Chapter 9

Burden of disease estimates for Andhra Pradesh and implications for policy

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The AP Burden of Disease (APBD) estimates arrived at in this study are of importance from two different policy perspectives. Firstly, any NBD estimate will be of immediate interest to those concerned about health policy of the concerned national or sub-national entity for which the study is made. Those concerned with the state of people's health in Andhra Pradesh will naturally be interested in knowing the magnitude of disease burden suffered in the state and its composition. Secondly, I have embarked on this exercise in pursuit of some generic questions about the usefulness of NBD estimates and conditions in which NBD studies would enrich and inform formulation of health policy. One of the research questions raised in chapter 1 is to reflect on appropriateness of possible investments on NBD studies. In the first section, results on burden of disease in Andhra Pradesh and important causes of burden are presented. Then I return to the research questions raised in chapter one are reverted to. I examine changes in disease burden profile at different levels of anchorage with local data. Which in fact is the primary concern of this work. Disability adjusted life years were computed for Andhra Pradesh separately for rural and urban areas. All estimates reported here use age weighting with the same age weight parameters used by Murray and Lopez (1996). Discounting is done at the rate of 3%.

Andhra Pradesh Burden of Disease Study results and important causes of disease burden:

I present two estimates of disease burden in Andhra Pradesh. The two differ in the set of disability weights used for the health states. There are different schools of thought and preferences about the method of valuation to directly measure the subjective utility of different health states from individuals. Some believe that VAS tends to obtain a more severe valuation for milder health states, and think that TTO valuations are less biased. Although theoretical justifications for TTO valuations have been advanced, the belief appears to have been strengthened by its closeness to judgements by public health experts about disability weights for various health states.

Health state valuations are by definition individual preferences between different health states. So valuation by public health experts are indeed individual preferences of these professionals. A public health professional can hardly claim any expertise in valuation of health states, except for his / her own valuations. These professionals usually have better knowledge of different health states. In other words their expertise is in visualising description of health states and connecting a disease label to some description. In addition, people may attach some importance to personal preference of public health experts. Extending upon this willingness of people to defer to professional judgement, the expert rated disability weights can also be viewed as objective assignment of health state values. The disability weights used by the GBD96 study were derived from workshops mostly attended by medical and public health experts from different areas and are labelled expert rated disability weights. These disability weights can be considered as aggregated individual preferences from a convenience sample or as objective assignment of weights by public health experts, depending on one's point of view. The expressions "expert rated" and "expert judgement" etc. are used here to mean valuation by public health experts.

The Andhra Pradesh Health State Valuation Study 1999, described in chapter 6-7 revealed that the community in Kondakkal village assigned consistently higher disability weights compared to the GBD96 weights. We have seen earlier that part of the difference between APHSV99 community rated disability weights and GBD96 weights can be attributed to VAS. But another part of the difference appears to be real. If VAS is indeed generally scaling the disability weights upwards and more so for milder conditions, then it is in effect giving more weightage to disability component of the summary measure of population health status. In any case the disease burden estimate using VAS-based local measurement of disability weights can be viewed as a scenario giving relatively higher importance to disability component over premature mortality component. Policy makers can then reflect on the commonalties and differences between disease burden estimates based on local cause of death data and a conservative estimate of disability component using generally lower disability weights arrived at by experts, and VAS based measurements of disability weights from community studies. Here the set of disability weights obtained from community survey are referred as community rated disability weights.

Thus the two burden of disease estimates presented below use the (a) expert rated disability weights and (b) community rated disability weights, respectively. The community rated disability weights are generally higher than the expert rated disability weights, for corresponding health states. Hence the burden of disease estimate based on community rated disability weight is expected to emphasise disability component of the disease burden. Such estimates can be useful for planning of health care delivery capacity and types of health care delivery institutions. The expert rated disease burden estimates would show the mortality component of the disease burden more than the other estimate. Hence they can be used to plan for preventive programs and to set priorities for research. Some leading causes of burden may show up in all estimates. Such causes of disease burden found to be important from more than one perspective will naturally deserve greater attention and be prime objects of health policy.

APBD estimates using expert rated disability weights:

Results presented in this section are based on general demographic estimates of mortality level and population, and causes of death in the state. Epidemiological estimates of incidence, age at onset and duration are taken from the Global Burden of Disease study 1996 (Murray and Lopez, 1996) for the India region. The GBD96 disability weights used by Murray and Lopez (1996) for the GBD study are maintained. Estimates of DALYs lost, YLL and YLDs by cause, age sex, rural and urban region, are provided in Appendix 9-1 to 9-3.

Figure 9.1: Rural-Urban distribution of disease burden in AP

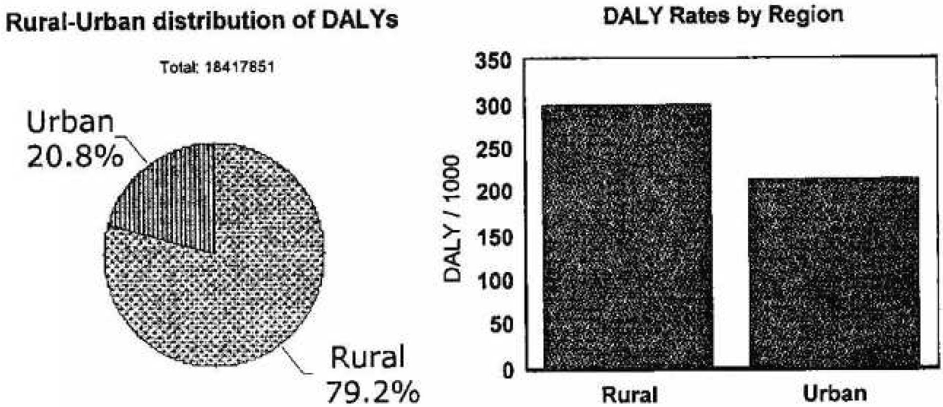


Figure 9.1 shows the rural-urban distribution of disease burden in the state. About 79% of disease burden is estimated to be in the rural region. The rate of disease burden is also higher in the rural areas, where rate of loss is 300 DALYs / 1000 persons. In urban areas the rate of loss is 214 DALYs / 1000 persons.

Figure 9.2: Distribution of DALYs and YLL : YLD ratio by age sex groups

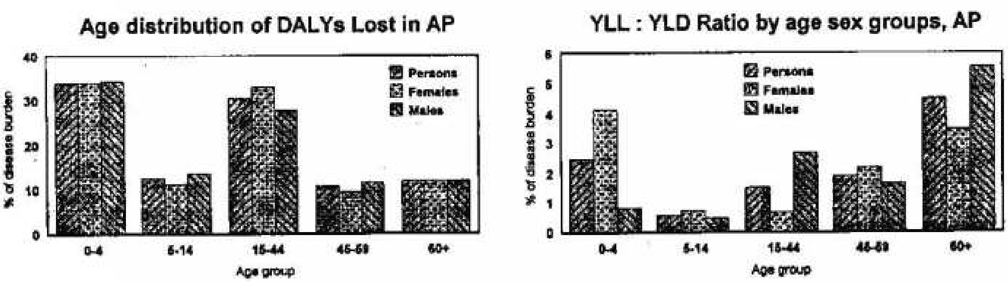


Figure 9.2 shows age-sex distribution of disease burden and the composition in terms of YLL : YLD ratios. A lot of disease burden is concentrated in infancy and early childhood. These are mostly due to premature mortality, as can be inferred from the high YLL to YLD ratio in this age group. Within the 0-4 year age group, girl infants and children are more vulnerable to death (YLL:YLD ratio = 4.14), whereas male infants and children live with disability (YLL to YLD ration = 0.83). In adult age group of 15 to 44, the situation is reversed. Among those who suffer, females tend to live with disability and males are more vulnerable to death.

