate	Remission rate
15-24	167	8.38	32.34	59.28	23.95	20.36	55.69
25-34	337	6.53	38.28	55.19	27.6	23.15	49.26
35-44	298	8.72	36.91	54.37	36.24	17.45	46.31
45-54	210	13.81	40.95	45.24	42.86	15.71	41.43
55	144	13.19	36.81	50	51.38	18.06	30.56

We have calculated the instantaneous remission and case fatality rates from this data using the outcome at fifth year.

Age specific instantaneous rates from Madanapalli study		
Age group	Instantaneous remission	Instantaneous case fatality rate
15-24	0.23	0.1
25-34	0.19	0.11
35-44	0.2	0.15
45-54	0.18	0.18
55	0.13	0.21
All	0.19	0.14

This study was undertaken in early sixties and subsequently there has been a phenomenal change in tuberculosis chemotherapy which will have influence on outcome. Hence, we have reviewed studies which assessed the outcome of tuberculosis cases in recent times. Dr. Manjula datta et al[30]have assessed the outcome of 2257 smear positive cases registered for treatment under District Tuberculosis control programme in North Arcot district, Tamil Nadu. Though this report did not provide age and sex specific cure rates, it provides aggregated information on outcome of all cases. This information also captures the outcome of the defaulters and hence consistent with the burden of disease approach of estimating the disability and mortality at the current operational efficiency of the intervention programmes. When we compared the aggregate remission and case fatality (after excluding general mortality rate), we found that mortality rates of Madanapalli are comparable with North Arcot while remission rates in North Arcot are 2.5 times higher. Though both cohorts received treatment, the North Arcot patients had access to better chemotherapy (69% received short course chemotherapy) which explains better remission. The marginal difference

[30]Manjula Datta et al. Critical assessment of smear-positive pulmonary tuberculosis patients after chemotherapy under the district tuberculosis programme, tubercle and lung disease 74,1993 pp 180-186.

between mortality rates could be due to the known observation that even single INAH administration favourably reduces the mortality. Considering the fact that Madanapalli study was undertaken in Andhra Pradesh and provides age specific follow-up data we have used it as an input to DISMOD after applying an adjustment factor of 2.5 to correct for current treatment practices and patient compliance. While Madanapalli data on outcome is not available by sex, North Arcot study gives only information on deaths by sex.

Estimation of adjustment factors for sex							
Sex	Initial Cases	Cases cured	Died	Instantaneous remission rate	Instantaneous case fatality rate	Adjustment factor for remission	Adjustment factor for case fatality
Male	94	29	46	0.12	0.2	1.1	0.86
Female	32	12	16	0.18	0.24	0.76	1.01
Both sexes	126	41	62	0.14	0.2	1	1

Adjusted age and sex specific instantaneous remission rates								
Age group	Male				Female			
	Madanapalli	Adjustment factor for chemotherapy	Adjustment factor for sex	Adjusted rate	Madanapally	Adjustment for chemotherapy	Adjustment factor for sex	Adjusted rate
15-24	0.23	2.5	1.1	0.63	0.23	2.5	0.76	0.44
25-34	0.19	2.5	1.1	0.52	0.19	2.5	0.76	0.36
35-44	0.2	2.5	1.1	0.55	0.2	2.5	0.76	0.38
45-54	0.18	2.5	1.1	0.5	0.18	2.5	0.76	0.34
45-54	0.18	2.5	1.1	0.5	0.18	2.5	0.76	0.34
55+	0.13	2.5	1.1	0.36	0.13	2.5	0.76	0.25
All	0.19	2.5	1.1	0.52	0.19	2.5	0.76	0.36

Adjusted age and sex specific instantaneous case fatality rates						
Age group	Male			Female		
15-24	0.1	0.86	0.08	0.1	0.76	0.07
25-34	0.11	0.86	0.09	0.11	0.76	0.08
35-44	0.15	0.86	0.13	0.15	0.76	0.11
45-54	0.18	0.86	0.15	0.18	0.76	0.14
55+	0.21	0.86	0.18	0.21	0.76	0.16
All	0.14	0.86	0.12	0.14	0.76	0.11

Using these instantaneous rates as inputs we have adjusted the instantaneous incidence rates to correspond with the known age specific annual incidence rates and estimated age specific deaths to get the best plausible match.

DISMOD outputs for Rural AP								
Age group	Male				Female			
	Annual incidence /100000	Annual prevalence/100000	Annual age specific deaths	SCD estimated deaths	Annual incidence /100000	Annual prevalence/100000	Annual age specific deaths	SCD estimated deaths

0-4	15.8	15.2	34	509	11.9	13.6	27	218
5-14	20	28	131	185	19	28.9	115	316
15-44	439.5	617.8	7,775	6,268	233	45.7	4,166	4,199
45-59	1,227.5	1,846.8	9,582	14,296	655.2	1,298.5	5,627	10,590
60+	1,555.5	2,918.2	8,385	9,784	735.2	2,078.4	3,819	5,296
All	465.1	714.7	25,907	31,042	248.2	532.3	13,754	20,619

By adjusting the age specific incidence rates we tried to get the best match for the estimated prevalence and deaths. The DISMOD outputs suggest that we have to go for higher age specific incidence rates than reported to arrive closer to the estimated deaths and prevalence. Even than the estimated deaths are lower than the deaths estimated from SCD surveys. Considering the fact that SCD data is based on lay reporting there is more likelihood of overestimating the tuberculosis deaths we felt the DISMOD outputs are fairly representative of prevailing cause specific mortality due to tuberculosis.

When we applied the same rates in urban areas, the death estimates were found to be very high. Our estimates of prevalence are based on surveys undertaken in rural areas. Though the National sample survey reported higher prevalence in urban areas, we felt that the urban residents have better access to treatment and hence better remission rates. Hence, we have adjusted the remission rates of the rural areas by a factor of 1.25 and then adjusted the incidence rates to match the deaths estimated from MCCD data. These results are presented in table.

DISMOD outputs for Urban AP								
Age group	Male				Female			
	Annual incidence /100000	Annual prevalence/100000	Annual age specific deaths	MCCD estimated deaths	Annual incidence /100000	Annual prevalence/100000	Annual age specific deaths	MCCD estimated deaths
0-4	14.3	12.2	10	479	10.7	11.1	8	257
5-14	18	20.7	36	136	13.5	21.7	32	72
15-44	398.6	470.3	2,354	2,370	141	233.1	840	837
45-59	1,019.2	1,301.3	2,231	2,211	384	616.9	730	651
60	1,666.1	2,683	1,881	1,867	881.9	211.5	1,054	1,119
All	388.4	498.6	6,512	7,063	163.2	301.7	2,664	2,936

The estimated age specific incidence rates in urban areas are comparable with the incidence rates reported from BCG trial. It is, however, evident that in both urban and rural areas, the number of deaths reported in the less than 15 years are less than the reported deaths. In fact, we tried to match the annual incidence rates in these two age groups as close as possible to the age specific incidence reported from the longitudinal studies reviewed. Even then the DISMOD estimated deaths remained much lower than the deaths estimated from registration schemes. Tuberculosis experts often argue that it is difficult to get samples

of sputum from this group. Also, the proportion of extra-pulmonary forms of tuberculosis would be higher in this group which are not captured by the community based surveys. Hence, we have to apply an adjustment factor to correct the incidence and mortality estimates of this age group.