Table 9.1 shows ten leading causes of burden in rural and urban areas of the state. Six leading causes are common to both the areas. These are: (a) lower respiratory infections, (b) diarrhoea, (c) low birth weight, (d) ischaemic heart disease, (e) falls and (f) tuberculosis. Poor nutrition, lack of safe drinking water and sanitation are common risk factors for three of these, namely lower respiratory infection, diarrhoea, and low birth weight. Four of these (a, b, c, and f) are already included in various public health and disease control programs of the state. The results obtained here reinforces the desirability of those programs.

Table 9.1 Leading causes of disease burden (DALY) in rural and urban areas of AP

Rural: Cause	%	Urban: Cause	%
Lower Respiratory Infections	8.4	Falls	6.91
Diarrhoeal diseases	6.94	Low birth weight	6.32
Low birth weight	6.8	Lower Respiratory Infections	5.98
Ischaemic heart disease	6.09	Tuberculosis	5.34
Falls	5.45	Diarrhoeal diseases	4
Self-inflicted injury	4.24	Ischaemic heart disease	3.77
Tuberculosis	4.1	Fires	3.47
Cerebrovascular disease	2.56	Birth Asphyxia and birth trauma	3.21
Bacterial meningitis and meningococcaemia	2.39	Road accidents	2.96
Epilepsy	2.24	Unipolar major depression	2.91
Road accidents	2.15		
Residual cause groups with % burden higher than last cause included above:			
Other unintentional injuries	5.83	Other cardiac diseases	3.72
		Other unintentional injuries	3.68

It will be useful to look at the age pattern of the next two top causes of disease burden, namely ischaemic heart disease (IHD) and falls. Figure 9.3 shows the age distribution of DALYs lost due to these two conditions. The burden on account of ischaemic heart disease occurs at older age groups. The age distribution of DALYs lost on account of falls is just the opposite. Most of the falls appear to occur at younger age groups. Children age group of 5 to 14 years are most vulnerable. Unfortunately, there is no initiative yet to study the causes of fall in children and how they can be prevented. Regarding ischaemic heart disease, a fairly large capacity of curative treatment of cardiac diseases have been developed in the state, mostly in the private sectors, and to some extent in the public sector. Attention on issue of lifestyle, and training of doctors in medical management of myocardial infarction are areas where some state intervention may be called for.

Figure 9.3: Age distribution of DALYs lost on account of IHD and Falls

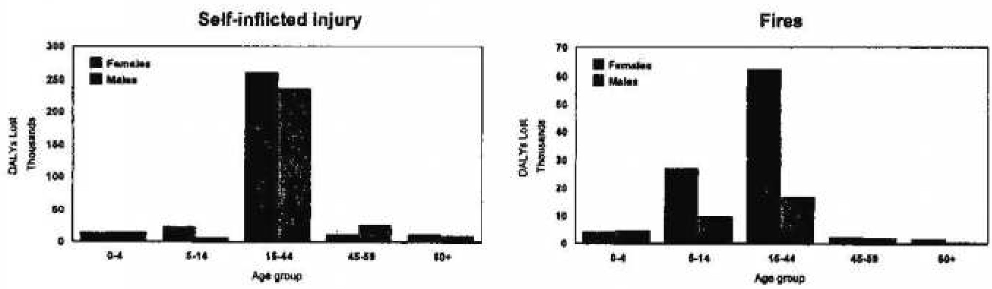
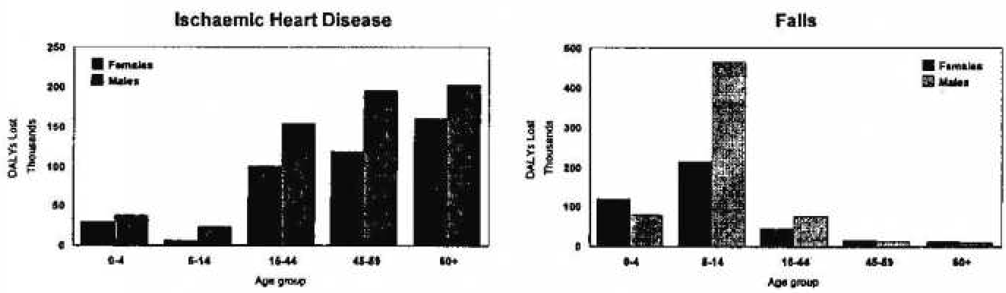


Figure 9.4: Age sex distribution of DALYs lost on account of suicide and fires



Among the leading causes of burden unique to the rural area, self-inflicted injury deserves attention. Figure 9.4 shows the age distribution. Clearly almost all of these deaths are in the adult age group 15 to 44 years. Figure 9.5 shows the rural, urban, YLL and YLD break up of the DALYs lost due to self-inflicted injuries and fires. The DALYs lost due to self-inflicted injury are simply deaths due to suicide and most of it is in rural areas. The age distribution of burden due to fires is similar to age distribution for self-inflicted injuries. DALYs lost on account of fire accidents are mostly among adults and young children. The difference between the age-sex pattern of burden due to fires in urban areas and suicide in rural areas is in the gender distribution. Incidence of self inflicted injuries in rural areas appears to be nearly equal for females and males. In urban areas, females are the major victims of fire accidents. Although fires showed up in the ten leading causes of burden in urban areas, the problem is just as prevalent in rural areas. As seen in Figure 9.5 (right plot), the bulk of the disease burden attributable to fires is in the rural areas. This is simply due to the large population in the rural areas. Fires have caused both premature mortality and disability.

Figure 9.5: Rural-Urban and YLL-YLD break up of DALYs lost on account of suicide and fires.

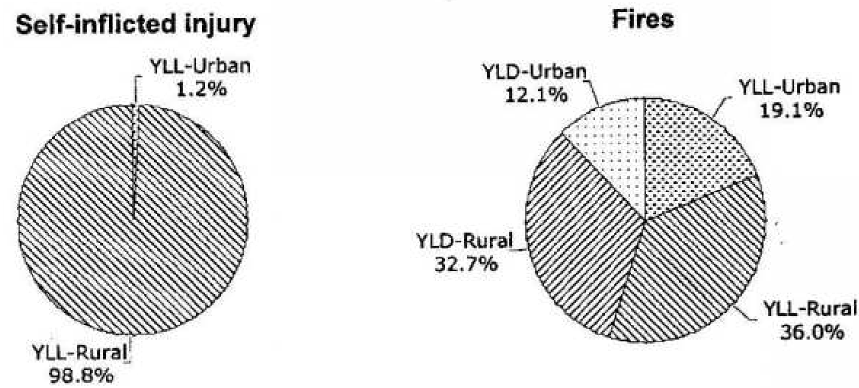
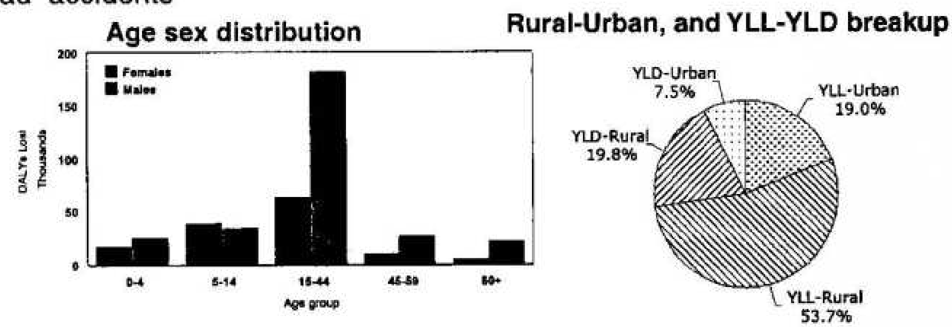


Figure 9.6: Age-sex distribution and composition of DALYs lost on account of road accidents



Road accidents are another cause for concern, rampant in both urban and rural areas. Although road accidents did not show up within the ten leading causes for rural areas, it happens to be the eleventh cause of burden in rural areas. Victims here are mostly in adults in age group 15-44, although all other age groups do suffer some burden due to road accidents. More males are affected.

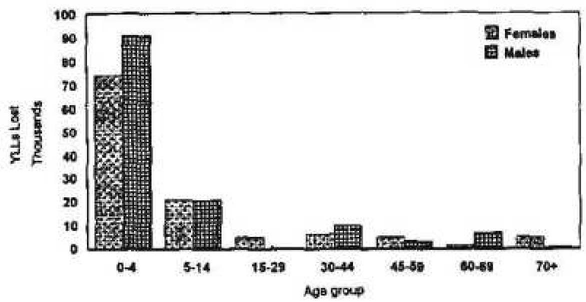
Table 9.2 Leading causes of premature mortality (YLL) in rural and urban areas

Rural: Cause	%	Urban: Cause	%
Lower Respiratory Infections	11.43	Low birth weight	9.74
Diarrhoeal diseases	9.26	Lower Respiratory Infections	9.4
Low birth weight	9.01	Tuberculosis	7.86
Ischaemic heart disease	8.49	Ischaemic heart disease	6.18
Self-inflicted injury	6	Diarrhoeal diseases	5.84
Tuberculosis	5.12	Birth Asphyxia and birth trauma	4.17
Cerebrovascular disease	3.25	Road accidents	3.59
Bacterial meningitis and meningococcaemia	3.22	Fires	3.58
Cirrhosis of the liver	2.63	Cerebrovascular disease	3
Malaria	2.47		
Road traffic accidents	2.22		
Residual cause groups with % burden higher than last cause included above:			
Other unintentional injuries	4.99	Other cardiac diseases	6.28
		Other infectious diseases	4.26
		Other perinatal conditions	4.03

In urban areas, birth asphyxia and trauma are among the ten leading causes of DALYs. Most of this burden is on account of premature mortality. Appearance of the burden due to birth asphyxia and trauma in the urban areas, instead of the whole state, could be due to location of hospitals and nursing homes. Birth asphyxia and trauma are most probably reported from hospitals and nursing homes, most of which are located in urban areas. These would include cases from both rural and urban areas, since hospitals in urban areas do serve surrounding rural hinterlands. Hence, it would be reasonable to say that birth asphyxia and birth trauma is an important cause of disease burden for the whole state. This finding has important implications for policy regarding development of infrastructure for institutional deliveries and also for the quality of maternity services provided by hospitals and nursing homes. Table 9.2 shows the leading causes of burden due to premature mortality. Most of the leading causes of overall disease burden, for example, lower respiratory infections, diarrhoeal diseases, low birth weight, tuberculosis, etc are repeated here. In addition, malaria appears as a leading cause of mortality in rural areas. Most of the premature mortality due to malaria occurs in infancy and early childhood (Figure 9.7).

Figure 9.7: Age-sex distribution of premature mortality due to malaria in rural areas.

Malaria - YLL : Age sex distribution



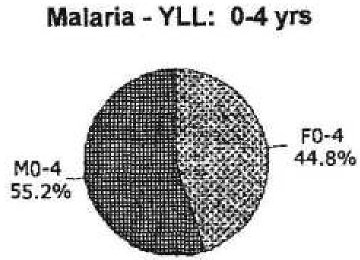


Table 9.3: Leading causes of disability (YLD) in Andhra Pradesh

Rural: Cause	%	Urban: Cause	%
Falls	16.43	Falls	16.22
Unipolar major depression	6.66	Unipolar major depression	7.14
Epilepsy	5.64	Epilepsy	5.85
Cataracts	3.65	Schizophrenia	3.37
Fires	3.26	Fires	3.32
Schizophrenia	3	Cataracts	2.98
Protein-energy malnutrition	2.66	Lymphatic filariasis	2.53
Lymphatic filariasis	2.39	Protein-energy malnutrition	2.45
Obsessive-compulsive disorders	2.23	Obsessive-compulsive disorders	2.4
Chlamydia	2.16	Chlamydia	2.37
Abortion	2.11	Abortion	2.32
Residual cause groups with % burden higher than last cause included in ten leading causes:			
Other unintentional injuries	7.85	Other unintentional injuries	7.85

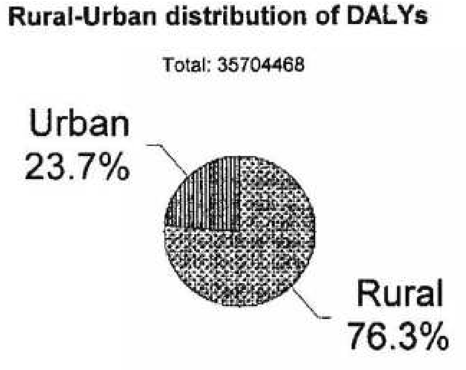
Table 9.3 shows leading causes of disability in the state. Falls and fires are among the leading causes of disability. This reflects the fact that falls and fires not only cause loss of life, but also produce a lot of disability. Protein energy malnutrition is a major cause of disability. The burden is on account of developmental disability suffered by children due to poor nutrition. Unipolar major depression is yet another leading cause of disability to be viewed this along with the fact that suicide is a leading cause of premature mortality. Cataract blindness, for which a control program is under implementation, is also among the leading causes of disability.

APBD Estimates using community rated disability weights:

Results presented in this section are based on the general demographic estimates of mortality level and population, and causes of death in the state. Epidemiological estimates of incidence, age at onset, and duration are taken from the Global Burden of Disease study 1996 (Murray and Lopez, 1996) for the India region. The disability weights are based on VAS results from the community survey of health state valuations in Kondakkal village in Andhra Pradesh (APHSV99-VAS weights). Methodology of the health state valuation study was described in Chapter Six. Details regarding estimations of disability weights for all health states using the results for indicator conditions from the community survey and the GBD96 system of disability weights were given in Chapter Five. Estimates of DALYs lost, YLL and YLDs by cause, age sex, rural and urban region, are provided in Appendix 9-4 to 9-6.

Figure 9.8 shows the rural-urban distribution of disease burden in the state. The overall rate of disease burden is higher at 537 DALY / 1000 population compared to 277 DALY / 1000 population according to the estimate using expert rated disability weights. The rate of estimated burden is 560 DALYs / 1000 population in rural areas and 474 DALYs / 1000 population in urban areas. This is expected, since the community ratings of disability weights has been higher than the expert rated disability weights. The share of disease burden in rural areas is slightly less at 76% with a corresponding increase in share of disease burden in urban areas at 24%. The change in rural urban distribution of disease burden is because the rural burden is largely due to premature mortality and the urban disease burden is largely due to degenerative and non communicable diseases. Since the community rated disability weights are higher than the expert rated weights, the years lived with disability due to degenerative and non communicable disease in the urban areas get emphasised. Hence share of urban disease burden increases by 3% with a corresponding decrease in share of disease burden in rural areas.

Figure 9.8: Rural-Urban distribution of Disease Burden in Andhra Pradesh (Community Rated Disability Weights).



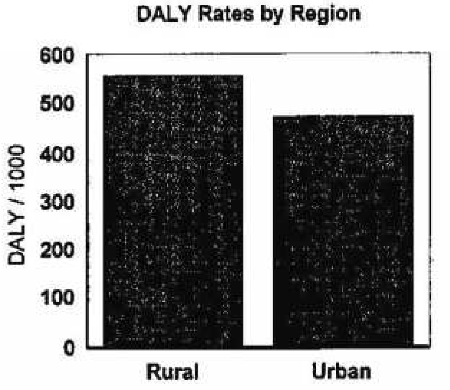
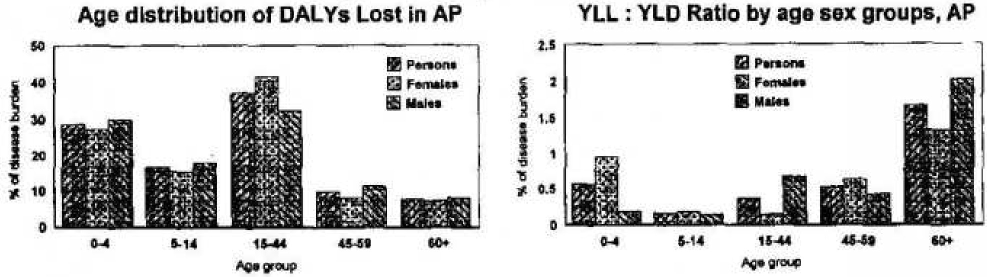


Figure 6.9 shows age-sex distribution of disease burden and the composition in terms of YLL : YLD ratios, according to the estimate using community rated disability weights. In the earlier estimate using expert rated disability weights, maximum disease burden was located in infancy and childhood (0 to 4 years). Now the locus of maximum percentage of disease burden has shifted to adults in age group 15-44 years.

Figure 9.9: Distribution of DALYs and YLL : YLD ratio by age sex groups. (Community Rated DWts).



Compare the Y axis scale of the right side plot in Figure-9.9 with Figure-9.1 and note that the range of Y axis scale has changed from 0 to 6 to 0 to 2.5. Use of community rated disability weights increased the disability component of disease burden giving rise to a reduction in highest YLL:YLD ratio from 6 to 2.5. Except for the elderly age group of 60+ years, the disability component of disease burden is more than the premature mortality component. Most of the YLL:YLD ratios at these age groups are less than one. The sex differentials in disability - premature mortality composition is maintained as in case of the earlier estimate using expert rated disability weights.

Table 9.4 Leading causes of disease burden (DALY) in rural and urban areas of AP (Community Rated Disability Weights).

Rural: Cause	%	Urban: Cause	%
Periodontal disease	7.36	Periodontal disease	9.16
Protein-energy malnutrition	5.63	Protein-energy malnutrition	6.60
Lower Respiratory Infections	**4.90**	Fires	6.06
Fires	4.85	**Falls**	**5.19**
Falls	**4.72**	Obstructed labour	4.07
Diarrhoeal diseases	**4.42**	**Lower Respiratory Infections**	**3.13**
Low birth weigh	**t3.86**	**Low birth weight**	**3.08**
Ischaemic heart disease	3.30	Upper Respiratory Infections	2.76
Obstructed labour	3.19	**Tuberculosis**	**2.73**
Tuberculosis	**2.47**	**Diarrhoeal diseases**	**2.63**

Residual cause groups with % burden higher than last cause included in ten leading causes:

Other unintentional injuries	9.64	Other unintentional injuries	9.27

Table 9.4 shows ten leading causes of burden in rural and urban areas of the state, according to the estimate using community rated disability weights. According to this estimate, nine leading causes are common to both the areas. These are: (a) periodontal disease, (b) protein energy malnutrition, (c) lower respiratory tract infections, (d) fires, (e) falls, (f) diarrhoeal diseases, (g) low birth weight, (h) obstructed labour, (i) tuberculosis. Five of these (shown in bold) were there in six of the top ten causes common to both rural and urban areas according to the estimate using expert rated disability weights. These are: (a) Low birth weight, (b) Lower respiratory infections, (c) Diarhoeal disease, (d) Fall, and (e) Tuberculosis. Certain diseases characterised mostly by morbidity appear in the present list. For example; periodontal disease. Fire accidents was already among the top ten causes of burden in urban areas, in the estimate using expert rating of disability weights. Here with community rated disability weights, fire accidents show up among the ten leading causes of burden both in rural and urban areas. But self-inflicted injuries recede lower down, since most of the burden under this cause is due to suicides. The disease burden due to fire accidents and suicides are manifestations of social problems.

Levels of anchorage to local data and NBD Results:

Inputs from the Global Burden of Disease study (World Bank, 1993; Murray and Lopez, 1996) were used to generate the minimally anchored NBD estimates for Andhra Pradesh. The final results of the first global burden of disease study were published in 1996 - GBD96. By the time of this final revision, causes of death in urban areas of Maharashtra had been gathered by the Andhra Pradesh Burden of Disease Study, to approximate the mortality experience in urban areas of India. The urban cause of death data from Maharashtra was incorporated by the GBD96 study for the Indian estimates (Murray and Lopez, 1996 p139). In the present study, urban causes of death data remain the same while rural causes of death data have been a recent addition. The GBD96 study also had access to some preliminary insights from the pilot study on rural cause of death in Andhra Pradesh (Murray and Lopez, 1996 p140). Since the GBD96 study already incorporates a lot of local information on causes of death, it will be interesting to look at the first GBD estimates published in the World Development Report, 1993 (World Bank, 1993). Call this the WDR93. The WDR93 results used here for comparative purposes are the results taken for India directly from the World Development Report (1993, Appendix B). The GBD96 based estimates have been computed for Andhra Pradesh using the cause-specific mortality proportions, incidence, and duration data for India as used by the GBD96 study. The GBD96 disability weights are also used as such. General demographic estimates for Andhra Pradesh described in Chapter 2 were used. These general demographic estimates are common inputs to the

GBD96 based estimate and the intermediately anchored estimates for Andhra Pradesh.

Three intermediately anchored estimates are presented. The first one starts with the inputs used for the GBD96 based estimate, but with the cause-specific mortality proportions replaced by local estimates. The local cause-specific mortality proportions come from two studies. The rural cause of death study described in Chapter 3 provided the cause-specific mortality proportions for the rural population of Andhra Pradesh. The urban cause of death data are based on analysis of data from Maharashtra as described in Chapter 3. I call this the cause of death anchored (COD anchored) estimate. All other inputs are the same as in case of the GBD96 estimate. The second one starts with inputs for the COD anchored estimate and replaces the GBD96 disability weights with the APHSV-VAS weights. The health state valuation study leading to estimation of these disability weights was described in Chapter 4. Call this the HSV-VAS anchored estimate. The third estimate uses APHSV99-Torrance-TTO disability weights instead of the APHSV99-VAS weights. Call this the HSV-Torrance-TTO estimate. So in all we have five estimates (Table 9.5). The epidemiological parameters like incidence, duration and age at onset, remain same as in GBD96. The locally anchored estimates were computed separately for rural and urban areas of the state whereas the GBD96 estimate has been computed for the whole state population. The WDR93 and GBD96 are the two minimally anchored estimates. The three intermediately anchored estimates comprise of the COD anchored, and the two HSV anchored estimates.

Table 9.5: Overview of Burden of Disease Estimates for Andhra Pradesh with different levels of anchorage to local data.

Estimate	Anchor to local data	GBD resource
WDR93	None	GBD Regional estimate for India
GBD96	General demographic estimates for AP Maharashtra urban cause of death data	Cause-specific mortality in India Incidence, age at onset and duration Disability weights
COD anchored	As above, plus Rural cause of death data from AP	Incidence, age at onset and duration. Disability weights
HSV-VAS anchored	As above, plus Community-based health state valuation	Incidence, age at onset and duration
HSV-Torrance TTO anchored	As above, but HSV-VAS disability weights are transformed using power function estimated by Torrance (1976), relating VAS to TTO valuations.	As above

Table 9.6 shows some results obtained through the different estimates. First note that Murray and Lopez have made substantial revisions between the first GBD estimates published in WDR93 and the GBD96 estimates. The GBD96 estimate of DALY loss per 1000 persons are about 20% lower than the WDR93 estimates. In comparison, the difference between GBD96 and COD anchored estimate is marginal, in the range of 0.6 to 2.5%. For YLL and YLD, we do not readily have the rates from WDR93. Comparing GBD96 with COD anchored estimate, we see that YLD rates remain the same. This is to be expected, since both estimates share the same epidemiological inputs and disability weights. The change in YLL rates is between 0 to 3.7%.

Table 9.6: Magnitude of disease burden in AP, and mortality-disability composition obtained by different estimates.

		Minimally Anchored		Intermediately anchored		
Result	Group	WDR93	GBD96	COD	HSV-VAS	HSV-Tor-TTO
DALY / 1000	All	344	283	277	537	394
	Females	359	276	269	550	396
	Males	331	291	293	539	403
YLL / 1000	All		196	189	189	189
	Females		185	178	178	178
	Males		206	206	206	206
YLD / 1000	All		88	88	348	204
	Females		90	90	372	217
	Males		85	87	334	197
YLL:YLD Ratio	All	2.18	2.23	2.15	0.54	0.93
	Females	2.27	2.06	1.98	0.48	0.82
	Males	2.10	2.42	2.37	0.62	1.05
Male : Female Ratio	DALY	0.92	1.05	1.09	0.98	1.02
	YLL	1.11	1.11	1.16	1.16	1.16
	YLD	0.94	0.94	0.97	0.90	0.91

Changes in YLL : YLD ratio and Male to Female ratio are minimal between GBD96 and COD anchored estimates. The situation changes completely, however, in case of the HSV-VAS anchored estimates. Recall that the disability weights obtained from the community study in Andhra Pradesh were all higher than the disability weights used in GBD96 study. All projected disability weights based on data from the community survey, are in the range of 0.28 to 0.803 with a median value of 0.474. Compare this with the GBD96 range of disability weights, which range from 0 to 0.85 with a median value of 0.145. As a result the magnitude of HSV anchored disease burden is inflated to nearly twice the COD anchored estimate as well as the GBD96 estimate. The YLL to YLD ratio changes to reflect the higher disability component. Burden due to premature mortality now appears as half of the burden due to disability. The HSV-Torrance-TTO estimates give magnitude of burden intermediate between the COD anchored and HSV-VAS anchored estimates. The reader may recall that the life expectancy at birth in Andhra Pradesh is about 60 years (Chapter 2). This is much lower than life expectancy achieved elsewhere in the world. The standard life expectancy used by us is 80 years for males and 82.5 years for females. This standard is based on actual experience in some parts of the world. Considering the intermediate mortality level in Andhra Pradesh, the radical shift in relationship of mortality and disability components suggested by the HSV anchored estimates is puzzling. But before we affirm up our views on the HSV estimates, let's continue with the comparison of different estimates, looked at from additional points of view.

Table 9.7: Age-sex distribution of DALYs from different estimates

		Minimally Anchored		Intermediately anchored		
Sex	Age	WDR93	GBD96	Cause of death	HSV-VAS	HSV-Tor-TTO
Persons	0-4	51.17	35.01	34.14	28.63	30.81
	5-14	7.12	11.99	12.59	16.63	15.04
	15-44	7.47	30.41	30.40	37.18	34.76
	45-59	13.38	11.65	10.76	9.79	10.08
	60+	20.85	10.94	12.11	7.78	9.31
Females	0-4	53.05	34.64	33.89	27.24	29.69
	5-14	7.44	10.73	11.40	15.33	13.89
	15-44	8.21	33.03	33.16	41.79	38.87
	45-59	11.52	10.46	9.56	8.28	8.63
	60+	19.78	11.13	11.98	7.36	8.92
Males	0-4	49.30	35.34	34.37	30.05	31.92
	5-14	6.79	13.15	13.68	17.95	16.16
	15-44	6.75	27.99	27.87	32.47	30.72
	45-59	15.25	12.75	11.86	11.33	11.50
	60+	21.91	10.77	12.22	8.20	9.70

Table 9.7 shows the age distribution of DALYs from different estimates. The same pattern repeats here. Changes between WDR93 and GBD96 are substantial. WDR93 estimates put more than 50% of disease burden in the age group 0-4 years and another 20% in the elderly above 60 years. The burden on adolescents and adults (5 to 44 years) was estimated at 15%. This pattern is maintained if we look at the distributions separately for females and males. The GBD96 estimates put the burden on 0-4 year olds at the reduced level of 35%. The burden on adolescents and adults turned out to be higher at 40%. The two

HSV anchored estimates, however, put the burden on adolescents and adults at 50%, a situation just opposite the age distribution obtained by the WDR93 estimates.

Table 9.8: YLL : YLD Ratio by age sex groups from different estimates

Sex	Age	Minimally Anchored			Intermediately anchored	
		WDR93	GBD96	Cause of death	HSV-VAS	HSV-Tor-TTO
Persons	0-4	5.63	2.67	2.48	0.57	0.98
	5-14	2.35	0.49	0.60	0.17	0.28
	15-44	2.11	1.64	1.55	0.37	0.63
	45-59	1.60	1.88	1.91	0.52	0.89
	60+	2.00	5.17	4.48	1.67	2.73
Females	0-4	5.33	4.40	4.14	0.96	1.66
	5-14	2.65	0.68	0.74	0.18	0.31
	15-44	1.76	0.74	0.70	0.16	0.28
	45-59	1.57	2.23	2.19	0.64	1.08
	60+	1.95	4.07	3.45	1.31	2.14
Males	0-4	5.87	0.95	0.83	0.19	0.32
	5-14	2.13	0.36	0.50	0.15	0.25
	15-44	2.58	2.86	2.69	0.67	1.14
	45-59	1.63	1.57	1.66	0.43	0.74
	60+	2.06	6.31	5.56	2.03	3.33

Table 9.8 shows the YLL to YLD ratio by age-sex group. According to WDR93 estimates, premature mortality is the dominant burden over all age groups. The YLL to YLD ratio range from 1.6 to 5.6. According to the GBD96 and COD anchored estimates, premature mortality is the dominant source of disease burden for all age groups, except in the age group 5-14 years and adult females in age group 15 to 44. In these later age groups, the YLL to YLD ratio range is from 0.5 to 0.6. Premature mortality is the major contributor to disease burden among infants and children in age group 0 to 4 years and the elderly at ages 60+ years. This is consistent with our understanding of the pattern of general mortality, concentrated among the infants and then the elderly. According to the two HSV anchored estimates, disability becomes the dominant source of disease burden at all ages, except the elderly group at 60+ years. Here also, the YLL to YLD ratio is quite low between 1 to 2. Here again we find that the GBD96 and COD anchored estimates are intuitively appealing and are consistent with our knowledge of general mortality pattern. The two HSV anchored estimate produces unacceptably low YLL to YLD ratios. If these estimates were to inform policy, then premature mortality reduction would get a back seat altogether.

Table 9.9: Leading causes of burden from different estimates

Minimally Anchored				Intermediately anchored					
WDR93	%	GBD96	%	COD	%	HSV-VAS	%	HSV-Tor TTO	%
LRI	10.35	LRI	9.56	LRI	7.90	Periodl. dis.	7.79	LRI	5.82
Diarh. dis.	9.63	Diarh. dis.	8.42	LBW	6.71	PEM	5.86	Periodl. dis.	5.14
TB	3.71	TB	6.67	Diarh. dis.	6.33	Fires	5.13	Diarh. dis.	4.95
Measles	3.21	Falls	5.46	Falls	5.75	Falls	4.83	LBW	4.83
IHD	2.80	IHD	4.44	IHD	5.61	LRI	4.48	Falls	4.77
Infl. HD	2.34	LBW	3.46	TB	4.36	Diarh. dis.	4.00	PEM	4.25
Cer.VD	2.15	Road acc.	2.61	Self-inflctd inj.	3.40	LBW	3.68	Fires	4.23
PEM	1.91	Fires	2.55	Cer.VD	2.46	Obstrd labor	3.40	IHD	3.96
Tetanus	1.80	PEM	2.24	Road acc.	2.32	IHD	2.93	TB	3.22
Falls	1.72	Birth asphx.	2.13	Fires	2.31	TB	2.53	Obstrd labor	2.45
Residual cause groups with % burden higher than last cause included in ten leading causes:									
Other perinatal	9.16	Other unintl. inj.	4.31	Other unintl. inj.	5.38	Other unintl. inj.	9.56	Other unintl. inj.	8.20
ther unintl. inj.	3.87	Other . cardiac dis	2.27						
Other congenital	3.24								
Other infect. dis.	3.05								
Other digestive dis.	2.53								
Other cardiac dis.	1.86								

Birth asphx. = Birth asphyxia and birth trauma.
Cer.VD = cerebro vascular diseases
Diarh. dis. = Diarrhoeal diseases
IHD = Ischaemic Heart Disease
Infl. HD = Inflammatory Heart Disease
LBW = Low Birth Weight
LRI = Lower Respiratory Infection
Obstrd labor = Obstructed labour.
PEM = Protein Energy Malnutrition
Road acc. = Road Traffic Accidents
TB = Tuberculosis

Finally, let us consider the leading causes of disease burden from different estimates. Table 9.9 shows the ten leading causes of burden from different estimates. Residual cause groups with percentage of burden higher than the last cause included in ten leading causes are shown at the lower panel. Five out of the ten leading causes are common to all five estimates. These are: Lower respiratory infections (LRI), diarrhoeal diseases, tuberculosis (TB), ischaemic heart disease (IHD) and falls. If we compare GBD96 with the local cause of death anchored estimate, another three leading causes are found to be common. These additional leading causes common to minimally anchored GBD96 and local mortality anchored estimates are: low birth weight, road traffic accidents, and fires. The top ten causes of burden produced by the two estimates differ by two conditions. The GBD96 estimate has protein energy malnutrition, and birth asphyxia. The local cause of death anchored estimate does not show this. Instead, self-inflicted injury, and cerebrovascular disease (Cer. VD) appear in the list of leading causes.

Periodontal disease shows up as the leading cause of burden in case of the local HSV-VAS anchored estimate. It goes to the second position, in case of the HSV-Torrance-TTO anchored estimate. The problem of protein energy malnutrition is highlighted by the two HSV anchored estimates. However, considering the present mortality level in the state, ranking of these disabilities as the top two causes of disease burden may meet with popular rejection. For example, tuberculosis is viewed as a serious public health problem in the state. The National Tuberculosis Control Program is being implemented in the state from 1962 (Mahapatra and Ramana, 1994). The Tuberculosis control program has continuously received political and professional support in view of the widely shared concern about the adverse public health impact of the disease. A School Health Project was started in the state in 1993, with assistance from the British Overseas Development Agency (ODA). Dental health of school children was a major component of this project which was subsequently discontinued in 1999. The British ODA did not renew funding, in view of less-than-expected project performance[1]. Although many factors would have contributed to discontinuation of the School Health Program, the limited inference I draw from a comparative review of support for the two programs described above is that the popular concern for tuberculosis control is much more sustained and stronger compared to a program with dental health as a major component. Based on this experience, my conjecture is that people will be quick to point out that the two HSV anchored estimate puts the estimate of tuberculosis at the lower end of the ten leading causes of burden and highlights periodontal disease as the fore most cause of burden. This is not to deny the importance of disease burden due to periodontal disease and protein energy malnutrition. The argument here is about choice of the primary NBD estimate. The two HSV anchored estimate can be used to demonstrate sensitivity of disease burden estimates to an alternate health state valuation.

We have compared disease burden estimates from two versions of minimally anchored estimates (WDR93 and GBD96) and three intermediately anchored estimates (COD, HSV-VAS, and HSV-Torrance-TTO), with local data on causes of death and health state valuation. It would have been useful to look at changes in burden of disease estimates with local data on descriptive epidemiological parameters namely, incidence, age at onset, and duration of different diseases. Unfortunately descriptive epidemiological data are hard to

[1] I state these on the basis of personal knowledge, in view of my association with the School Health Project, as a Joint Secretary to the Government of Andhra Pradesh, in the year 1993-94. My comments on discontinuation of the project is based on personal discussions with colleagues in the health department and former project officers.

come by. It needs co-ordinated efforts on the part of many epidemiologists to build up the descriptive epidemiological profile of a population. As and when such data are available, it will be useful to examine, how NBD estimates change with incorporation of local data on disease incidence and prevalence.

However, on the basis of limited comparisons made above, certain inferences can be made. Firstly, Murray and Lopez have made substantive revisions between the GBD estimates published in WDR 1993 and the final version published in 1996. As we have seen here, the revisions for the India estimates were in the desirable direction tending to match local mortality levels and cause of death patterns. The cause of death anchored estimates are only marginally different from the GBD96 estimates, mainly because the later had already incorporated local data on urban cause of death and had gained some insights from the pilot study on rural cause of death. Hence it would be wrong to infer that collection of local cause of death would not improve a NBD estimate over the GBD estimate for the corresponding region. Rather the opposite inference is due. Recall the substantial difference between the WDR93 and the GBD96 estimates for India. The improvement can be attributed to availability of local cause of death information to the GBD96 team.

Addition of local health state valuations highlights the disability component to various extents. The two HSV anchored estimates blur general mortality level in Andhra Pradesh and the age pattern of mortality. The HSV-anchored estimates highlight disability as the major source of disease burden, almost to the exclusion of premature mortality. If disability is the major source of burden, the life expectancy in Andhra Pradesh would have been higher and the infant mortality rate, lower. It is doubtful whether the people in Andhra Pradesh are ready to ignore premature mortality and focus on the disability component of the burden to the extent the HSV estimate would recommend. Since we have not presented this estimate to people in Andhra Pradesh for serious consideration by policy makers, there is no evidence to support the above conjecture. But some insights are available from a somewhat similar situation elsewhere in the world. In 1989, the Oregon state in US set up the Oregon Health Services Commission and charged it with the responsibility of preparing a list of health services ranked by priority from the most important to the least important, representing comparative benefits of each service to the entire population (OHSC Website, 2000; Brown, 1991, Tengs and others, 1996). The commission produced a priority list in 1990. There was a lot of criticism and popular outrage about the ordering of various condition treatment pairs. One of the contrasts chosen by some people was to point out that routine dental care had received priority over life- saving procedures like appendectomy (Hadorn, 1991). OHSC responded to the popular outrage and revised the priority list altogether. Now let's compare the life expectancy at birth in Oregon and Andhra

Pradesh. In 1990, Oregon had a life expectancy at birth of 76.6 years (males = 73.4 and females = 79.8). My estimate of life expectancy in Andhra Pradesh around the same time (1991) is between 56 to 60 years. Oregon was already experiencing a much lower level of mortality at the time of these developments.

How do we then account for the difference between the priority implicit in the community valuation of health states and popular support for public health interventions to reduce mortality? One reason could be the difference in states of the world visualised by persons while valuing health states as an individual and while considering priorities for public health intervention by the community. For example, valuers may give higher importance to their own suffering while valuing a health state. They may be able to take a more detached view in the context of public policy. Another reason could be measurement error in health state valuation. While it is clear that further research on health state valuation is required, the lesson for NBD estimation is that investments on health state valuation may not give immediate returns to inform policy. Instead, NBD estimates seeking to inform current policy should invest in cause of death, and descriptive epidemiological studies. However, research on health state valuation in different settings will be important for methodological advancement of summary measures of population health.

Finally what is the information value of a National Burden of Disease estimate? Anchoring NBD estimates to local data on cause of death, incidence and prevalence of diseases gives added confidence to the validity of those estimates and encourages policy makers to give more weightage to the evidence produced by NBD estimates. Policy maker's confidence and reliance on NBD estimates will depend on the quality of local data to which the estimates are anchored. Another important contribution of NBD estimates is usually in allowing for disaggregated analysis for different population groups within the national or sub-national entity. For example, differences in needs and organisation of health care for rural and urban areas is an important issue. The Andhra Pradesh Disease Burden estimates, prepared for the rural and urban populations separately, allowed for rural - urban analyses, wherever necessary.

Summary and Conclusion:

This study has highlighted the need for reliable and valid local data for National Burden of Disease Estimates. Using the case of Andhra Pradesh in India, the study examines available sources of data and describes their usability. Deficiency in availability of local data is highlighted to draw attention to the need for improving vital statistics, cause of death and epidemiological surveillance systems. The Global Burden of Disease Estimation projects has encouraged internal consistency checks, indirect estimations, synthesis of epidemiological and demographic information, sheer perseverance to tap a wide array of data sources and estimation of missing data points by triangulation. These efforts have made it feasible to generate some estimate of Global and National Burden of Disease. While this is a major achievement, there is a limit upto which plausibility checks and indirect estimates can yield the required information for the increasingly complex policy choices in the health sector.

Valid and reliable statistics on cause of death is an essential input for setting of priorities in the health sector. Major initiatives to systematically identify health sector priorities have used cause of death information. An ideal cause of death reporting system consists of: (a) a fully developed vital registration system with, (b) cent percent medical attendance at the time of death, and (c) full compliance by the health care providers in writing up and transmission of cause of death reports. Developing countries like India are making efforts to operate cause of death reporting systems that are feasible within the given constraints of partially developed registration of vital events, and poor availability of medical facilities. We examine the cause of death reporting systems in India and usability of the statistics. For rural areas, cause of death statistics used to be collected through the SCD-Rural scheme which operated till December 1998. There after, rural cause of death statistics is sought be generated by adding a few columns to capture of cause of death information for deaths reported under the SRS-COD component. For urban areas, there is the medical certification of cause of death (MCCD) scheme extended by state governments, mostly, to municipalities and urban areas. To assess usability of cause of death statistics we examine the SCD-Rural and MCCD data for a period of about five years in the first half of 1990s using nine usability criteria. These usability criteria are: (a) content validity of lay reporting systems, (b) adequate coverage and compliance, (c) validity of statistics at sub-national levels of disaggregation, (d) minimal usage of residual categories, such as unclassifiable, or ill-defined conditions, (e) consistency of cause-specific mortality proportion with general mortality level, (f) absence of incorrect assignment of causes with clear age-sex dependency, (g) no case of improbable age-sex distribution by cause, (h) consistency of cause- specific mortality proportion over time, and (i) timely compilation and publication of the statistics. We find that major factors affecting usability of the cause of death statistics in India are (a) poor coverage, (b) high incidence of unclassifiable deaths, (c) long delay and irregular publication of statistics, and (d) lack of systematic screening. Its unfortunate that enough attention was not paid to cause of death statistics, even in the era of conventional aids to priority setting using mortality based data. We recommend, based on our subjective understanding of the problems, certain steps required to improve usability of cause of death statistics in India. We propose that a drive be launched by the Registrar General and Ministry of Health, Government of India, and all State Governments through the Ministries of Health and Municipal Administration, to improve coverage by cause of death reporting systems. Based on our experience in Andhra Pradesh, we conjecture that simply introducing periodical reviews jointly by the Departments of Health and Municipal Administration, identification of non-reporting municipalities and sample units, and further identification of non-reporting health care institutions sustained over a period of, say, five years will raise coverage substantially. Other measures recommended by us include: (a) training programs to build up cause of death report writing skills among physicians, (b) compilation and publication of cause of death statistics at the state level, (c) sponsored research on cause of death structure and their policy implications, (d) computerisation of filing, tabulation and flow of cause of death statistics, at the municipality and state level. To reduce the unusually high level of unclassifiable deaths, we recommend that an amendment be brought in the Registration of Births and Deaths Act (RBD Act.) requiring hospitals and health care institutions to maintain medical records. We are unable to make any definite recommendations specifically for the rural areas, since a change in the system has taken place recently. We have some apprehensions about the design of the new system. We point out that the cause of death columns added to the SRS data collection forms do not provide for recording of symptoms. This later information is required for systematic screening and coding of cause of death reports. However, it is too early to make a judgement on the new system. We recommend that research be taken up to evaluate the performance of the new cause of death reporting system in rural areas.

An important contribution of this study is the advancement of methodological aspects of health state valuation in developing country communities. A health state description system incorporating a graphic description component was developed to facilitate communication in partially literate communities. Some deliberative tools for conduct of health state valuation workshops for educated persons were developed. The experience gained for valuation of health states in developing country settings, we hope, will help in future research.

On the substantive aspect of the subject, this study has shed some light and raised many questions about the nature of the health state valuation process in our minds. Analysis of test retest data on ordinal ranking of health states, valuation of own health state and differences in distribution of valuations at the community level, all lead us to hypothesize that the true health state valuation in our minds is a multi- valued fuzzy set with different degrees of clarification. Conventional theory that the true valuation is a single valued function, is not consistent with our observations, and appears intuitively less appealing.

The incidence of measurement error and the our present understanding about the nature of valuation process, would suggest that community level valuation of health states require large sample size and also repeated measurements. Large sample sizes would help minimise the measurement error for mean values estimated form community surveys. Repeated measures, it is anticipated, will occasion repeated deliberation by the valuers and thereby help clarification of their value sets. The tradeoffs between sample size and repeated measurements will have to be studied. So far, researchers have focused on the mean valuations. This study has demonstrated that community valuation of all health states do not follow the same distribution. Differences in distribution of valuations by the community for different health states has policy implications, and hence, should be the subject of further research.

The study provided an opportunity for a comprehensive estimation of disease burden in AP during the 1990s. Clearly (a) lower respiratory tract infections (LRI), (b) diarrhoeal diseases, (c) low birth weight (LBW), (d) tuberculosis and (e) falls were the top causes of disease burden in AP, during the 1990s. These five conditions showed up in the ten leading causes of burden list from estimates using expert rated disability weights as well as community rated disability weights. Three out of these five, namely: LRI, diarrhoea, and LBW, are public health problems for infants and children. They should serve as stark reminders to the persisting problems of poor nutrition, water supply and sanitation. Tuberculosis, another infectious disease, continues to be a major problem. Currently there are programmes seeking prevention and treatment of these problems. For example: the reproductive and child health programmes, programme to build awareness about usefulness of oral rehydration therapy, tuberculosis control programmes. Obviously, the agenda to control diseases due to infection - malnutrition - poor hygiene complex remains unfinished.

Falls as a major cause of burden strikes one as a little bit of surprise. There is hardly any discussion about falls as a public health problem. Lack of attention on falls as a major cause of disease burden, I believe, is largely due to ignorance about the size of problem attributable to falls. These estimates should serve to focus attention to this problem. It is difficult to pinpoint a single cause leading to falls. A variety of causes including (a) design factors and (b) poor compliance to safety norms may be responsible. The first task is to investigate and study a fairly large sample of cases involving falls and identify the causes responsible for it. Only then we will understand, how to go about the business of prevention. Considering that a large part of the burden due to falls is among older children and young adults, investments on study of causes of falls and measures to prevent its occurrence will help alleviate a lot of emotional burden suffered by families, in addition to the personal disease burden factored into the current estimates.

Self-inflicted injury and fire accidents emerged as major causes of disease burden in the state. These two causes of disease burden clearly reflect larger social, cultural problems and points to the need for urgent social cultural reform. Suicides, mostly among adolescents and young adults is largely due to problems of adjustment due to many factors during the transition phase of a person's life. The high burden on account of fire accidents, particularly among women, is consistent with widespread social ill of bridal harassment, dowry etc. A large proportion of suicides among young women is probably due to the same factors. In addition, the educational systems inability to impart useful economic skills is probably another factor leading to a lot of frustration and suicide among young boys and girls.

The high level of disease burden due to road accidents is a cause for concern. This burden is going to increase, unless appropriate preventive steps are taken urgently. The automobile population is continuing to increase at a very rapid rate and road and traffic signalling infrastructure do not appear to be keeping pace with the same. In addition, we have the problem of poor driving skills. The granting of driving licences in most states is more bureaucratic, rather than functional. There is no system of written examination about knowledge of traffic rules prior to the grant of a driving licence. The driving tests required by law before issue of driving license does not appear to be taken seriously.

One hopes that the disease burden estimates for Andhra Pradesh prepared now, will help focus policy maker's attention on some of the leading causes of disease burden in the state.

References

Brown Lawrence D. The national politics of Oregon's rationing plan. Health Affairs. 1991 Summer:28-51.

Hadorn David C. Setting Health Care Priorities in Oregon. Cost-effectiveness meets the rule of rescue. JAMA. 1991 May; 265(17):2218-2226.

Mahapatra Prasanta, Ramana GNV; Health Sector Status in Andhra Pradesh: Sustainability of Programs and Projects, IHS Working Paper WP8/1994, Institute of Health Systems, HACA Bhavan, Hyderabad, AP 500004, India.

Murray Christopher J.L. and Lopez Alan D; The global burden of disease. A comprehensive assessment of mortality and disability from diseases, injuries, and risk factors in 1990 and projected to 2020. Boston: Harvard School of Public Health; 1996.

OHSC Website; http://www.ohppr.state.or.us/ohsc/About/Index.htm, accessed in March 2000.

Tengs Tammy O.; Meyer Gregg; Siegel Joanna E.; Pliskin Josephs S.; Graham John D., and Weinstein Milton C. Oregon's Medicaid ranking and costeffectiveness: Is there any relationship? Medical Decision Making. 1996; 16:99-107.

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